# REDESIGNING UNIVERSITIES *for a* SUSTAINABLE FUTURE


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# FOREWORD

Universities around the globe have been viewed as a treasure house of knowledge and wisdom, engaged in creation, assimilation and dissemination of knowledge for the larger collective good of humanity. They have been perceived as a seat of intellectual power and a hub of scholastic pursuits from time immemorial. It goes without saying the universities have shaped the world at all times. However, with the rapid pace of industrialization, the need for aligning university education to the needs of industry became more prominent in the last two centuries.

The overall impact of globalization, and the deep strides made by the science and technology community in the universities and in R&D organizations moved the global community including the MNCs and the industries around the globe to confront the challenge of quality, relevance, and employability of the graduates.

Further, the rapid advancements made on the scientific front and the technology innovation pushed industries along the pathways of rapid integration of technology into manufacturing as well as service sector, making inroads for increased use of robotics and automation. Computer Science and Engineering that was initially thought to provide the soft power to computing became a major discipline with its integration with electronics and communication systems to revolutionize the world of work as well as the world of trade and business as also the governance. However, with emergence of IoT and virtual reality, further supported by rapid advancement of AI have brought us face to face with a monumental challenge that is being popularly voiced as “Future of Work”.

The future of work needs careful attention to nurturing creative and innovative minds and redraw the canvas of university activities and programs to meet the twin objectives of employability and entrepreneurship. The universities need also to take on board a large share of community development and partner with the government for the success of its developmental missions and goals. The NEP-2020 has presented before us the roadmap to redesign the education and research ecosystem of the universities of tomorrow to contribute to the holistic development of their students and making universities strong pillars of strength to the nations’ economy.

In the above context, I am indeed very pleased that the present book edited by my former colleague from IIT system, eminent academician and past President of Association of Indian Universities, Prof. P B Sharma and his team of Dr. P R Trivedi, Dr. Sanjna Vij, Dr. HRP Yadav and Dr. Lucky Krishnia have put together highly thought provoking articles on various aspects relating to redesigning the university education and research canvas for the new age which is driven by the combined impact of innovative, enterprising and scholastic minds of the tech-savvy new generation of university faculty members and the inspired minds of students.

I am truly happy to note that the present book includes book articles contributed by eminent academicians like Prof. Prem Vrat, Prof. JS Rajput, Prof. Syed Hasnain, Prof. Omkar Singh, Dr. Markandey Rai, Prof. MP Gupta and Dr. YK Mishra among others. I am sure the present book shall inspire the educators in the world of learning as well as the professionals in the world of work to pool together the genius of man to meet and greet the current and future challenges and uphold the importance of universities of tomorrow in shaping the bright future for the global community.

I feel immensely proud to write this Foreword and wish the publication a great success.

***Prof. Anil D. Sahasrabudhe***
Chairman, NETF, NBA and EC-NAAC
Former Chairman, AICTE

7th June 2024

# PREFACE

In the rapidly changing world we live in today, the role of universities has never been more crucial. As we face complex global challenges such as climate change, social inequality, and resource depletion, it is increasingly evident that our traditional higher education institutions must undergo a profound transformation to address the urgent needs of our time.

As humankind moves forward with technology empowerment in a connected world, the pace of technological innovations and scientific advancements gets further accelerated to create an altogether new environment for learning, living, and working together. In this new world, the role of higher education and research is to be redefined from the point of view of a major shift towards creating the workforce of tomorrow for the New Age industries and enterprises besides providing vital support for march of the humanity on pathways of sustainable growth and development.

This becomes all the more important as industries and enterprises are themselves undergoing a rapid technological transformation with an ever-increasing impact of Artificial Intelligence, Data Intelligence, smart and intelligent autonomous machines and network systems. The corporates as well as the communities in this new world of transparency driven by smart technology integration are required to submit to the calls of integrity and sustainability, and that too with conviction and commitment to peace, prosperity, and harmony. The same will be the case for governance and policy making systems which now are to be necessarily human centric and aligned to a nature positive approach to maintain empathy and harmony so vital for a blissful coexistence.

This book, "Redesigning Universities for a Sustainable Future," explores the critical role that universities play in shaping the future of our planet and offers innovative ideas and practical solutions for reshaping them to meet the demands of a sustainable world. The journey towards sustainability requires us to reimagine the very essence of higher education, challenging existing paradigms and embedding sustainability principles within every facet of university life.

While universities have always served as knowledge generators, fostering critical thinking and research, we must now go beyond traditional academic pursuits and actively engage with the issues that threaten our collective well-being. This book explores how universities can become hubs of sustainability, fostering interdisciplinary collaboration, developing sustainable solutions, and cultivating a new generation of thinkers and practitioners who are equipped to lead systemic changes in various spheres of human endeavors.

We maintain that the education that we offer today to the university education aspirants shall have a decisive impact on the future of mankind as well as the future of the planet Mother Earth. While we align our education ecosystem to the needs and aspirations of the new age learners who have a great advantage of technology tools and services to augment their knowledge, we need to recognise that education is not just for capabilities and competencies. Education has to be a valid means of creating a responsible human society that practices the values of Truthfulness, Compassion and Caring concern for Peace and Harmony. As such the universities of tomorrow are to be equipped with a learning environment that nurtured character skills akin to the clarion calls of the hyper connected world that demands integrity both personal and professional and in all aspects of human endeavours. The redesigning universities of tomorrow shall take these additional dimensions of nurturing human instincts, human values and character skills that include a positive and optimistic attitude that always inspire learners to be on the side of the solution to pressing problems and ready to engage their intuitive, innovative and intellectual mind to make education in true sense a pursuit for preparing oneself for service and sacrifice demanded from the learned quarters for the collective good of the humanity.

Throughout the pages of this Book, we will examine a range of key areas that are integral to redesigning universities for a sustainable future. From curriculum design and campus operations to community engagement and institutional governance, each chapter explores the various dimensions that need to be addressed for universities to become true champions of sustainability. Moreover, this book seeks to inspire readers and ignite a sense of urgency among university leaders, educators, students, and policymakers. It serves as a call to action, emphasizing that the time for incremental changes has long passed. We must embrace this transformative journey wholeheartedly, recognizing that the future of our planet depends on our collective efforts.

Drawing upon the collective wisdom and expertise of leading scholars, educators, and practitioners in the field of higher education and research, this book presents a comprehensive and holistic approach to reimagining universities for future. It is not just a theoretical exploration but a practical guide that offers tangible strategies, best practices, and case studies to inspire meaningful action and positive change.

Lastly, we would like to express our deep appreciation to all the contributors who have poured their knowledge, experience, and passion into this book. Their insights and collective wisdom have helped create a comprehensive resource that can guide universities towards a sustainable future.

Together, let us embark on this transformative journey, redesigning our universities as beacons of sustainability and paving the way for a future where education, innovation, and sustainability intersect harmoniously to create a bright future for 8 billion people on planet Mother Earth, now that more than ever before the world community has understood our collective responsibility to nurture the concept of One Earth, One Humanity, One Future as the Vedas proclaimed long ago '*Vasudhaiv Kutumbakam'*. The time for transformation actions is now, and the stakes have never been higher. Let's write a new chapter in the history of higher education, one that leads us toward a truly sustainable future.

***Prof. P B Sharma***
***Prof. P R Trivedi***
***Dr. Sanjna Vij***
***Dr. HRP Yadav***
***Dr. Lucky Krishnia***

# ACKNOWLEDGMENTS

The editors would like to express their profound gratitude to all the eminent academicians who have poured their matured wisdom in their articles for the book "Redesigning Universities for a Sustainable Future." This book represents a collaborative journey, and we are deeply indebted to the individuals and institutions whose support and contributions have made this work possible.

First and foremost, we express our sincere gratitude to the distinguished contributors, authors, and co-authors whose expertise and insights have greatly enriched this book. Special thanks go to those who provided visionary ideas on research cultures, internationalization, smart campuses, pedagogy, and integrating sustainability and digital transformation in Higher Education. Their contributions have added significant depth to the book.

We are also grateful for the insights on NEP2020, Nation-building, University Social Responsibility, Technological advancements, Agriculture and Climate Change, new frontiers in Artificial Intelligence, Machine Learning, and Health Education. These contributions have illuminated critical areas of futuristic development and have highlighted the importance of integrating technology and environmental sustainability into the body fabric of higher education to ensure its relevance and impact on the march of humanity on pathways of sustainable development.

The editors would like to express their special appreciation to Shri Sandeep Singh, OSD to Vice Chancellor, Amity University Haryana and the publishing team for their professional guidance and support throughout the publication process. Their expertise has ensured that this book reaches a wider audience, and help in creating the intent and the urgency of redesigning the university ecosystem for higher education and research for the universities of tomorrow.

The book is a testament to the collective efforts of all those who believe in the transformative power of higher education and its potential to lead us towards a sustainable future. It reflects the shared vision and collaborative spirit of many individuals and institutions dedicated to advancing the role of universities in society.

The editors would like to place on record the interest of the younger generation of seekers of university education and their deep interest in research and innovation in universities and colleges in India and around the globe for charting a bright, prosperous and sustainable future for the current and the future generations that necessitate redesigning the university teaching learning and research environment inline with the current and future aspirations and challenges.

Thank you all for your invaluable contributions. Your efforts have made this book possible and have helped to create a valuable resource for educators, policymakers, and university leaders worldwide.

***Editors***

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# 1
# HIGHER EDUCATION IN INDIA - FOCUS ON VALUES, RELEVANCE & CREATIVITY

**Prof. P B Sharma**

*Education, especially higher education, is to be the fountainhead of a developed, prosperous, and enlightened human society that shall contribute to peace, prosperity, harmony, and happiness all around. This is, of course, a tall order, but then who other than the universities, the repositories of tremendous wisdom of the Orient and Occident, blessed with enlightened and inspired minds of faculty and students and the torchbearers of the faith of people could deliver this promise. This calls for a sustained focus on Quality, Relevance, and Excellence, nurtured in an environment of Integration of Education with Values so that the universities of the new age could become, in the true sense, partners in the progress of the nation's development and meet the global aspirations of human excellence.*

***Keywords:*** *Research, Higher Education, Excellence, Spirituality, Quality, Integration, Values, Creativity, Innovations and Technology*

His Holiness Shri Dalai Lama Ji, Hon'ble Vice Chancellor of Central Institute of Higher Tibetan Studies Prof Samten, Secretary General of Association of Indian Universities, AIU, Prof Furqan Qamar, former Presidents of AIU, fellow Vice Chancellors, distinguished invitees, members of the faculty, enlightened members of the press and media, Ladies and Gentlemen.

Let me at the outset extend my utmost reverence and warm gratitude to His Holiness Shri Dalai Lama Ji for his kindness in sparing his highly valuable time to be with us this morning at the Inaugural Ceremony of the 92$^{nd}$ Annual Meet of the Association of Indian Universities (AIU) at Central Institute of Higher Tibetan Studies, at the Divine place, Sarnath in the Spiritual Capital of the world, Varanasi. His Holiness, your gracious presence at this annual meet is a matter of great honor and privilege to my fellow Vice Chancellors and each one of us present in this august gathering.

On behalf of the Association of Indian Universities and my behalf may I extend to you a warm welcome to this “Kumbh of Kulpatis”, the university leaders from all over the country. His Holiness we look forward to your inspiring words of wisdom to inspire all of us to make Higher Education in India a vehicle of the transformation of our great republic into a vibrant, developed, and prosperous country, inhibited responsible citizens, exhibiting the highest respect for human values, personal integrity, and professional ethics akin to the modern digital age, and make Mother India proud of its higher education and research.

My warm greetings to you, the fellow Vice Chancellors of the Indian universities and I wish to thank you for sparing your highly valuable time to be present at this historic meet at our university. This historic meet is taking place at a time when the resurgence of India as the brightest star of the East is being acknowledged by the world at large. As such it is our responsibility, fellow Vice Chancellors, in the universities in India to make our universities a major partner in progress for the making of a New India, a developed and prosperous India of our dream. To do this, we need to create enterprising and creative minds in our universities and thus transform our universities as the “factories of Innovation, Technology Incubation and Enterprise Development” alongside producing Industry-ready-professionals for the new knowledge age which is rapidly descending in our industry, trade, business, and governance, and in fact in all aspects of human endeavors.

I therefore, hope that the synergy of mind created at this meeting shall enable us to present a road map of growth and development of higher education that shall assure the quality of education, the relevance of our research and innovations and accelerated growth of startups and enterprises from the campuses of our Indian universities to meet and greet the current and future challenges so as to make India a world leader in education and research in the coming years.

> *“The end-product of education should be a free creative man, who can battle against historical circumstances and adversities of nature. For this, the universities should attract the best minds for its teaching faculty”.*
>
> Dr. S Radhakrishnan (Former President of AIU (1942-43)

The above words of wisdom of one of the most illustrious sons of Mother India, Dr Sarvepalli Radhakrishnan, the former President of AIU(1943-44) are more relevant today than ever before as the 21st Century bestows upon the universities in India a great responsibility to provide to the nation the inspired and ignited minds of graduates and postgraduates and scholars of eminence to fuel unprecedented growth and development to wipe out poverty, hunger, disease, unemployment, enormous pollution(air, water and soil) and advance the frontiers of knowledge, shrink the boundaries of ignorance and create the bliss and happiness all around. And that too, by nurturing creativity and innovativeness in abundance to manifest the fullest of human potential yet protecting the interest of man and Mother Nature together.

***Our Glorious Past- An Inspiration to Integrate Education with Values***

We need also to create in us and our university community a sense of pride in our ancient wisdom that once made India a cradle of globally acclaimed high-quality education and human development par excellence. At the same time, we must commit ourselves to revive the ancient wisdom of practicing a righteous way of life-based on strict compliance to truth, maintaining purity of thoughts and actions, conforming to self-discipline, unending quest for research and new knowledge creation, but on top of that a caring concern for the well-being of mankind and Mother Nature, attaining perfection in work activity and conformance to work ethics and professional morality, discovering the meaning and purpose of life, and living a live full of divine bliss and happiness in plenty.

The Indian Universities of *Nalanda* at Rajgir in Bihar, *Takshashila* in North West of India, close to Gandhar at that time and *Viramshila* at Ujjain in Central India and later in Bhagalpur in Bihar and the Gurukuls of *Sandeepni Ashram* at Ujjain, *Dronacharya Ashram* at Gurugram, *Viswamitra* and *Bhardwaj Ashrams* at Chittrakut during Mahabharata and Ramayana times were the centres of higher education and research for the cultivation of most advanced science and technology that created the wonder that was India and brought the much acclaimed global eminence for its scholastic and scientific advancements. Scholars from around the world and seekers of knowledge congregated at these "centres of global excellence" in India to attain enlightenment and cultivation of peace and harmony.

These and many more residential *Gurukuls*, universities of ancient India provided education in harmony with nature and inspired the seekers of knowledge to adhere to the principles of peace, purity, and righteousness as the cardinal principles for leading a dignified human life. The focus here was on the integration of education with values, capabilities with virtues of humility and simplicity to serve the society and Mother Nature with utmost devotion and unconditional commitment.

What is more important to realize that the quest to attain the highest altars of prosperity was invariably associated with the unclenching commitment to *Parhit* i.e., to ensure the well-being of the society at large that enabled the Indian mind to proclaim *Sah No Yasha Sahno Brahma Barchasam*, as in *Tatriya Upnishad*, i.e., together attain name, fame and glory and reach to the highest alters of spiritual enlightenment and material prosperity together. It is this essence of the ancient wisdom that we need to assimilate and integrate with our modern university education to succeed in re-establishing ancient India's glory and global eminence in higher education.

I need not over-emphasize that education, especially higher education, is to be the fountainhead of a developed, prosperous, and enlightened human society that shall contribute to peace, prosperity, harmony, and happiness all around. This is, of course, a tall order, but then who other than the Indian universities, the repositories of tremendous wisdom of the Orient, blessed with enlightened and inspired minds of faculty and students and the torchbearers of the faith of people could deliver this promise. This calls for a sustained focus on Quality, Relevance and Excellence, nurtured in an environment of Integration of Education with Values so that the universities in India could become, in true sense, partners in progress of nation's development and meet the global aspirations of human excellence.

It is my considered opinion before this august assembly of the Vice Chancellors of Indian universities that the care and concern for the society, catering for local and global needs and service to society and Mother Nature should find an important space in the curriculum and should become an important aspect of higher education and research in our universities. I am confident, my fellow Vice Chancellors are committed to creating such a bright future for our great democratic republic.

**Impressive growth of Higher Education in 70 years of independent India**

India's higher education has registered an impressive growth during the last 70 years of independent India. It has provided to India and the advanced nations of the world some of the finest inspired minds of graduates and postgraduates who brought high recognition to India's higher education and made Mother India proud of their creative and innovative genius. The rise of the IISc, IITs and a few selected central and state universities such as University of Delhi, JNU, University of Hyderabad, MS University Baroda, University of Mumbai, University of Madras, Calcutta University, University of Allahabad, Punjab University Chandigarh, AIIMS and PGI Chandigarh, a few engineering colleges and institutions, including Delhi

College of Engineering, DCE now, Delhi Technological University, DTU, Punjab Engineering College, PEC now PEC University, Jadavpur University, Bengal Engineering College that became Bengal University of S&T and now Indian Institute of Engineering Science and Technology, IIEST Shibpur, Guindy College of Engineering, now Anna University, VJTI Mumbai, HBTI Kanpur, and some of the RECs now NITs in the government-funded sector and BITs Pilani, Amity University, Dhirubhai Ambani Institute of Technology, Manipal University, SRM University, Thapar University, Patiala, SASTRA University, Thanjavur, Sharda University and lately Shiv Nadar and Ashoka University to name a few in the self-financed sector are some of the finest examples of India success story in field of higher education. They produced the Nobel Laureates Dr Hargovind Khurana( Punjab University), Dr Amaratya Sen(Presidency College Calcutta), Dr Venkat Ramakrisha( MS University of Baroda), Kailash Satyarthy( Samrat Ashok Technological Institute, Vidisha), Chip Craft of the World Vinod Dham( DCE) who designed the Pentium Chip, NASA Astronaut Kalpana Chawla(PEC) , Founder of Infosys Narayan Murthy (IIT Kanpur ), Founder of NIIT Rajendra Pawar(IIT Delhi), the DRDO Chief, now a Member of NITI Aayog Dr. VK Saraswat (MITS Gwalior and IISc Bangalore), Chairman and Managing Director of Nuclear Power Corporation of India VK Chaturvedi(SATI Vidisha 1965 and BARC, Trombay), and above all Bharat Ratna, India's topmost defense technologist and former President of India Hon'ble Dr. APJ Abdul Kalam (MIT Madras). These and many more ignited the minds of the higher education fraternity of India and made us all feel immensely proud of the vibrancy and global eminence of India's higher education.

Likewise, the accelerated growth of Indian Institutes of Science Education and Research, IISERs, National Law Universities, establishment of new AIIMS, new IITs, NITs, NITTRs, new Central Universities, specialized universities to promote education and research in traditional medicine, physical education, music, and culture all make a highly impressive reading of India's higher education landscape.

With only 20 Universities and 500 Colleges in the country at the time of independence with 2.1 Lakhs students in higher education, India's higher education grew by leaps and bound during the last 70 years, more rapidly in the post globalization era, 1991 onwards. As per the UGC Annual Report 2015-16, the numbers have increased to 40 times in the case of the Universities, 100 times in the case of colleges and the student enrolment has gone up to 165 times in the formal system of higher education in comparison to the figures at the time of independence. As on 31.03.2016, the number of Universities stood at 799 universities – (44 Central, 75 Institutions of National Importance, 342 State, 198 State Private and 140 Deemed to be Universities) and 39071 colleges and 11923 standalone institutions enrolling 34.6 million students as per the UGC Annual Report 2015—16. So far as the number of universities is concerned, Rajasthan tops the list with 70 universities, followed by Uttar Pradesh 70, Tamil Nadu 52, Karnataka 49, Maharashtra 46, Haryana 38, etc. The number universities in India have gone up 1074 , 56 Central, 460 State,430 Private Universities and 128 Demmed to be universities as per the UGC Annual Report 2022-23.

But numbers alone do not suffice to earn India its repute in the field of Higher Education in the world. Serious concerns have been voiced repeatedly for utterly poor employability, acute shortage of well qualified faculty, lack of culture of research and knowledge creation, poor connect with industries and for ineffective regulatory system. The system is also least supportive of internationalization. The net result being that despite significant growth in the enrolment, quality, relevance and excellence remain as major challenges being faced by India's Higher Education system.

I, must however, add that the way ahead is equally challenging. On one hand the higher education in India is reeling under the crisis of low employability, on the other hand, it has a great promise in store for accelerating society and industry relevant research and innovations, given the innovative and creative potential of the young India. For this to make a phenomenal success, the higher education system in India has to align itself to the relevance and excellence that shall make higher education a powerful vehicle to fuel the growth of startups and new enterprises in plenty and meet the challenges of higher education of tomorrow driven by mind boggling advancements on the scientific and technological fronts.

The idea of a university today should revolve around providing a learning environment that promotes the spirit of enquiry, a sense of commitment to find solutions to the pressing problems of the society, an unending quest to discover the truth of being and to unveil the secret of creation and at the same time engage in pursuits of translating acquired knowledge and capabilities to create a better tomorrow. It is this idea of a university; we need to seriously ponder today when education is being seen as a powerful vehicle of transformation of nation's economies and well-being of the vast humanity.

**Restructuring of India's Higher Education Needed**

The FICCI report on Higher Education in India-Vision 2030 released at the FICCI Higher Education Summit in 2012 argues that despite the fact that we are on the threshold of great opportunities to leap frog in quality and excellence "We are in the 2$^{1st}$ century with a mid 20$^{th}$ Century Regulatory Architecture. During this time we have seen countries like China, Korea and Singapore, transform from developing to advanced economies in a decade due to strategic planning and a larger vision that correlated economic development to transformation in the education sector, in particular higher education and research, to become globally competitive."

The need for Restructuring has been voiced earlier by National Knowledge Commission in its Report to the Nation 2007. It has identified India's fat university affiliation system being totally ineffective to monitor and regulate quality and recommended that we should delink the undergraduate affiliated courses in the colleges and set up State Board of UG Studies to relieve the universities from the bulk of the burden of affiliated colleges. But then if this recommendation of the National Knowledge Commission is accepted would it not do a greater harm than good it aims to achieve. We must not forget that India's strength lies in its energetic and innovative and enthusiastic UG students and thus an exercise of restructuring should find a better solution to harness this strength than to devoid universities of the inspired innovative minds of Undergraduates whose potential of creativity and innovativeness if harnessed in right earnest shall provide a major boom for research, innovations and new techno-entrepreneurship. May be a better solution lies in granting autonomy to those colleges which amply deserve on the basis of their track record of strict adherence of quality standards and record of their maturity and integrity to utilise the "Autonomy as a Freedom to Excel" and not the "Freedom to Exploit" as is seen in the past in the case of colleges and some of the universities.

I must add that at a time when the call for developing a new India of our dream is a national mission of priority, there should be no room for complacency and mediocrity in the university system. The leadership of the university holds a great responsibility in this respect and under no circumstances we, as Vice Chancellors should yield to misguide on sacrificing merit, performance and standards of quality.

The agenda for higher education, in my opinion, therefore, has to focus on Relevance Driven Excellence and a Strong connection to Society and Industry. Further, the integration of human values with education needs be given a renewed emphasis in the campuses of our universities as we cannot afford to pay a heavy price for the loss of human values in an enlightened and specialized workforce in a country like ours where loss of values has already created an unprecedented rise of lust, greed, and anguish. We need to, therefore, resonate peace and harmony in the corridors of our universities and discuss the value and worth of civic sense and responsible citizenship in our classrooms and in the discussion forums. Fellow Vice Chancellors, let this learned assembly today resolve to foster values and education together in the temples of learning of the awakened India, namely, the universities and herald a new era of resurgence of higher education that shall enable Mother India to regain its global pre-eminence in higher education and research.

**Policy Interventions for fostering Quality and Relevance needed**

92nd Annual Meet of the Association of Indian Universities (AIU) at the Central Institute of Higher Tibetan Studies, Sarnath, Varanasi, Uttar Pradesh.holds a special significance as we are on the thresh hold of major reforms in higher education system in our country. The New Education Policy is on the anvil. Let our collective wisdom at this important meet generate the trajectories of policy interventions to revitalize even redesign the higher education in India to meet the national and global aspirations.

Fellow Vice Chancellors, we can no longer blind our eyes from the burning problems faced by the society, let alone expect someone else to solve these problems. For me, the universities are the body, mind and soul of the Nation’s intellectual canvas and are charged with the onerous responsibility to play a leading role in creating a bright future for the mankind. We thus need to effectively tackle themonumental challenge ofattracting the best inspired and creative minds in the faculty and thereafter to provide them the vital ecosystem to manifest their fullest of potential to develop industry ready, inspired, creative and enterprising minds of graduates and postgraduates from the campuses of the universities, engage in cutting edge research and innovations and to roll out startups and new enterprises. We need therefore, to seriously ponder on the implementable strategies for our new Education Policy that shall meet this emergent and highly important need of Faculty Development and accelerated growth of creativity and relevance in our universities in India.

We, in India, have a highly enriched spiritual heritage and are blessed with cultural traditions that provide a sound basis for cultivation of peace and harmony besides inspiring us to rise to the altars of humility and human excellence. We must, therefore, effectively blend the wisdom of our antiquity into the modernity of our human civilization to support the resurgence of India to its global eminence. I call upon you, the fellow Vice Chancellors, to work for effectively for integrating education with values and assure highest levels of quality of education, relevance of research, innovation driven growth of startups and enterprises and be a great force in supporting the resolve of making a New India, India of our dream, where education becomes an empowerment of capabilities, character and commitment to serve the society and the nation with fullest of dedication and to win back, for India its lost glory of global eminence in higher education and research in the new knowledge era.

**Education policy for New India is urgently needed**

Is it not already late for Indian government to roll out its education policy as four years of the new government in office are nearly over. Ideally the new education policy should have been rolled our soon after coining major missions such "Make in India", "Digital India", "Skill India" and " Startup India", well intentioned and well thought missions for a new and resurgent India. But it should have also been realized that in the absences of a well-defined and well-articulated education policy, such novel missions would face the scarcity of talent pool, lack continuous supply of innovations, easy availability of advanced science and technology and above all the vital ecosystem to harness creativity and enterprising minds that are required to make astounding success and create India of our dream. *(Opined Prof PB Sharma, President of Association of Indian Universities, AIU* *while addressing the ASSOCHAM summit on Policy Reforms for Higher Education for Excellence, Employability and Entrepreneurship, at Delhi on February 17, 2018).*

Perhaps, it is still not too late, as the committee to draft the New Education Policy headed by India's eminent Scientist Dr Kasturirangan is in the process of finalizing its report. The New Education Policy must come out with a clear policy framework that shall address the formidable challenge of Quality of Primary Education and Quality and Relevance of education and research in the Higher Education sector.

The New policy should be targeted to boost employability of professional education, from currently 15-20% to 120% on one hand and ensuring relevance of research and innovations to the needs of the society and industry at home on the other. It should also meet the regional and global aspirations. We need to align India's Education Policy to National Development to pay attention to creating “Advantage India” from the efforts we invest in education and research and make education a powerful vehicle of societal transformation. Unfortunately, the goal of successive education policies in the past revolved around increasing access in the name of increased Gross Enrolment Ratio, GER, in higher education and inclusive education being grossly misunderstood as driving everyone towards university education while focus on quality and relevance took a back seat. The net result being that we have achieved significant increase in GER, currently just over 25% but with utterly low quality of out-turn and also low employability. After all you get what you plan! So the prime question is whether the new education policy this time shall have a radical departure from the approach to policy formulation in the past.

To begin with, we would have liked that an approach paper to the new education policy should have been drafted with due diligence by the Niti Ayog and it should have clearly spelled out the major goals of the new policy. But now at least we have a few drafts of new education policy such as that of TSR Subramaniam report and a well-articulated vision documents such as FICCI Higher Education Report of 2012 and Yes Bank Global Institute report on Higher education in India, 2017.AIU on its part in its submission to the New Education Policy Drafting Committee in November last year has made it clear that unless the new education policy is targeted to provide to the Nation a policy thrust to make education a powerful vehicle for National Development and attaining global esteem, education in India shall continue to reel under the crisis of poor quality and loss of values. The AIU document presented to the Dr Kasturirangan committee advocates for focus on “relevance driven excellence”, making Universities as the " Factories of Job Creation", harnessing creativity and innovativeness by making universities as "Cradles of Innovation and New Enterprise Development" and engaging the young, inspired minds of students by promoting extended “learning by doing” rather than master minding the contents of the text books as in the past. The AIU documents also strongly advocates for autonomy of the universities and institutions of higher learning, but with a caution that autonomy and accountability should go hand in hand so that autonomy becomes "Freedom to Excel" and not the "Freedom to Exploit" as in past. It is here the role of regulators is not to prescribe the curriculum but to enforce quality standards and facilitate the growth of scholarship and knowledge creation.

The new education drafting committee headed by Dr Kasturirangan is well advised to look into the draft national education framework left behind by Dr Sam Pitroda in his Knowledge Commission Report to the Nation 2006 and 2007 where integration of Education with Research and integration of Knowledge and Skills have been strongly advocated.

Dr Kasturirangan Committee is also well advised to take note that while on one hand India is reeling under the crisis of loss of human values and lack of focus on national and global aspirations, the integration of education with values should form a strong pillar of strength of the new education system that the new education policy intends shall promote. We the Vice Chancellors of Indian universities with the collective wisdom at our command should recommend to the Government of India to setup "10 *Gurukuls* of modern India" as the marvels for intellectual wisdom alongside nurturing universal values of *"Satya mev Jayate*", Purity of thought and action, *"mansa vacha karmana"* as ordained in the Vedas, Humility, Peace, and Harmony that shall drive the agenda of Education for Global Peace and Sustainable Development.

I want to see the inclusive education redefined. The inclusive education that the new education policy intend to promote should mean inclusion and integration of education with values, education for employability and entrepreneurship and education for Nation building and for creating global esteem. Let the signature towers of the universities of tomorrow be the Knowledge and Innovation Incubation towers and Centers of Human Development promoting universal human values, work ethics and professional morality, I propose.

**Paradigm shift in carrying our Research needed**

Universities and Institutions of higher learning are to be the lifeline of the local industries and drivers for change both at national and global levels to cause technology revolution and innovative new product development. This requires a paradigm shift in the way research is carried out in the universities and in institutions of higher learning. We need to devise mechanisms which supports the growth of Solution Research and with the active participation of the industries engages the innovative minds of the faculty and students in developing technology, knowhow and innovations that shall give rise to the growth of new enterprises**.** The new structure of the Higher Education in India need to rejuvenate the universities to create the desired ecosystem for Solution Research, Technology Incubation and supportive environment for I2IP, ideas to innovated products and commercialization. In short, it calls for a major departure in our approach from “Universities as centers of learning and scholarship” to “Universities as Global Knowledge Enterprises” i.e.. Centers of learning and scholarship, technology incubation, innovation, and enterprise development. Universities then shall adopt the mantra “Knowledge to Prosperity” and become the propulsive thrust for accelerating the Socio- Economic development of the society.

The need of the hour is therefore to nurture interdisciplinary education, engage in cutting edge research, cultivate translational and solution research and foster creativity and innovations in abundance and take them to the level of commercially viable technologies and products of vital value to make India a world leader in quality education and research.

I call upon you to collaborate not only with the best in the world but also to collaborate and cooperate between our universities in India, create regional and national network of Indian universities and pool together your capabilities and transform our universities in India as the world leaders to make Mother India proud of its universities.

**Concluding Remarks**

The need of the hour is to create *Panchmirit* of Academia, Industry, R&D organizations, Society and Government. Let you keep the noble objective of ***Janni Jamabhumasche swargadapi gariyasi***, that is, to transform our Motherland as a haven on earth while at the same time serving the divine cause of ***Vasudha ev Kutumbakam***. I also invite you to create the ***Panchamirit*** of Academia, Industry, R&D organizations, Society and the Government so that we succeed in making our universities, in true sense, partners in progress for the success of our National missions of Make in India, Skill India, Innovation and Startups India and also meet the Sustainable Millennium Goals for which the nations of the world including India are firmly committed.

Fellow Vice Chancellors, as you leave after this summit on 21st March, take back the collective wisdom of the Vice Chancellors of this great nation, enrich your soul with the fragrance of spirituality in the divine abode of Sarnath and in the spiritual capital of the world, Varanasi, drink deep in to the fountains of wisdom that are behind and then march forward and stop not till the goal of resurgence of India’s Higher Education is fully realized. As you reach back to your university campuses, let a sea change be seen in your outlook and approach, let you be seen as a breakthrough leader working with speed leadership approach.

I would urge each one of you to create the vital synergy of minds in your university, cast a renewed collective vision and draw a strategic plan for your university to make stupendous progress on Quality of Education, Relevance of research and development, causing accelerated growth of Innovations and Technology Incubation giving rise to startups in plenty and make your university a powerful vehicle of transformation of regional and national development.

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# 2
# CREATING AN INSPIRING RESEARCH CULTURE

**Prof. J S Rajput**

*Celebrated 19th century philosopher Ralph Waldo Emersion laid down a rule that when friends of the same flock meet after a certain gap, they should - after usual greetings –begin their conversation by asking each other a question: Has anything become clear to you since we met/conversed last time. Or let me put it in the current context: since we attended the last international seminar on the education policy, how much we have grown up professionally! This probably is the most important pedagogical principle that deserves to be accepted by every institution, researcher, teachers and teacher educators. It is a must for teacher educators, research guides and senior academic icons engaged in the task of preparing young teachers as icons for learners at every stage education; from schools to universities. If accepted as a regular practice and pattern, it could transform the very texture of academic world! Any comprehension of the knowledge system is incomplete without seriously examining the twinning of the individual and the institution (Rajput, 2023) In 1909, Sri Aurobindo wrote in the Karmayogin: "The first necessity for building up of a great intellectual superstructure is to provide a foundation strong enough to bear it". Information cannot be the foundation of intelligence; it can only be part of the material out of which the knower builds knowledge, the starting point, the nucleus of fresh discovery and enlarged creation. An education that confines itself to imparting information is not education". With so much churning inflicting the content and pedagogy in education, the horizons for good quality research are expanding fast. All concerned have to take a fresh look on identifying new approaches and delineate their priorities once again.*

**Keywords:** *NEP-2020; Knowledge; Skills; Scientific Development; Higher Education; Research; Knowledge Creation; Qualitative transformation*

## Introduction

The Indian tradition of the knowledge quest has established its continued relevance and deep understanding of basic essentials that could provide a solid epistemological foundation to the futuristic approach to research and innovation in India. These could generate new knowledge and skills, and achieve attitudinal transformation amongst those engaged in research in universities and other institutions working in specialized areas. Research essentially intends to explore the secrets of nature and at higher intellectual levels, attempts to know oneself, the inner self and the purpose of life on the planet earth. This aspect – though some may hesitate to call it lacking in concrete evidence in the usual sense prevalent in the world scientific research -is the real distinct strength of the ancient Indian tradition of knowledge quest. Illustrious individuals, intellectuals and scholars have contributed in both of these sectors; external and internal words that complete the individual and collective life cycle on the earth.

The most outstanding exposure of ancient India, its philosophy, thought and culture were its stirring exposition by Swami Vivekananda in the World's Parliament of Religions, Chicago, on September 11, 1893; and also on subsequent days. It received unprecedented attention with unparalleled respect and adulation by the global audience. In the 20th century Indian contributions to knowledge and civilization were fully exposed to the western world and the antiquity of Indian knowledge and wisdom leading to better comprehension of the nature and man relationship, man to man relationship and mans own relationship with himself were acknowledged by those who had, in their ignorance, reduced all Indian knowledge to nothing, rather they had felt the need to 'salvage the souls of the savages! And they meant Indians! At this junction of history,

it is inversely acknowledged that the contributions of Indian knowledge creators could be a great asset in investigating further the physical, mental and psychological aspects of life on one hand and that of nature and its role in sustaining life on the planet earth. Young scholars unfamiliar with the ancient Indian contributions in science, technology, astronomy, mathematics, medicine and several other areas are indeed overawed on how the Seers, sages, Acharyas, Rishis, and dedicated learned luminaries of the past could manage such a comprehensive, precise and scientific understanding of the earth and the cosmos. How could they predict the exact timings of solar and lunar eclipses that were to occur years ahead? And that to the accuracy the accuracy of minutes and seconds, and this happened at a time when no gadgets were available to assist the researchers. If this was not scientific research, what else it could be?

To illustrate this point further, one may just recall the words of Swami Vivekanand that are quoted very often and interpreted in considerable detail: Education is the manifestation of perfection already in man.

The immediate inference is that every child who takes birth on the planet earth and is blessed with the power of ideas and imagination, without any discrimination must be encouraged to let these flourish further, these unhindered and interrupted right from day one. His curiosity and creativity must be supported and not restricted in any way by the schools, curriculum, examinations and teachers! Yes, they may require support and right direction which must come from the members of the family and the teachers. This contrasts the prevailing practice in our schools – and also universities - that confines the child to prescribe textbooks and examinations making them focus only on performance in the written final examinations. Einstein articulated this concept in one of his famous statements that if he had the authority, he would like the children to study only two subjects: music and mathematics at their own pace.

Mahatma Gandhi wanted education to begin child's education with Takli. He wished education to draw the best out of Head, Hand and Heart! He expected that it would make the learner explore every other aspect that would be needed to live a creative, contributing and value-based life. Gurudev Rabindranath Tagore was so much convinced that ideas, imagination, curiosity and creativity that are inherent possessions of every child must be encouraged, and corresponding action inspired and initiated to let the child move ahead. Shri Aurobindo had given a great challenge to the education systems that "nothing can be taught"! If this could be understood properly, higher education institutions would be flooded with young entrants already fired with imagination and ideas to explore, investigate and research in areas of their liking. Excellence would be the obvious outcome! Real breakthroughs would come in abundance, and innovations could follow in plenty. In a knowledge society, moving ahead to days of wisdom and discretion – Vivek -, India could establish itself as a leader of global community.

From such a profound and intellectually sound yet pragmatic philosophy that India has presented to the world, emerges the path to be followed in research, explorations and in-depth studies in the current times. Once this is understood and integrated with the content and pedagogy of education, it would be much easier to enhance the quality not only of research but also of human life. Gurudev Rabindranath Tagore had mentioned that the prime task of universities is not to teach but to create an environment of research and higher studies. Teaching comes only afterwards. He wrote in 1919 (Devi Prasad, 2000): "It has been established that with its own intellect India had thought about the problems of the world and had found the ways for resolving them. For us that education would be true education if it gives us the strength to gather knowledge, search for truth and bring it into light by own endeavours. The education which teaches the skill of repetition is not the education for the development of our mind. Afterall, repetition can be accomplished by the use of machines." Now that Indian education policies are seriously talking about multi-disciplinarity, it is relevant to recall the vison of Gurudev that could be a guiding light to young researchers (Ibid): "When India had meditated with her own strength it had the unity of mind which now has been scattered. Today all the branches of the tree have forgotten that they were 'inside' and united with the main stem. The lack of awareness of the union between its various parts is almost like its death". The Universities at this juncture are engaged mostly in research that intends to explore the major crises looming before humanity and these include climate change, global warming, pollution, deforestation, death of rivers, and others. On the other side, the studies also look at social sectors and areas like increasing tension in human life, visual distrust, acrimony amongst nations, violence, wars, demographic transformations and cultural constraints emerging out of large populations migrating to alien places facing unfamiliar environments, social structures, languages, religions and practices. A lot of other areas could be listed, but yes, human beings are in a state of flux on what is in store for humanity in future. Let no one forget that the intellectual work suffers when there is absence of peace, tranquillity, social cohesion and religious amity outside the boundaries of the research institutions!

One of the examples that every young researcher needs to comprehend fully in its essence and import is being presented taking an example from the life of Mahatma Gandhi. When M.K Gandhi returned back to India in 1915 and expressed his desire to work for Indian people and their liberation, Gopal Krishna Gokhale offered him some serious advice that only Gokhale could render to him: that he was not yet equipped in his understanding and needed to travel throughout the country to understand their social, economic, cultural conditions, their suffering sand potentials only after being fully convinced of the beauty of diversity in practically every sector that India is blessed with, he needs to fully understand the pulse of the people of India. Gandhi followed the advice verbatim. And in the 20th century, one could hardly mention any other person who has as much understanding of India and Indians as Mahatma Gandhi has acquired. For every researcher, it says all that needs to be said.

The NEP-2020 states: "knowledge creation and research are critical in growing and sustaining a large and vibrant economy, uplifting society, and continuously inspiring a nation to achieve even greater heights. Never before has, "A robust ecosystem of research" been more important to India than at present. So much is changing at an unprecedented pace, so many issues and concerns are threatening the very survival of the human race on planet earth, only a sustained and well-directed comprehensive effort to move towards a knowledge society could ensure, "economic, intellectual, societal, environmental, and technological health and progress of a nation." Creation of a research culture that could respond to all the expectations of the people, has to be examined in the light of the most critical input; investment in education. Universities are primarily the centers of acquiring and creation of knowledge, establishing its utility and facilitating its transfer to future generations. In the Indian tradition of the quest for knowledge, one must immediately add that knowledge and skills so acquired must be used for the welfare of humanity: *Sarva Bhuta Hite Ratah!* This ought to be the universal goal but is not so in actual practice. At this juncture of human history, materialistic pursuits have overtaken the spiritual quest. "Learning to earn" is the key operative in individual and institutional consideration. It contrasts with the universal perception that education and its institutions must, "Develop good, thoughtful, well-rounded, and creative individuals of developed character." At the societal level, it must contribute in creating a "Socially conscious, knowledgeable, and skilled nation." India has now launched a new National Education Policy (NEP-2020) that aims to transform its higher education system (HES) in approach, structure, processes, and learner outcomes, that is, products.

It has been specifically stated in the NEP-2020, (, NEP-2020: 45): "Knowledge creation and research are critical in growing and sustaining a large and vibrant economy, uplifting society, and continuously inspiring a nation to achieve even greater heights. Indeed, some of the most prosperous ancient civilizations (such as India, Mesopotamia, Egypt, and Greece) to the ones of the modern era (such as the United States, Germany, Israel, South Korea, and Japan) were or are strong knowledge societies that attained intellectual and material wealth in large part through celebrated and fundamental contributions to new knowledge in the realm of science as well as arts, language, and culture that enhanced and uplifted not only their own civilizations but others around research and innovation investment in India is, at the current time, only 0.69 per cent of GDP as compared to 2.8 per cent in the United States of America, 4.3 per cent in Israel, and 4.2 per cent in South Korea." One genuinely expects it to be enhanced and augmented from sources other than the governments.

**Education and Research Go Together**

It is universally acknowledged that the best research outputs emerge from, "multidisciplinary university settings". It invariably leads to the best teaching and learning processes not only in higher education, but it impacts school education as well. It is indeed encouraging to note that India has realized the need to create an organic relationship between research and school education. The policy envisages, "Definitive shifts in school education to a more play and discovery-based style of learning with emphasis on the scientific method and critical thinking." Qualitative transformation in higher education and research just cannot be achieved without a sound base of good quality school education.

The ideas accepted at policy level and their articulation in the pragmatic context could be better comprehended in the light of some of the learned discourses by luminaries who dazzled the sphere of research through their own dedication and commitment and gave precious gifts of knowledge that paved the path for a better future. These continue to inspire generations to explore, extract, and achieve more and more from the unfathomed treasures in the ocean of knowledge. Delivering an address at the 60th birthday celebrations of eminent scientist Max Planck in 1918, Einstein referred to classes of people who take science and its study and research. For some it was a sense of joyful superior intellectual power, and there were those who, "have offered the products of their brains on this altar for purely utilitarian purposes." He further elaborated that in the Temple of Science, with many mansions, if these were the only two categories, only creepers would grow! Where are the others who bring the fragrance of sublime life to humanity? Einstein quotes Schopenhauer who says that one of the strongest motives that leads men to art and science is to escape from everyday life with its painful, crudity and hopeless dreariness, from the fetters of, "one's own ever-shifting desires", something like the, "Townsman's irresistible longing to escape from his noisy, cramped surroundings into the silence of high mountains, where the eyes range freely through the still, pure air and fondly trace out the restful contours apparently built for eternity. " ( Einstein1954 :224). Then he goes on to mention the real positive motive: "Man tries to make for himself in the fashion that suits him best a simplified and intelligible picture of the world; he then tries to some extent to substitute this cosmos of his for the world of experience, and thus to overcome it.

This is what the painter, the poet, the speculative philosopher, and the natural scientist do, each in his own fashion." This was said over hundred years ago, if a survey is conducted on, "how, why, who, and what for" of research in science and other sectors — in an age of multidisciplinary — the outcomes would certainly be classified more precisely, but the essence would not change. The human urge for security, emotional support, and peace is the core motivation for the higher order intellectual, innovative, and entrepreneurial initiatives. If one moves ahead in times, and comes to 1979, the articulation appears more familiar. In a lecture titled "Beauty and the Quest for Beauty in Science", S. Chandrasekhar referred to the illustrious scientist Poincare (Chandrasekhar 1991: 59), "The scientist does not study nature because it is useful to do so. He studies it because he takes pleasure in it; and he takes pleasure in it because it is beautiful. If nature were not beautiful, it would not be worth knowing and life would not be worth living… I mean the intimate beauty which comes from the harmonious order of its parts and which a pure intelligence can grasp." Man has explored the vastness of stars, galaxies, the stellar space, and the Cosmos beginning with a telescope, on one hand, and also the vastness of the smallest, beginning with a microscope! Humans have explored — and it shall remain an eternal process to look within, and beyond. That would offer humans new opportunities to excel in creativity; and striving to better the lives of all human beings.

**Research is a Cautious Quest**

Dr. Radhakrishnan, who had said that education is not a class privilege, had also said, "Intellectual work is not for all, it is only for the intellectually competent." He went ahead to state if our universities, which showed so much promise on the eve of Independence, now appear to be in a state of disarray. The reason was simple: our higher education system opened its doors to all, including those who had inadequate initial it preparation in schools to instill in their minds the love for experiencing the adventure and thrill of higher education. In the words of Dr. Radhakrishnan: "We have made short work of tests of intellectual competence in order to make peace with every kind of social and political pressure". He did agree that 'Education is a universal right, and not a class privilege'. In a large-scale expansion – which was inevitable with a literacy rate of mere 18% - dilution in quality is inevitable, but India now needs to consolidate, and ensure the right work culture and research environment in its universities.

Presently in the existing structure of higher education systems, research is supposed to begin only after attaining a post-graduate qualification. In the proposed education policy – the NEP – 2020 - set up, and introduction of four-year undergraduate courses, research could be initiated in the fourth year, and after completing it, could be continued for a doctoral degree. Not all would continue research after obtaining their formal degree, those who do continue afterwords are expectedly serious scholars, and researcher who would grow into learned academics, and intellectuals. A truly inspired person could be doing research without any formal qualifications, pursuing his idea of exploration, gaining more comprehension of things around him, or those inspired by his imagination. It is imagination, ideas, curiosity, and creativity that gel together and lead to an output that may surprise the Creator himself. Those in the formal informed systems, familiar with the latest developments in the area need to realize the power of imagination, so lucidly articulated by Einstein (Tathagatananda 2013: 21): "Imagination is more important than knowledge. For knowledge is limited, whereas imagination embraces the entire world, stimulating progress, giving birth to evolution." We are all familiar with the great advances in sciences and their applications that have transformed human lives all-around. However, these alone cannot enhance the Human Happiness Index, as "Humanity has every reason to place the proclaimers of high moral standards and values above the discoveries of objective truth." On several occasions, Einstein expressed his ideas and concerns about morality and ethics with an intensity that flows direct from the heart (ibid.: 174): "The most important human endeavor is the striving for morality in our actions. Our inner balance and even our existence depend on it. Only morality in our actions can give beauty and dignity to life. To make this a living force and bring it to clear consciousness is perhaps the foremost task of education. The foundation of morality should not be made dependent on myth tied to any authority lest any doubt about the myth or legitimacy of the authority imperil the foundation of sound judgment and action." He like many others could see the symphony of scientific growth and developments, and the independence of thought from prejudices, and authoritarian interference.

Scientific developments and their technological imperatives have changed the contours of human life. But hunger, poverty and ill-health continue to disrupt the lives of billions even today. Further, these advances have not led to the universalization of the dignity of life to every human being. The Eastern philosophy of "*Aparigraha*: non-accumulation", increasingly appears to offer a ray of hope to the entire humanity, in these times of unprecedented pace of change ushered in by the developments in ICT. Could it be because of the "Modern people who neglect or disobey the laws of spiritual development?" From Einstein, go to Swami Vivekananda (ibid.: 16): "It is one of the evils of civilization that we are after intellectual education alone and take no care of the heart. It only makes man ten times more selfish, and that will be our destruction. Intellect can never become inspired. Only the heart, when it is enlightened, becomes inspired. An intellectual heartless man never becomes an inspired man. Intellect has been cultured, with the result that hundreds of sciences have been discovered, and their effect has been that few have made slaves of many; that is all the good that has been done." Everyone is experiencing this phenomenon — in the manner that multinationals have captured markets, uprooted millions, call them "business partners", depriving them of all the dignity that was their lone solace as independent workers. So much research is being sponsored by these multinationals, including pharmaceutical companies. One must probe into the possible objectives behind these endeavours.

**Assessing Research**

Horizons for a researcher open-up once we seriously re-visit the vast and extended realm of quest for knowledge that flourished in ancient times in India and still survives in its continuity and relevance. From the Taxila-Nalanda days, the anecdote concerning Acharya Bhadant and his *shishya* (disciple) Jivak, presents a glimpse of how well-established and scientific-in-approach was the Indian tradition of research and knowledge quest even in those days. When the *shishya* evaluated his own achievements as a learner, he approached the Guru, and informed him that since he had completed his studies; he would like to offer the *Guru Dakshina* that the learned Acharya may indicate, and then seek his blessings to go back and utilize the knowledge acquired at his feet to "serve humanity". As *Guru Dakshina*, the Guru asked him to find some herb, shrub, plant, tree, leaf that was of no use in human welfare! In contemporary parlance call this a project, and obviously Jivak must have followed a systematic process of project formulation, decided upon hypothesis, the delimitations, experimentation, observation, tabulations; and so on. After a reasonable time-gap, the *shishya* reported back to his guru that he could not find anything that grows on earth, in nature, that was not useful to living beings!

This is a profound truth of the man-nature mutuality, at least from the aspect of nature, and at the same time is a revelation in the present-day context of how brutally mankind has violated the bounties of earth and nature leading to the dire consequences of global warming and its fallout. This '*dakshina*' that the Guru asked for was a unique means of creating new knowledge for his *shishya*! The Guru knew the truth, but ensured that his *shishya* 'discovered' it. That is what Swami Vivekananda taught us, "The goal of mankind is knowledge . . . What man 'learns' is really what he discovers by taking the cover off his own soul, which is a mine of infinite knowledge." No one can actually 'teach' anyone else. For the learner, it is discovery from within, the manifestation of perfection already in man. For the teacher, the task is to show the direction and the path. There is enough evidence, despite the adversities through several centuries, of Indian contributions of excellence in varied fields of science, mathematics, astronomy, social sciences, psychology, philosophy and spirituality. This would have never been possible if India had not learnt to seek beauty in its totality: Satyam, Shivam, Sundaram; Truth, Godliness, Beauty.

We can see its reflections in the heart-warming lines of Poet John Keats (Chandrasekhar, op. cit.: 91)

*Beauty is truth, truth beauty – that is all*
*Ye know on Earth and shall ye need to know.*

**Inspiration to do Research**

Inculcating a culture of research requires continuity from the initial years. The NEP-2020 has recommended nurturing of the talent and traits by creating continuity right from the beginning, from the age of 3+ years onwards. Here we recall three of the basics taught to us by Sri Aurobindo: from near to far; nothing can be taught; the mind must be consulted in its own development. If teachers learn to comprehend their role in this light, they become partners in learning and in discovering. As Gurudev Rabindranath Tagore had reiterated, every child is blessed with two boons by God and nature: the power of ideas and the power of imagination. Sadly enough, the trend in our education systems seems to impede these, somehow! This is showcased by prevalent school 'board' examinations, the study-by-rote culture, or the evaluation and assessment systems. We have also not developed a transparent system for teacher recruitment. This poses a great challenge for researchers. The concern is best exemplified by an instance, from outside India, that indicates how teacher-educators and teachers must be sensitive to the finer intricacies, and the consequences of an infirm evaluation.

Richard Feynman, after receiving his Nobel Prize, decided to visit his school, as a gesture of gratitude. Excited school authorities dug out his performance records and found that his IQ was rated as "fairly low"! Reaching home, Feynman told his wife that for him to win Nobel Prize was of little significance, but the fact that he had won it despite such a 'low' IQ was something great! Teachers may recall similar instances of 'average' students who succeeded beyond expectations. Mohandas Karamchand Gandh's IQ may never have been actually measured in the school, but he was certainly not considered a brilliant learner. However, his adherence to morals and ethics was indeed very firm; far beyond excellent. He refused to avail o the opportunity his teacher offered hinting him to copy the correct spelling of the word kettle – Gandhi had written it as ketal - from his classmate! By his own admission Steve jobs was never a good student in school, he had also dropped out of the college after six months. While Bill Gates' was an intelligent student, he easily got bored with school and often got into trouble. Albert Einstein was considered a poor student. He had to cram for examinations as he often missed school. Such instances are available in plenty, in every culture and situation, and could indeed act as great motivators for young researchers particularly in India where inadequacies of resources and facilities often hinder the enthusiasm of the young age.

What Albert Einstein had to say to intellectuals is very relevant to the present-day fast-changing global scenario for young persons engaged in research in every sector of human activity and endeavor: "By painful experience we have learnt that rational thinking does not suffice to solve the problem of our social life. Penetrating research and keen scientific work have often had tragic implications for mankind, producing, on the one hand, inventions, which liberated man from exhausting physical labor, making his life easier and richer; but on the other hand, introducing a graver restlessness into his life, making him a slave to technological environment, and —most catastrophic of all — creating the means for his own mass destruction. This indeed is a tragedy of overwhelming poignancy" (Swami Tathagatananda, 148). This points to how research in science lead to the social, economic, cultural, and security imperatives. After the successful Trinity test of a plutonium implosion device of Los Alamos, the dire and extreme outcome was the atom bombs dropped on Hiroshima and Nagasaki!  The way the world was shaping after WW-II, disgusted Einstein. The race for producing self-annihilating weapons and the parallel increase in violence not only continued in his lifetime, but dominates even today, becoming quite uncontrollable. So much of resources and efforts were, and continue to be invested in this sector of research.

**Concluding Remarks**

The present trends of research, innovation, entrepreneurship, and acquisition of skills is all about the outcomes for the future of nations, for the future generations, and for peace, tranquility, and human values. The quest for new knowledge is an instinctive human pursuit and it shall continue ever-after. In the process of implementing NEP-2020, India would be working on the suggested transformations in the categorization of universities, bringing its regulatory bodies under one umbrella, and creating the National Research Foundation (NRF).  However, to enhance and quality of education and research is only possible as a consequence of good quality schools and HEIs, and to sustain the values of personality development, character formation, and internalized commitment among children in schools. In the Indian context, over 60 per cent schools are functioning under conditions of severe deprivation and deficiency, with a rapidly down-sliding credibility and public acceptance. Nations have learnt through experience that the maximum returns accrue only through investment in education, and focus on innovations, entrepreneurship, and research. Quality research output in India will only be possible when all schools and HEIs actually function at the professionally and academically acceptable. The Indian education system must strive to achieve these goals at the earliest. The role of dedicated academic leadership remains a pre-requisite.

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# 3
# INDIAN INSTITUTES OF TECHNOLOGY AND INSTITUTIONS OF NATIONAL IMPORTANCE IN INDIA

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*This article focuses on the establishment of the Indian Institutes of Technology Starting from IIT Kharagpur in 1951 onwards and traces the history of IITs over the last 72 years and the impact it has made globally as a brand. It presents the SWOT analysis of the IIT system and impact of rapid expansion of IITs in terms of its socio-economic impact; the role of JEE and coaching institutions for admission to the IITs. Since the author is associated with the IIT system for the last 62 years out of its total 72 years of existence; he also opines on the not so positive side effects of IIT system in terms of dilution of its brand equity; social stress in getting into or not able to get into the IITs as well as the shortage of talented faculty to maintain IITs brand equity. This article also brings out the impact of declaring IITs as institutions of National Importance by the Indian Parliament. The global respect IIT system has brought to India and its global acceptance as great institutions is discussed. Role of IIT alumni in branding of IITs globally is acknowledged. Towards the end, the articles makes an overview of the concept of the institutions of National Importance which was first given to IIT Kharagpur in 1956 and then in 1961 extended to all IITs. It shows statistically how the number of such institutions which were 15 in 2000 has expanded to 167 in July 2023 by including all IITs, IIITs, NITs, IIMs, IISER, NISER, IIEST; NIPER, NID, SPA; AIIMS, FDDW, NIFTEM; and 7 central universities as well as 12 other specialized institutes into the tag of institutions of National Importance. This liberal tag given as seen through exponential growth of institutes of national importance may have diluted the pride that the author as a student of IIT Kharagpur had when he used to see this tag at the entrance gate; particularly the budget of education having remained the same as around 50-60% of promised 06% of GDP since 1986 and 2020 education policies.*

***Keywords:*** *Higher Technical Institutes, Growth, Expansion, Generations of IIT, Establishment, Engineering, Technology*

## Introduction

### Brief historical background of setting up of IITs: The first stage

The initiative to setup four 'Higher Technical Institutes' (HTI) was taken even prior to Indian independence by setting up a committee under the chairmanship of Mr. Nalini Ranjan Sarkar in 1945 to recommend establishing of four top notch technical institutions in India at par with the Massachusetts Institute of Technology, USA. This Committee had 22 members and Dr. S.R. Sengupta was its Secretary. It included stalwarts like Sir JC Ghosh; Dr.S.S. Bhatnagar and its interim Report was submitted in 1946 with a note of dissent by one of its members, Dr. Nazir Ahmed, who wanted to first conduct a survey to determine the needs and also first strengthen existing technical education institutes rather than setting up new ones. It recommended setting up four Higher Technical Institutes starting with first in or around Kolkata (then Calcutta) and another in western region near Mumbai (then Bombay); the remaining two must be in the north at Kanpur and south at Chennai (then Madras). The idea was to have even distribution of these top technical institutions in the country to cover all four regions. Location was to be chosen in a manner where a good cluster of industries existed. Sarkar committee gave a detailed roadmap to ensure that these will be at par with the best in the world in terms of standard of education.

Real implementation of Sarkar Committee Report began post-independence when in 1948 final Report of the Committee was submitted for the post-independence industrial development of India. First in the chain of these four institutes was set-up in then Calcutta on 15$^{th}$ May 1950 which was formally inaugurated on 18$^{th}$ August 1951 at Kharagpur and named as 'Indian Institute of Technology, Kharagpur' 120 kms south west of Kolkata. Since West Bengal had the largest concentration of industries, then Chief Minister of West Bengal, Dr. B. C. Roy, convinced Pandit Jawaharlal Nehru, the first Indian Prime Minister to set it at Kharagpur in Hijli detention camp in West Midnapore district five kms. from Kharagpur Railway station, which had the largest railway workshop and then perhaps the longest railway platform in India.

Hijli detention camp, where IIT Kharagpur was inaugurated by Maulana Abul Kalam Azad on 18$^{th}$ August 1951 was used by the British for detainees of Indian freedom struggle. Sir Dr. J.C.Ghosh was the first Director of IIT Kharagpur, who was also a member of the Sarkar Committee and was Director of IISc Bangalore before taking up this assignment. N R Sarkar; the Chairman of this committee became the Chairman of the AICTE and Dr. S.R. Sengupta, who was the Secretary of the Sarkar Committee, became the Secretary of AICTE, which was an advisory body until 1987 when it became a statutory body by an Act of Parliament. On 18th May 1956, Lok Sabha, through Bill No. 36 of 1956, declared IIT Kharagpur as an Institution of National Importance. After Sir J. C. Ghosh moved to National Planning Commission as a member; Dr. S. R. Sengupta, who was Secretary of the Sarkar Committee became the Director of IIT Kharagpur, who could effectively implement the recommendation of the Sarkar Committee. The author had the privilege of studying at IIT Kharagpur, when Dr. Sengupta was the Director and his first degree of B.Tech. (Hons) is signed by him. Chief Minister of West Bengal used to be the Chairman Board of Governors of IIT Kharagpur in initial years. Main Building of IIT Kharagpur was inaugurated by Prime Minister Nehru on 15th September 1956 during first convocation of IIT Kharagpur, when he said: "Here in the place of that Hijli Detention camp stands the fine monument of India representing India's urges; India's future in the making. This picture seems to me symbolical of the changes that are coming to India". IIT Kharagpur has around 2100 acres of land and continues to be the largest IIT.

Second IIT to be set up was IIT Bombay in 1958 with support from then USSR; IIT Madras was setup in 1959 with technical support from then West Germany. IIT Kanpur was setup in 1961 with supported from a consortium of top US universities and started functioning from a block of HBTI Kanpur (the author was interviewed in 1962 after clearing JEE at that place) before it moved to its 600-acre campus at Kalyanpur. Beyond the recommendations of Sarkar Committee, a fifth IIT was set up as IIT Delhi by upgrading the College of Engineering and Technology, Hauz Khas, New Delhi in 1963. Thus, from 1951 to 1963; a chain of five IITs came into being. The author has the privilege of having been a part of the faculty of IIT Delhi for past 55 years since 1968; after graduating in 1966 with M. Tech in 1968 from IIT Kharagpur.

**Typical Template of an IIT as visualized by Sarkar Committee**

The Sarkar Committee visualized IITs to the top-class technical institutes second to none in the world and created a template to enable realization of this goal of academic excellence. These were to be autonomous institutions fully supported financially by the Central Government through the Ministry of Education; with the President of India being the Visitor for all IITs and the major common service policies across all IITs being established through a Council of IITs (IIT council) chaired by the Union Minister in charge of Technical Education Government of India. Each IIT will be operationally independent within overall policies laid down by IIT Council. Each IIT will have a separate Board of Governors (BOG) with a part-time Chairman (now Chairperson) nominated by the President of India in the capacity of the Visitor of IIT; with Registrar of the Institute being the Secretary and Director as the ex-officio member of BOG. The BOG will include two professors nominated by the Senate of the Institute, four nominees of the IIT Council with concerned Jt. Secretary in the Ministry as a member and a representative from each of the state government within the zone in which a particular IIT is located. BOG will have Finance Committee to be chaired by the Chairman, BOG, Building and Works Committee to be chaired by the Director of the Institute. Senate will be the highest academic decision making body comprising of all professors; heads of departments other than professors; three external experts nominated by the Chairman BOG on the recommendation of the Director. Director will be the Chief Academic and Executive officer of the IIT whereas Registrar will be ex-officio Secretary of the Board; the Finance committee and the Senate and will be custodian of all records and the head of the administration. This structure enables a democratically functioning participative form of decision making fully empowering the IIT to decide within overall policy of IIT Council anything that helps achieving academic excellence. Director will have Deputy Director (s); Deans; Heads of departments and centers reporting to him/her. Such a standard organization structure in each IIT will provide a systematic and uniform framework in governing each IIT autonomously.

**Salient academic norms suggested by the Sarkar Committee**

For each IIT, academic and infrastructural norms to enable world class education was detailed out in the Nalini Ranjan Sarkar Committee Report benchmarking with the best in the class institutions. It suggested faculty to student ration of 1:10 for undergraduate students and 1:5 for specialized post graduate courses. B.Tech course duration was to be 4 years after 10+2 and post-graduate duration may be of 1-2 years. Ratio of undergraduate to post graduate was to be 2:1 in each IIT aiming at 2000 UG population and 1000 PG population after reaching stability. Each department will have at least two full professors including the Head of the Department. The committee did not comment on the rotational nature of leadership which was later adopted in each IIT around 1970's. Admission were to be strictly on merit based on entrance test which later on became famous globally as the JEE (Joint Entrance Examination) considered now as one of the toughest in the world. Initially subjects of English; Mathematics, Science, Drawing and Sketching were prescribed in a detailed 03 hour examination for each subject. It prescribed some reservation of economically and socially backward though the Committee was not unanimous on this issue. Final year will have a Thesis even in B.Tech programs with one year of field training after the final examination under college supervision. Detailed L-T-P was also prescribed.

A distinguishing feature of each IIT was a 100% residential campus for faculty and students and non-teaching staff. In terms of infrastructure it prescribed details of the classrooms, senate room, board room, accommodation for director and staff as well as students as per following norms: Director 3000 sq. ft.; professor 2000 sq. ft.; Asst.

Professor 1500 Sq. ft; bachelor's accommodation 400 square feet; Lecturer 1000 square feet for and 120 square feet for servant quarter: 120 sq. ft. /student in hostel and 300 sq ft. office room for professor/asst. professors. This set the benchmark which are still very relevant and almost the norm for each IIT even now. To attract brilliant minds to teaching profession it suggested Rs. 3000 p.m. for the Director, 1500-2000 for the HOD; 1000-1500 per month for the professors, 600-1000 for the assistant professors and 300-600pm for the lecturers. It suggested a non-recurring budget of Rs. 03 crores / year and Rs. 68 Lakhs/ year of recurring budget for each IIT in 1948. It can be seen that after accounting for the inflation; even now these are very attractive financial compensations to attract the best faculty. To support brilliant students from economically weaker section; it suggested creating 400 merit-cum-means scholarships to 35% of students. The fees were low and hostel room rent was nominal. Thus IIT's could attract poor but meritorious students. To strike a personal note here; in 1962 when the author got admission to IIT Kharagpur through JEE in a 4-year B.Tech (Hons) programme; he could aspire to study in IIT Kharagpur because of Rs. 110 per month National Merit Scholarship he received whereas average total cost was around Rs. 150 per month. Due to this he could study at IIT Kharagpur despite belonging to a very poor farmer's family with a rural background. Unfortunately under current distortions due to costly coaching for JEE, Rs. 02 Lakhs/year tuition fee and costly boarding and lodging in current scenario; a poor but brilliant student from weaker section or rural background cannot aspire to study in IIT system now. This demonstrates the wisdom of the fathers of IIT system to enable world class education with equal opportunities to economically weaker population on merit alone.

**Indian Institute of Technology Kharagpur: The Mother of all IITs**

The author as an alumnus of IIT Kharagpur, who also was bestowed the honour of 'Distinguished Alumnus Award' in 2004 feels that IIT Kharagpur; being the first of the IITs set a successful trail of academic excellence globally recognized and since it was set-up in 1951; by the time other the IITs came up in 1958 at Bombay; 1959 in Madras and 1960 in Kanpur; IIT was a global brand. Hence it can be safely inferred that IIT Kharagpur was a number one brand name in engineering and technology when the other IITs came into existence. Being the oldest in the family of IITs it set the benchmarks of standards and practices and can be considered to the mother of the IIT system. It attracted faculty and students from all over the country and even from foreign countries through Government of India schemes. Thus it had cosmopolitan character in terms of faculty and students, though the supporting staff was primarily from the region in which it was located. The focus on teaching; co-curricular activities including compulsory physical education or NCC; large number of humanities and social sciences courses; inter-hall sports and cultural competitions, personal tutor scheme where 8 to 10 students were assigned to a teacher (tutor) to have personal interaction and help resolve academic and non-academic problems of students set the benchmark for other IITs to follow. A student lived in the same hostel (hall of residence) in the entire stay and developed a very strong hall spirit and batch (graduating year) sprit which remains lifelong. If IIT Kharagpur had not succeeded in developing into a world class brand, perhaps IIT system may not have been what it is today. Its motto "योगः कर्मसु कौशलम्" is from chapter 02 verse 50 of Bhagwat Gita. The main building opened by Prime Minister Nehru reads "Dedicated to the service of the Nation". It has been pioneer in many new initiatives in emerging fields of studies; for example in 1966 when this author was admitted to M.Tech in Industrial Engineering & Operation Research after B.Tech (Hons) in Mechanical Engineering from there; it was the only M.Tech programme in the country then and was open to all branches of engineering though at that time it was housed in Mechanical Engineering Department. Multi-disciplinary research centers: alumni endowments such as 'Vinod Gupta School of Management' in mid-1980 were new initiatives of IIT Kharagpur; Master of Medical Technology after MBBS; Centre for IPR Laws for giving LLB after B.Tech/MSc degree are some of the bold initiatives of IIT Kharagpur. Alumni chairs; Alumni Foundations in India/USA; off campus part-time training at Kolkata Centre and Partha Ghosh Leadership Academy are some initiatives to mention a few. It can be said that much of the spirit of NEP2020 was captured by IIT Kharagpur in its existence for past 72 years. Recently setting up a medical college in IIT Kharagpur in another novel idea of the Institute.

**Growth and Expansion of IIT System: Three Generations**

Starting with IIT Kharagpur in 1951; other four IITs were established in the country in quick succession during 1958-63. Bombay in 1958; Madras in 1959; Kanpur in 1961 were set-up in accordance with NR Sarkar Committee but in 1963 IIT Delhi was upgraded from College of Engineering & Technology, Hauz Khas, established in 1961 partly by transferring some departments such as Chemical Engineering and Textile Technology from erstwhile Delhi Polytechnic (now Delhi Technological University). These five are informally known as original IITs. These were essentially considered as a comparable brand with certain departments in some IIT more popular than others. Agriculture and Food Engineering was only in IIT Kharagpur and Textile Technology was only in IIT Delhi. Kharagpur had multi-country UNESCO support whereas IITs at Bombay, Madras, Kanpur and Delhi came up under support and mentorship from erstwhile USSR; West Germany; US and UK respectively. From 1963 to 1995 there was a lull and then IIT Guwahati came up in 1995 under Assam Accord with the then Prime Minister Rajiv Gandhi. In 2001 famous and the oldest technical University of Roorkee was upgraded to IIT Roorkee and the author had an opportunity to be appointed as its first director. With some initial reluctance IIT Roorkee along with IIT Guwahati could be integrated into the family of five IITs and these 07 IITs can be considered as the first generation of IITs. The concept of foreign mentorship changed to mentoring by existing

IITs and one among these 07 IITs was to become a mentoring IIT to the new IITs that were set-up subsequently. The concept of foreign institute level mentoring and collaboration was shifted to project based collaboration from any country. IIT Roorkee was mentoring IIT Mandi and so on.

The concept of Joint Entrance Examination (JEE); the most prestigious of the entrance tests globally underwent a series of modifications from 04 papers of 03 hours each on two days of JEE to screening test based on objective multiple choice questions followed by in-depth qualitative exam for those who clear the screening test primarily to manage evaluation of large number of JEE aspirants in a very short time interval available for evaluation of answer sheets. JEE itself has gone through metamorphosis with JEE Main and JEE Advanced. The latter is conducted by IITs from which IITs take their candidates whereas JEE Main – having purely objective multiple choice questions which will be used for admissions to other engineering colleges and only fewer candidates who clear JEE Main with a minimum cut-off score will be allowed to go for taking up JEE Advanced. Initially the medium was only English; later on it was opened for Hindi and other regional languages. These Seven IITs continued to be sought after institutions of national importance accorded by the Act of Parliament.

Each institute had its share of problems with the emergence of a strong employees union in 1972 at IIT Delhi which is now part of a federation of employees unions of all other IITs. IIT Kharagpur had experienced mess employees strike with predictable frequency but a strong visionary leadership, dedicated faculty and talented students together with strong foundation of IIT system through Sarkar committee implemented by IIT Kharagpur could withstand those temporary operational storms and hiccups. IITs became a global brand and getting into any IIT through JEE became the national aspiration of parents.

The success of IIT system and its huge demand but limited capacity led to demand for creating more IITs in the country. The number was more than doubled through a number of so-called second generation of IITs established at Ropar, Bhubaneshwar, Gandhinagar, Hyderabad, Patna and Jodhpur in 2008 and at Indore and Mandi in 2009. IIT (BHU) was carved out of IT (BHU) which was a part of BHU, Varanasi in 2012. Thus the total number of IITs in 2012 became 16-roughly double the number that existed during the previous 55-60 years. This was called the second generation of IITs. To meet ever increasing demand for more IITs a third generation of seven more IITs came up at Palakkad (2015); Tirupati (2015), Bhilai, Dharwad, Jammu and Goa in 2016 along with upgrading the famous Indian School of Mines set up in 1926 to IIT (ISM) Dhanbad in the same year (2016). Thus today there are 23 IITs in the country out of which 16 have come up during 2008-2016 whereas for 55 years only 07 IITs existed. This is quite an exponential growth of IIT system which had its strengths and weaknesses that will be discussed later in this article.

The rapid expansion of IIT system from 07 since independence till 2008 and 16 IITs from 2008-2016 has its pros and cons- on one hand it has increased the intake capacity for admission to IITs contributing to better access and spread of these institutions across various states of the country contributing to the process of national development and enable these IITs to address the problems of the region in order to find solutions to those through technology. This will lead to socially relevant research outcomes. It would also enable the candidates to prefer a particular IIT close to his/her native place facilitating frequent interaction of parents with the student to address psycho-social issues; but on the other side of the coin are three grades of IITs depending on which generation of IIT it is. Hence the variability of quality perception about some recent and particularly not conveniently located IITs could lead to a dilution of perceived brand of IIT as a brand. There is a perception that in case of first generation of IITs; all the IITs in general had a brand value and within the group of those 5-7 IITs, the quality levels perceived by society was not substantive except that certain departments in a particular IIT were preferred more than others.

However due to this perceived brand dilution; it is the noun that follows the acronym IIT that determines whether it is a brand name. For newer IITs; there are problems of attracting and retaining most talented faculty who may get a foothold in a new IIT and keep on trying to move to a more established IIT. Some IITs in 02$^{nd}$ and 03$^{rd}$ generations have developed must faster than others. Internal migration of talent within the IIT system is an issue which calls for some policy intervention. Due to poor connectivity, IITs in a far flung location without adequate housing; schooling; civic amenities and medical facilities may experience that parents may be unwilling to send their children there and the most talented faculty may also not apply. There are strong incentives given by old IITs by way of liberal research grants for joining them which new generation of IITs cannot afford because their own internal resource generation capacity is limited. A number of seats remaining unfilled despite multiple rounds of counselling is a pointer to this and at times a student may prefer to go to an established NIT/Government engineering college than going to an IIT in 02$^{nd}$ and 03$^{rd}$ generation category. The same may hold good for attracting best academic leadership. The progress of some of these new IITs may be very sluggish. For example; IIT Goa has not yet been able to even acquire the land for last 08 years since it was set-up in 2016. Thus IIT as a brand faced a bit of dilution.

## Global outreach of the Indian Institute of Technology

IIT graduates have been sought after for higher studies and research in developed countries notably the USA. They all have done extremely well in academics and the corporate world; many of them in the leadership role in top American Universities and CEO's of large multinational companies. This has led to enormous enrichment of global branding of IITs. This in the past had concerned the people in power and the society about the so-called 'brain – drain' in which it was felt that India is spending money in these IITs to train them for American professors as their research scholars and to foreign corporates to enhance their competitive advantage. While this may by partly true that best brains are lost to other countries but on the other side of the argument, these great minds due to enabling work culture and merit driven career growth are responsible for enhancing IIT as a brand name globally and have since returned back to their alma mater by way of substantive endowments or remittances to their families and promoted IIT brand and brought great name and fame to India.

This global recognition of IIT system has led to many bilateral corporation level agreements between a concerned IIT in India and its counterpart institution abroad. Student and faculty exchange; joint degree programs; joint PhD supervision and various MOUs have been signed between an IIT and many foreign universities such as IIT Bombay – Monash University joint PhD, IITD – Queensland University of Technology, Australia, joint supervision of M. Tech theses between IITs and Technical Universities in Germany through DAAD to name a few. This has created demand for setting up IITs in other countries. Government of India has now permitted an IIT to set-up a campus in other countries. IIT Madras has taken a lead in setting up IIT Madras – Zanzibar campus catering to a large number of students from African region. IIT Delhi – Abu Dhabi campus is now in the process and many more IITs may expand their campuses outside Indian geo-graphy. This will add to making of an IIT a truly global brand.

## Issues concerning accreditation and ranking of IITs

IITs generally are not keen in getting NBA or NAAC accreditations which other technical and management institutions are expected to do. Under Washington Accord an NBA accreditation is required for a degree from India to be recognized in countries which are signatories to the Accord. However since US universities and others in UK; Singapore; Australia etc. are keen to have IIT graduates without even NBA accreditation, they may be reluctant to go for accreditation. It may be a bit of implied intellectual arrogance on their part thinking that they are the best in India and no one can judge them. In contrast even the best of American University – MIT, Stanford have to go for ABET accreditation. Fortunately through a nudge by the IIT Council in its recent meeting held at IIT Bhubaneshwar; IITs are now open to the idea and are expected to get some kind of accreditation done. However, in international rankings such as QS world ranking; THE ranking; Shanghai rankings, these are open to participation though some established old IITs have refused to participate in some world ranking due to difference of opinion on the parameters such as weightage given to perception and global faculty and students. It is felt by them that in the global rankings the parameters and weights assigned to them are more favorable to their own country rather than India.

However, in NIRF rankings, IITs are not only participating but occupy most slots in top ten ranks year after year. NIRF rankings of IITs further expose the dilution of brand IIT as some second generation and third generation IITs find a rank much below NITs and even some private state universities rankings and QS – world rankings for 2023.

Table 1 clearly shows the unimpressive world rankings of even top rated IITs where IIT Bombay has 172 rank; Madras (number 01 in NIRF) is 250; IIT Indore at 396 is the only 02nd generation IIT to be in top 500. IIT Hyderabad and IIT (BHU) are in the range (581-590) and (651- 700) respectively. More worrisome is the QS world ranking % score with MIT at 100%; IIT Madras (1st NIRF rank) score is only 38.6%.

**Table 1 QS – World Rankings and NIRF rankings for top ten IITs in 2023**

| **Relative Rank in India** | | | | **NIRF Rankings** | | |
|---|---|---|---|---|---|---|
| **Rank in India** | **QS World Rankings** | **Institute** | **% Score** | **Rank in India** | **Institute** | **% Score** |
| 1 | 155 | IISC Bangalore | 49.5 | 2 | IISC Bangalore | 83.09 |
| 2 | 172 | IIT Bombay | 46.7 | 4 | IIT Bombay | 81.28 |
| 3 | 174 | IIT Delhi | 46.5 | 3 | IIT Delhi | 82.16 |
| 4 | 250 | IIT Madras | 38.6 | 1 | IIT Madras | 86.69 |
| 5 | 264 | IIT Kanpur | 37.6 | 5 | IIT Kanpur | 77.23 |
| 6 | 270 | IIT Kharagpur | 37.2 | 7 | IIT Kharagpur | 71.82 |
| 7 | 369 | IIT Roorkee | 29.9 | 8 | IIT Roorkee | 71.66 |
| 8 | 384 | IIT Guwahati | 29.3 | 9 | IIT Guwahati | 68.78 |
| 9 | 396 | IIT Indore | 28.7 | 28 | IIT Indore | 58 |
| 10 | 581-590 | IIT Hyderabad | - | 14 | IIT Hyderabad | 64.24 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 651-700 | IIT (BHU) | - | 31 | IIT (BHU) | 57.08 |
| • **Rank 01 MIT Score: 100%** | | | | • **Rank 01 IIT Madras** | | |

Two things clearly emerge from the comparisons in Table 1.

**(a)** Even after 15 years of their creation the second generation of IITs have not yet been able to find a slot in top 500 of global institutions which means that IIT in general as mentioned earlier is no longer a generic brand and $2^{nd}$ and $3^{rd}$ generation of IITs have to put in a lot of efforts to get global recognition. Hence the statement that IITs, in general, being a world class institution needs to be taken with a pinch of salt.

**(b)** Even our top rated IIT in QS Ranking (IIT Bombay) secured only 46.7% marks at rank 172 whereas MIT at rank number 1 is 100%. Among $1^{st}$ generation of IITs; IIT Guwahati has QS rank 384 and scores 29.3%; which is not an inspiring observation even after 28 years of its existence as an IIT. Hence the IIT system; though richly admired in India; is yet to become a truly global brand particularly the second and third generation IITs. Hence if IITs are truly aspiring to be world class; then government, industry; alumni and philanthropist have to come forward in a big way to liberally fund IITs as compared to the funds given to top rankings universities in the world. Another positive way to look at this is that despite very low financial allocation to an IIT compared to its global counterparts; these institutions have done rather well.

**Alumni connect: An Important Differentiator in Branding IIT**

An alumnus or alumnae are an important stake holder in brand building of an IIT. An IIT feels elated due to reflected glory of its alumni in the world of work. Hence nurturing alumni connect is a vital strategy and those IITs which have focused on this aspect have done rather well in branding themselves because an alumnus has a life-long emotional bond with their alma mater. Many, if not all IITs have recognized the need for connecting to its alumni through creating an office of the Dean/Associate Dean/ Professor in charge Alumni Affairs. Some have combined it with international programs as well. Parallelly; each institute has encouraged and facilitated its alumni to form their respective alumni associations with articles and branches all over India and even abroad.

These alumni associations in conjunction with the office of Dean Alumni Affairs have helped in intensifying bonding of the alumni with their alma mater through regular meetings, social get to gathers, annual alumni meet, silver; golden and even diamond jubilee celebrations when they visit batch wise to reconnect with their teachers and batch mates and express their nostalgia during their studies at their IIT. Some show to their spouse and children even the hostel rooms where they stayed. The alumni associations of

23 IITs have further forged a federal structure by way of Pan – IIT Alumni Association in India and abroad. Pan - IIT Alumni Association in the USA is very active. Pan – IIT meet, annual functions, social networking events make IIT alumni connect with each other and contribute towards bonding and branding of the IITs.

IITs on their part have instituted processes to recognize the distinguished alumni through 'Distinguished Alumnus Award' 'Distinguished Service Awards'; Young Alumni Award every year given during convocation or Foundation Day Celebrations. The Alumni Associations themselves have created awards to confer awards to recognize their members for their contributions to the society or the service to the association. Some IITs have set-up Alumni Foundations in India and abroad to marshal funding support from their alumni to their alma mater. IIT Delhi Alumni Association for example has established 'Outstanding Contribution Award for National Development' (OCND) given every year. The author of this article received the ONCD from IIT Delhi Alumni Association in 2002 by virtue of being an alumnus of IIT Delhi having obtained his PhD from IIT Delhi in 1974. IIT Kharagpur started recognizing its alumni through 'Distinguished Alumnus Award' from the late 1980's or early 90's. The author received the 'Distinguished Alumnus Award' from IIT Kharagpur in 2004 being an alumnus of IIT Kharagpur with B.Tech (Hons) in 1966 and M.Tech in Industrial Engineering and Operations Research in 1968. Recently IIT Kharagpur has chosen him for their prestigious 'Life Fellow' award. Starting with IIT Kharagpur; various IITs have produced a very large talent pool of alumni who are doing wonders in the world of work globally and perhaps are major contributors in branding IITs worldwide.

However; the oldest IITs have a rather huge advantage in having a large talent pool of distinguished alumni as compared to the second and third generation IITs and in terms of alumni support by way of rich endowments; chair professorships; setting up of special centers and research programme. These alumni have contributed to branding; image building and generating huge corpus and financial resources to their alma mater. In contrast, the new generations of IITs do not have such a large talent pool of their accomplished alumni, donors and hence suffer in terms of internal resource generation and branding by virtue of reflected glory to their alma mater by virtue of their eminence. This might further increase the gap between the old and new IITs in terms of their funding support and flexibility to offer incentives to attract brilliant faculty to new IITs. Hence perhaps it is imperative on the part of famous alumni from old and established IITs to show a rather larger heart by also supporting liberally the new IITs though they may not be the alumni of those IITs. This will be their contribution to save brand IIT in general which is somewhat getting eroded for reasons discussed earlier. May be the Pan – IIT Association is a right forum to take up this task of hand holding some of the new IITs by the distinguished alumni of some of the old established IITs otherwise the "rich IITs will become richer" and brand gap will be wider which is not a good thing in the overall interest of brand IIT.

For the newer IITs the alumni connect has not been fully realized because the relatively lower numbers in alumni base as well as some of these alumni are relatively young to scale the peaks of professional attainments or even honoring them with the distinguished alumnus award has not started. Hence the role of alumni in such 2nd and 3rd generation IITs in internal resources generation and branding is not that dominant as in old IITs. However this has to be given priority because it should not remain an untapped potential. Instead of expecting huge endowments from them, increasing the degree of alumni participation even with modest support in direct or indirect support including mentoring; invited lectures, internships, placements support, sponsored projects, joint project supervision, curriculum review etc. can help strengthen the bond which in the long run could also result in similar financial support as in older IITs.

**Innovation, Incubation and Entrepreneurship**

In the early stage of old IITs the focus was primarily in teaching, academic research, funded research and consultancy. Focus on IPR and entrepreneurship was not much and IIT alumni took to entrepreneurship after graduation on their own either due to family business obligations or after gaining some experience in industry. However in recent times in all IITs; old and new, the support of IPR, filing of patents; facilitating innovation through technology and business incubators as well as formal training through courses on entrepreneurship are being emphasized. While in the US many IITian have played key roles in the Silicon Valley; in India such a cluster of IIT entrepreneurs has not yet become prominent. However even without formal focus earlier, many IITians (say about 13% of IIT Delhi alumni) have been very successful in their own business, quite many times very different from their own technical background. In India; Dr. R.N Khanna of IIT Kharagpur is founder and chairman of C&S Electric Ltd; R.S Panwar and Vijay Thadani founded NIIT Ltd; Vishu Dussad and Yogesh Andley of IIT Delhi founded Nucleus Software and more recently ventures like Zomato; policybazaar.com etc. have been created by IIT Delhi alumni.

In current times IITs are giving a lot of attention to this area and have set-up foundations such as FITT (Foundation for Innovation & Technology Transfer) at IIT Delhi which has facilitated TBIU (Technology – Business Incubation units). The Boards of IITs through policy support have enabled its faculty and alumni to establish Section 8 companies and even allowed IIT professors to be chairman of such companies and could take long leave to fully devote time to such startups and return back later. IIT Kharagpur was pioneer in creating STEP (Science and Technology Entrepreneurship Park) at its campus. IIT Delhi at its campuses in Sonipat and Jhajjar in Haryana are expanding its activities of main campus. IIT Madras has a Technology Park. A good outcome of this changed focus is that IITs are now focusing on addressing socially relevant research problems which has indeed helped in handling many problems during Covid-19 Pandemic. Dr. Manindra Agrawal of IIT Kanpur used his modelling expertise to predict Covid pandemic in different waves with a fairly good accuracy. Thus IITs are now connecting to the society.

**SWOT Analysis of IIT system**

Strengths; Weaknesses; Opportunities and Threats (SWOT) analysis is a very insightful tool for institutional soul searching. An attempt to analysis IIT system through SWOT analytic framework here is made which is by no means exhaustive; never-the-less gives insights on positive and not so positive impact of the IIT system in the country. Strengths and weaknesses are historical and internal to the system while opportunities and threats are futuristic and external to the system. This can be a useful input for mid-course correction and policy intervention for making IIT system stronger and socially more relevant. A tentative listing as follows in Table 2.

**Table: 2 SWOT Analysis of IITs**

| Strengths | Weaknesses | Opportunities |
|---|---|---|
| ❖ Excellent student quality.<br>❖ Very good faculty quality.<br>❖ Fully residential nature.<br>❖ Liberal funding by government.<br>❖ Academic Autonomy.<br>❖ Strong postgraduate and research focus.<br>❖ Positive Public Perception.<br>❖ International Reputation.<br>❖ Large sponsored research & consulting.<br>❖ Multi-disciplinary focus. | ❖ Toughest JEE leads to coaching culture.<br>❖ Three generations of IITs have diluted perceived IIT brand.<br>❖ Diverse academic caliber in the same class leads to variability in results.<br>❖ Stress, dropout and increasing tendency of student depression<br>❖ Huge faculty shortage due to non-filling of faculty positions<br>❖ Rapid increase in intake leading to shortage of hostels/faculty residences and overcrowding in campus and reduced greenery.<br>❖ UG:PG ratio of 2:1 as planned is reversed to 1:2 which in turn have shifted focus to research publications from teaching in some of the old IITs.<br>❖ No B.Tech of an IIT prefers to do M.Tech/PhD from an IIT – particularly in their own. | ❖ Enhance global employability for demographic dividend.<br>❖ Increasing on-line education for practicing executives.<br>❖ NEP-2020 roadmap for future policy.<br>❖ Contribute to national development agenda 2047.<br>❖ Introducing teaching in Hindi and regional languages.<br>❖ Setting up IIT campus abroad.<br>❖ Increase industry connect/Professor of Practice. |

| | | |
|---|---|---|
| ❖ Substantial focus on humanities/social sciences.<br>❖ Relatively low bureaucratic. /political interferences.<br>❖ Faculty cadre flexibility.<br>❖ Uniform policies across IITs through IIT council.<br>❖ Frequent updation of curriculum by Senate.<br>❖ Strong alumni support.<br>❖ Faculty freedom.<br>❖ Diversity and social inclusion.<br>Review and regulatory control only by Parliament. | ❖ High MNC Packages make teaching, research, government job unattractive.<br>❖ Brain drain at masters/doctoral level.<br>❖ Remote IIT location of newer IITs does not have the same brand value.<br>❖ Strong employee unions<br>❖ Increasing suicides on campus and at coaching centers causing social distress.<br>❖ Perceived cast biases in class/hostels<br>❖ Increasing dropout rates among socially deprived category.<br>❖ Indifference in student: teacher relationships; complaints of student harassment.<br>❖ Increasing fees/cost of studies is burden on poor students.<br><br>Lower number of global faculty and students. | ❖ Explore CSR route for generating resources.<br>❖ Get national/international accreditation done.<br>❖ Use talented retired faculty without age – restriction as per practice in top US universities.<br>Design multi-attribute Performance format for performance appraisal. |

**Need for Social Audit of IIT System**

One of the main purpose of setting up of IITs in the country as visualized in the NR Sarkar Committee is to train high quality engineering graduates in IITs who will contribute through teaching and research in improving the quality of other engineering colleges and research institutions by way of multiplier effect. Have IITs met that objective or has there been a changed focus on going for more lucrative multinational companies often in non-engineering role? Similarly has over – hype of IITs and rapid expansion not negatively impacted government – state engineering colleges by way to reduced funding, quality of faculty and quality of teaching learning processes and research? About 80% of the government funding goes to CFTI (primarily IITs) which may be contributing to 10% technical manpower whereas large number of state and private colleges are not able to get due financial support. The coaching menace filters out poor rural population due to lack of affordability of coaching. Increased social pressure even in coaching is putting students under mental depression. Students admitted in IITs are fatigued at the entry level due to stressful process of admissions. Has JEE impacted board exams and is it really required to be so rigorous in the admission process? There is an urgent need to do social audit and cross – impact analysis of IIT system as it has becomes an operating necessity to look at educational quality holistically at the national level.

**The concept of Institutions of National Importance**

Institute of National Importance (INI) is a status that may be conferred on a premier higher education institution in India by an Act of Parliament of India an institution which serves as a pivotal player in developing highly skilled personnel within the specified region of the country/state. Institutes of National Importance receives special recognition, higher autonomy and funding from the Government of India.

IIT Kharagpur through an Act of Parliament was given the privilege of being an Institution of National Importance in 1956. Almost in the same year All India Institute of Medical Science was given the same status. Indian statistical Institute Kolkata (then Calcutta) was given that tag in 1959. When new IITs at Bombay, Madras and Kanpur were added to the IIT system; Indian Parliament through an Act in 1961 (amendment) included all the four IITs as the Institution of National Importance. Later on whenever new IITs were set-up; the Act was amended to include all IITs into its fold. The tag of an 'Institution of National Importance' to IIT Kharagpur was very inspiring to the students and teachers alike and it gave us all a sense of recognition as student of IIT Kharagpur when the author joined it as an undergraduates student in 1962 in a 4-year B.Tech (Hons) Programme. This was boldly displayed at the main gate and every time we entered; this gave us renewed enthusiasm to conduct our-self worthy of such an institution of national importance. By 2001 when IIT Roorkee was established and brought up into the fold perhaps the total number of institutions of national importance was 15. Thus it was an exclusive club of elite institutions.

However, the number of institutions now declared as the institutions of national importance has increased almost exponentially since then as in July 2023, there are 167 institutions of national importance by frequent upgradation of institutions through Act of Parliament. Now the list of institutions of national includes 23 IITs; 31 NITs; 20 AIIMs;; 25 IIITs; 07 IISERs; 07 NIPERs; 03 SPAs; 02 NIFTEMs; 07 central universities', 04 medical research institutes and 12 other specialized institutes. Some more are proposed to be brought under the category of institutions of national importance.National Institute of Technology were renamed by converting erstwhile Regional Engineering Colleges

(RECs) and through an Act in 2007 these were accorded the status of institutions of national importance. In 2015 the five Indian Institutes of Information Technology (IIIT) were brought in under this category in which in 2020 another 20 IIITs under P-P-P model were given the same status. In 2017 Indian Institutes of Management (IIM) were given this status. National Institute of Design (NID) was included in this elite club of institutions in 2014 and Footwear Design and Development Institute FDDI was declared as INI through FDDI Act 2017. School of Planning and Architecture (SPA) was declared as INI through 'School of Planning and Architecture' Act 2014 and its subsequent amendments. IIEST Sibpur was declared as Institute of National Importance through 'National Institute of Technology' Science Education and Research Act 2007 and its subsequent amendments, which also included all IISER in the country. National Institutes of Pharmaceutical Education and Research (NIPER) through an Act in 1998; and its subsequent amendments. Table 3 gives a summary of these INIs.

**Table 3: Summary list of Institutes of National Importance (Till July 2023)**

| | | |
|---|---|---|
| **1** | **23 IITs at** | Kharagpur, Mumbai, Chennai, Kanpur, Delhi, Guwahati, Roorkee, Gandhinagar. Bhubaneshwar, Indore, Hyderabad, Jodhpur, Patna, Ropar, Mandi, IIT (BHU) Varanasi, IIT (ISM) Dhanbad, Tirupati, Bhilai, Goa, Palakkad, Dharwad, Jammu. |
| **2** | **21 IIMs at** | Ahmedabad, Kolkata, Bengaluru, Lucknow, Indore, Amritsar, Bodh Gaya, Kozhikode, Kashipur, Raipur, Ranchi, Rohtak, Shillong, Sirmaur, Udaipur, Tiruchirappalli, Vishakhapatnam, Nagpur, Sambalpur, Jammu, Mumbai. |
| **3** | **25 IIITs at** | Gwalior, Allahabad (Prayagraj), Jabalpur, Kanchipuram, Guwahati, Kota, Kalyani, Dharwad, Lucknow, Kottayam, Imphal, Chennai, Bhagalpur, Bhopal, Kurnool, Agartala, Nagpur, Pune, Raichur, Ranchi, Sonipat, Surat, Tiruchirappalli, Una, Vadodara. |
| **4** | **07 IISER at** | Pune, Thiruvananthapuram, Mohali, Bhopal, Tirupati, Kalyani, Brahmapur. |
| **5** | **20 AIIMS at** | New Delhi, Patna, Raipur, Jodhpur, Bhubaneshwar, Bhopal, Rishikesh, Raebareli, Kalyani, Madurai, Mangalagiri, Nagpur, Bilaspur, Deoghar, Bibinagar, Jammu, Bathinda, Rajkot, Gorakhpur, Guwahati. |
| **6** | **31 NIT at** | Raipur, Rourkela, Ravangala, Silchar, Srinagar, Tiruchirappalli, Srinagar (Pauri, Garhwal, Uttarakhand), Warangal, Jalandhar, Jaipur, Bhopal, Prayagraj, Agartala, Tadepalligudem (Andhra Pradesh), Yupia (Arunachal Pradesh), Kozhikode, New Delhi, Durgapur, Farmagudi, Hamirpur, Jamshedpur, Mangaluru, Kurukshetra, Imphal, Shillong, Aizawl, Chumukeidma (Nagaland), Patna, Karaikal, Nagpur, Surat. |
| **7** | **05 NID at** | Ahmedabad, Amravati, Jorhat, Kurukshetra, Bhopal. |
| **8** | **07 NIPER at** | Ahmedabad, Guwahati, Hajipur, Hyderabad, Kolkata, Mohali, |

| | | |
|---|---|---|
| | | Raebareli. |
| **9** | **03 SPA at** | New Delhi, Bhopal, Raebareli |
| **10** | **02 NIFTEM at** | Kundli (Haryana), Thanjavur. |
| **11** | **FDDI at** | Noida |
| **12** | **12 Specialized Institute** | IIEST Sibpur, ISI Kolkata, The Asiatic Society Kolkata, IIPE, Vishakhapatnam, RGIPT at Jais (UP), Dakshina Bharat Hindi Prachar Sabha Chennai, Kalakshetra Foundation Chennai, Academy of Scientific and Innovative Research, Ghaziabad, New Delhi International Arbitration Centre, Regional Centre for Biotechnology Faridabad, Rajiv Gandhi National Institute of Youth Development, Chennai, Institute of Teaching & Research in Ayurveda at Jamnagar (Gujrat). |
| **13** | **07 Central Universities at** | Allahabad (Prayagraj), Shantiniketan, Rastriya Raksha University, Gandhinagar, Dr. Rajendra Prasad Central Agriculture University Samastipur, Rani Lakshmi Bai Central Agriculture University Jhansi, Nalanda International University and National Forensic Science University Gandhi Nagar |
| **14** | **04 Medical Research Institute at** | Bengaluru, Chandigarh, Pondicherry, Thiruvananthapuram. |

**Critical appraisal of status of Institution of National Importance**

When the concept was started in 1956 with IIT Kharagpur and AIIMS, New Delhi; the Institute of National Importance was a unique distinction giving special privilege to such institutions. Till 2007 it still remained a powerful status symbol and pride of its faculty, students and alumni; with about 13 such institutes in the country. Even IISc Bengaluru did not have status whereas it is rated as the best in the country. However large scale conversion of all NITs, all IIITs, IIMs etc. has resulted in exponential increase in the number of such institution and within this elite category there are huge quality variations. It is a known fact in system dynamics modelling that anything that grows exponentially is not sustainable. Perhaps that could be the reason of creating a new brand of Institute of Eminence (IOE) in which only few original IITs find a place though equal numbers of private universities are also in this club. This itself is debatable if these IOEs are comparable in quality and some of those not included in it could be perceived better than those included particularly in the private category.This article has attempted to trace the journey of India’s famous IIT brand starting with its oldest IIT at Kharagpur, which the author perceives as the mother of all IITs and the author is lucky to have studied there at B.Tech and M.Tech levels and also received the distinguished alumnus award. Even till date IITs have remained the pride of the nation and with a budgetary support at a small fraction of the top institutions in the world; IITs are giving them good competition among world rankings. However due to large and rapid expansion; the brand IIT seems to getting diluted and unfilled seats in some of the newer IITs is a pointer to their declining shine. The social stress for getting into the IIT due to coaching culture and stress of not managing student diversity well on the campuses is a cause of concern. SWOT framework may show the direction of improving brand IIT. Rapid increase in group of institution of national importance and wide perceived quality variation among them is also addressed in this article. It is hoped that this article will provide a synoptically overview of IIT brand and address various issues through policy intervention so that brand IIT as institutions of national importance is able to maintain its global quality perception.

**Concluding Remarks**

The initiative to establish four premier technical institutes in India was conceived before independence, inspired by the Massachusetts Institute of Technology (MIT) in the USA. The Nalini Ranjan Sarkar Committee, formed in 1945, proposed creating these institutes to be distributed evenly across the country: in Kolkata, Mumbai, Kanpur, and Chennai. The first, IIT Kharagpur, was established in 1951. Subsequently, IIT Bombay (1958), IIT Madras (1959), and IIT Kanpur (1961) followed. A fifth, IIT Delhi, was later added in 1963.
IIT Kharagpur set the precedent, transforming the Hijli detention camp into a world-class educational institution. The structure and governance of IITs were designed to ensure autonomy and academic excellence, with the President of India as a visitor and governance through a Board of Governors and an IIT Council.

The expansion of the IIT system continued with second and third generations of IITs established from 2008 to 2016, increasing the total number to 23. This rapid growth has led to challenges, such as faculty shortages, infrastructure constraints, and perceived dilution of the IIT brand. Despite these issues, IITs remain highly regarded, contributing significantly to global academia and industry.

IIT alumni have played a crucial role in enhancing the global reputation of IITs, with many excelling in academia and corporate leadership worldwide. This global recognition has fostered international collaborations and the establishment of IIT campuses abroad. However, the system faces challenges like the need for accreditation, addressing quality disparities among different generations of IITs, and managing stress and mental health issues among students.

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# 4
# BUILDING TECHNOLOGY DRIVEN SMART UNIVERSITY CAMPUSES FOR EFFICIENT LEARNING EXPERIENCE

**Shibu John and Seyed E. Hasnain**

*COVID-19 pandemic has impacted humanity and shaken the world like never before. Not just economy and human health but all spheres of governance continue to struggle with hardly any sign of normalcy. Education is paying a heavy price during this pandemic with far reaching and long-time implications. Countries such as India where we already have social divides along, caste, religion, sex are witnessing yet another kind of divide – the 'digital divide'. Despite enormous development in our country, India primarily still lives in the villages. There are still vast areas of habitation that does not get proper un-interrupted electricity, leave aside internet and appropriate bandwidth and access to modern telecommunication gadgets. It is under these conditions, quality education at all levels, primary, secondary, college/University and professional, across the nation irrespective of any social, economic and infrastructure divide, poses a formidable challenge.*

***Keywords:*** *Education Levels, Digital Education, Internet of Things, Smart Campus, Artificial Intelligence, Machine Learning, Infrastructure Development*

## Introduction

When it comes to higher education, the appeal of tomorrow's university campuses will be portrayed in their ability to be digital, versatile and utilitarian. They should emerge as enablers of creative teaching methods, study and research pertaining to their smart infrastructure whilst regulating expenditure and encouraging optimal resource utilisation. The advent of technology into the realm of education has aided some progressive and modernised universities to build and run courses that are a fully integrated and represent customised blend of the learning process facilitated with energy-efficient, green and smart buildings and e-mobility charging solutions across university campuses. These vital changes eventually amount to the creation of environments that are caring, conducive and capable of managing unprecedented trends and demands.

A stark commonality between smart campuses worldwide is that they make way for technology-driven interventions in the entirety of their operations by allowing IT and utilising sensors, IoT (Internet of Things) and cloud computing to control University operations where not only good communications are carried out, but the energy consumption is also reduced to maximise resource efficiency. It also reinforces responsibility, transparency, cybersecurity and redundancy in cyber systems. Although most universities have implemented IoT technology on campus, the 'technological revolutionization' of some may be hindered on account of their antiquated infrastructure. Educational administrators may nonetheless adopt an IT strategy for intelligently designing of campuses that fulfil long-term aims and attain immediate registration and reputation targets. Smart University campuses hugely rely on networked technology to make communication, security, and resource utilisation more efficient. In other words, a smart campus will increase efficiency, experience and educational opportunities. It allows an institution to link systems, such as, lights and door locks and provides students, teachers and personnel with a smooth and interconnecting experience.

Higher education is highly likely to benefit from "smart" technology utilised in banking, retail, digital workspaces, and even smart venues like gardens, play grounds and stadiums. According to a study done by the Centre for Digital Education and Century Link, almost half of higher education administrators believe smart campus technology would help them save money, while the remaining believe it will help them retain students. The campuses for higher education are the nation's refinery for educational research and growth, and therefore, it becomes even more pressing to convert your institution into an intelligent campus thereby enhancing students', teachers' and other staff's experience. The augmentation of smart campuses in India is the key to doubling the gross enrolment ratio, as targeted in the National Education Policy 2020.

Smart campuses can improve the utilisation of resources such as space, water, energy, etcetera, by implementing technological interventions. The intelligent and smart campuses can monitor campus pollution levels and release automated advisory messages. They can employ room temperature control sensors while the offices, laboratories and classrooms remain vacant. Furthermore, RFID may be used to track teachers and students, and administrative personnel can view students' comments on teachers directly through mobile applications. A well-managed smart campus can quickly orient incoming students and visitors. Universities may use artificial intelligence and machine learning (AI & ML) to automate temperature management and other settings in buildings by using Wi-Fi equipped access points and analysing when students, teachers, and staff arrive at and depart a particular location. If the University uses class scheduling modules *via* various apps and smart devices, classrooms can be shared.

**Defining smart university campus**

To deliver helpful and engaging experiences, a smart campus employs a modern network infrastructure and internet-connected gadgets. It connects people, devices, and apps, consequently enabling institutions to make data-driven choices that enhance security and maximise resources. Technology-enabled systems interact to provide university stakeholders with more immersive and automated experiences. To support the smart campus idea, Universities integrate wired and wireless infrastructure and hardware. Some common Smart Campus Technology uses include:

- Maintaining good health of students, faculty members and staff using digital platforms;
- Manging campus wide travel and directing people to available parking slots;
- Campus mapping through technology and digital devises;
- Early detection of water leaks or malfunctioning equipment to prevent serious repercussions;
- Facial recognition, and place intelligence to refine safety systems;
- Using technology to balance out the workload among non-teaching staff and to turn staff working style into more significant roles;
- Resource sharing and promoting self-service options to boost the efficiency in the system;
- Monitoring attendance and resource usage in leisure centres, residences, dining rooms, stadiums, and classrooms;
- Reorganising teachers and student activities during the course of learning process;
- Feedback and auto correction mechanism to ensure fool-proof functioning.

Globally, higher education institutions strive for an intelligent campus design in order to improve student performance and save expenses. There are limitless possibilities after a University has laid the foundation for wireless and wired services. Many universities in India and throughout the world are now hosting virtual graduation ceremonies *via* various internet platforms. A few of these virtual convocations even included augmented reality experiences that gave students the impression that they received their degrees live on stage. The benefits of Smart Campus Technology include, but are not limited to:

**Better student understanding**

In educational institutions, students are the key stakeholders. They demand the greatest amenities and quick access to all resources, such as the library, hostels, and playing fields. Universities must deliver modern campus experiences in a convenient, safe, and user-friendly manner to accommodate tech-savvy, always-connected students. They are continuously on the lookout for digital library systems, quick learning and examination alternatives, food service kiosks, and simple payment methods, among other things. In addition, accessibility is crucial. Students should travel freely about the campus and access services that are handy and simple to use. As directed by various governing bodies of higher education prevalent, the on-campus experience has to adapt rapidly to match the requirements of off-campus students. A solid student feedback system and its impact on the academic and administrative matters will enhance the confidence among students. Similarly, having a transparent scholarship process will build confidence among the students. Also, a technology driven institution will fetch good reputation and good reputation will attract easy education loans to its students. The experience of Collegiate life must be the same regardless of whether the classes are conducted in person, online, or through satellites, for that matter.

**Reduced operational costs**

Administrators can cut overall expenses by linking buildings and utilities to smart technology. Automation systems, for example, save time in administration and allow higher education administrators to refocus resources. They can recognise maintenance requirements and deploy regular maintenance people efficiently, such as ensure substitution of light bulbs before they are incinerated, inside a connected environment. By having a building management system, with a click of button, the entire facility can be controlled for good. Access control process and intelligent security system can reduce human interface, thus reducing the cost of operation.

**Data driven decision making**

Education requires data-driven and flexible decision-making. Smart campus design captures data that may be used across the entire organisation in real-time. Rather than bits of data, advisers may utilise wide use data to improve transportation routes and timetables based on travel patterns, find new income sources, and generate insights from contextual data based on user behaviour, among other things. Class time table, attendance, examination, overall governance system can be monitored based on real time data.

**University standing**

A smart university campus has a higher reputation in every facet of its existence. Increased safety, active student assistance and novel methods to education provide a competitive edge to the university. The institution may also collect user created material for use in advertising and public outreach activities with students who are always connected. Points scored for the usage of technology in the overall university governance system will reflect on the national and international ranking grades. Universities should establish consensus to focus on the campus by investing in contemporary, scalable architecture that meets the demands of today's educational institutions. Such universities attract many international students and become a byname for good pupils seeking to attend high-quality education institutes. One thing any higher educational institution can do immediately is to make excellent use of the Internet. The administrators can be prepared as services and demands develop by increasing their bandwidth and establishing a flexible architecture. Ultimately, "It is not the most powerful or intellectual species that survive, but those who are most adaptable to change."

**Building university into a smart campus**

A smart campus does not appear overnight. A conventional campus gradually evolves and emerges as a smart one, as a result of collective interventions. To use smart technology on campus, all the functioning bodies in Universities should have a shared understanding and vision. Before creating a strategy to construct a smart University campus, one must consider the University's holistic level. For implementing technical breakthroughs in their system, one must consider the promoters' purpose and vision. It should be checked whether long-term investments can be made in sensors, wires, and digital equipment. Also, adequate staff availability to handle a large number of linked devices and analyse the data collected, should be pre-determined. The vision of a smart campus is dependent on the desire to embrace the technology revolution and its application. Once the technological architecture is in place, institutions should concentrate on fundamental concepts that promote interconnection at all levels.

**User-centric**: The students of today are congenitally inclined towards adapting to and utilising technological platforms and devices. This user segment desires to interact with technology which is convenient and uncomplicated, and enhances their overall experience. It should be ensured that the IT systems put in place are closely based on the specific needs of the University stakeholders and bank on the audience persona and user journeys. IT systems that utilise video, audio, speech, gesture, and touch should compulsorily be centred around the people by whom they are intended to be used. These tools should be individualistic and accommodative, thereby facilitating extensive utilisation. The speech technology, for instance, can come in handy for teachers who intend to improve their speeches and lectures and send regular reminders/instructions to the students.

**Building value:** A smart campus will always enhance confidence among its staff, students and alumni. That is primarily due to the strong tag value attached to it. It will never face challenges in attracting good students or faculty members. Acceptance of its students by the industry or the employer will be instant. Campuses that become technologically advanced are rendered free from geographical boundaries. As soon as the seed for technological transformation is sown, the campus progresses from local to global, and it should be ensured that in that event, the quality of key deliverables is uncompromised and backed by data-based evidence.

**Elastic:** Considering that most campuses intend to see technological changes as a long-term investment, it is essential that the tools put into place have enough room to accommodate the perpetual evolution of science and technology. Ideally, a domain-driven design architecture built on microservices for the smart campus should be considered as an avenue, pertaining to its allowance and facilitation of the campus's gradual transformation. A University building or having a smart campus creates and inculcates a progressive mindset which behaves as a major attraction to students and employees. It ensures that the institution is fundamentally driven by the principles of sustainability, safety, security and adaptability, collectively focused on ensuring comfort and enhancing experience.

## Conclusion

Is your institution attracting top-notch students and faculty? If not, what is preventing your institution from progressing? Students and employees demand a smart, digitally linked campus from their Universities today. This improves security, promotes inclusive learning and simplifies student services. Investigating novel concepts for college campuses that allow for the usage of smart technology to improve operations and instruction while also engaging students is paramount. Universities must restructure their strategies to fulfil enrolment objectives, which is becoming increasingly difficult. They must modify and incorporate technology that has been leading other industries to great heights for a long time. Higher education institutions must focus on constructing a smart University model that includes subsections such as, smart campus alignment with smart city ideas, community-based services, intelligent microgrid on a smart campus, and smart campus dissemination. Conclusively, to achieve long-term success with an intelligent and innovative campus, all these sub-models work as an integrated model to better manage campuses by analysing acquired data through Radio frequency tags, sensors, cloud-based computing, actuator systems, enhanced reality, and internet services.

The Smart Campus Initiative's mission is to provide sustainable, environmentally friendly and energy-efficient development. A smart campus is a centralised framework that connects systems and enables users to detect restrictions, problems and possibilities for doing things better. It monitors the experiences of students and the efficiency of campuses to improve learning and improve the operations of Universities. The departments in different facilities have a connected digital and physical space in order to provide an accessible and pleasant educational and living milieu for the instructors and students to accomplish a humanised service to innovation.

Universities must implement smart campus technology if they want to remain competitive. The design of innovative e-campus is critical to the success of the deployment. Take the time, prepare ahead, and invest into the campus to pursue the formation of an intelligent campus the right way. Looking ahead, the Smart Campus concept might serve as a model for many companies with both residential and academic campuses. Having technology-driven smart-University campuses will pave the way for more research possibilities in areas such as electronic governance, administration, the IoT, smart technologies, and process re-engineering. It would also encourage cooperation through public-private partnership models to develop solutions that may also facilitate enterprise activities relating to ecosystems that allow smart innovative technology in campus. The effective execution of the Smart Campus plan will also increase the overall ecology of the institution, which will lure students and faculty from various destinations worldwide, and influence the national and worldwide rankings. In addition, it may also develop funded research projects and establish international collaboration with reputable agencies and government institutions.

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# 5

# NATION BUILDING AND UNIVERSITY SOCIAL RESPONSIBILITY (USR)

**Dr. Pankaj Mittal**

*This article explores the critical role of universities in the process of nation-building, focusing on their multifaceted contributions to education, research, social engagement, and cultural preservation. It emphasizes the significance of university-community linkages in achieving the objectives of higher education, outlining illustrative forms of community engagement prevalent in India. These include linking learning with community service, research with community knowledge, knowledge sharing, devising new curricula, including practitioners as teachers, and promoting social innovations by students. Institutionalization of University Social Responsibility (USR) as a structured and integral approach is required, positioning community engagement as intrinsic to learning and teaching.*

*An Alliance for Community Engagement (ACE) is proposed as a platform for knowledge sharing, best practices, and a mechanism for promoting, catalyzing, and recognizing initiatives in community engagement. The importance of curricula flexibility, crediting community engagement in evaluations, and the creation of new community-based educational institutions has been emphasized. The potential impact of the Indian Higher Education system, with its vast student and faculty population, is underscored, emphasizing the need for collaboration among stakeholders, including government bodies, institutions, and civil society, to effectively implement these strategies for societal development.*

**Keywords:** *Nation Building, University Social Responsibility (USR), Community Engagement, Alliance for Community Engagement (ACE), Higher Education, Curriculum Flexibility, Social Innovations, Corporate Social Responsibility (CSR), Stakeholder Collaboration*.

## Introduction

The universities are the centres of learning, research, innovation, and for production and dissemination of knowledge. By providing high-quality education, they equip individuals with the skills, knowledge, and expertise. They serve as repositories of a nation's culture, history, and heritage through arts, humanities, and social sciences programs. The university experts in various fields, including political science, economics, and public administration contribute to the development of effective policies and governance structures that are essential for nation-building efforts. Higher education institutions cultivate critical thinking, problem-solving, and analytical skills in their students. These skills are crucial for addressing the complex challenges that arise during nation-building processes. Universities facilitate international collaborations and cultural exchanges, fostering diplomatic relations and global perspectives that can benefit a nation's position in the global arena. Thus, universities are not just places of learning; they are also engines of progress and change within a society. Their contributions to nation-building are multifaceted, encompassing education, research, social engagement, and cultural preservation. By fulfilling their roles effectively, universities play a significant role in the nation's development and help it achieve its goals of social cohesion, economic prosperity, and stability.

## University Social Responsibility (USR)

University Social Responsibility recognizes the transformative potential of universities in shaping societies and advancing the goals of nation-building. While the idea of universities contributing to society and communities has a long history, the specific terminology "University Social Responsibility" has evolved in response to the changing roles and responsibilities of higher education institutions in the 21$^{st}$ century. It reflects the growing recognition that universities should proactively engage with society, address social, environmental, and ethical challenges, and play a pivotal role in shaping positive societal outcomes. Now, the universities worldwide acknowledge their social responsibility beyond traditional teaching and research, community engagement, environmental sustainability, social justice, and addressing societal challenges. Participation of students, faculty, and staff in civic activities, volunteer work, and public service, fosters a sense of civic responsibility among the university community.

Universities primarily contribute to society by training specialists and highly qualified professionals to address the needs of various sectors, and providing a range of services to specific communities, which can include adult education, consultation, technical support, and expertise across various domains to foster economic, political, social, ecological, and cultural development, ultimately striving for a more equitable social order (UNESCO

1991). The participants in the World Conference on Higher Education, at UNESCO Headquarters in Paris, from 5 to 9 October 1998, in their declaration on the vision of higher education under Article 6 stressed the relevance of higher education which is quoted as under:

*"(a) Relevance in higher education should be assessed in terms of the fit between what society expects of institutions and what they do. This requires ethical standards, political impartiality, critical capacities and, at the same time, a better articulation of the problems of society and the world of work, basing long-term orientations on societal aims and needs, including respect for cultures and environmental protection. The concern is to provide access to both broad general education and targeted, career-specific education, often interdisciplinary, focusing on skills and aptitudes, both of which equip individuals to live in a variety of changing settings, and to be able to change occupations.*

*(b) Higher education should reinforce its role of service to society, especially its activities aimed at eliminating poverty, intolerance, violence, illiteracy, hunger, environmental degradation, and disease, mainly through an interdisciplinary and transdisciplinary approach to the analysis of problems and issues.*

*(c) Higher education should enhance its contribution to the development of the whole education system, notably through improved teacher education, curriculum development, and educational research."*

UNESCO (2009) Communiqué highlighted the social responsibility of higher education, emphasizing its role in addressing global challenges such as climate change and food security. It called for interdisciplinary focus, critical thinking, and active citizenship. It emphasized the significance of access and equity in higher education and on promoting international cooperation and cultural diversity while stressing the importance of quality assurance in higher education. It also encouraged partnerships at regional and international levels to ensure the quality and sustainability of higher education systems in an increasingly interconnected world.

Yashpal Committee Report (2009) mentioned that the founders of the Indian Republic recognized the importance of universities in shaping the future of Indian democracy and believed that universities would play a crucial role in creating new knowledge, enriching cultural and scientific resources, and bridging societal divides. In a society marked by rural-urban disparities, class distinctions, gender inequality, and cultural biases, universities were seen as platforms for transcending these barriers. Higher education was viewed as a means to promote social equality, foster creativity, and generate innovation.

Consequently, it has been considered a national duty, with the state responsible for providing the necessary support to unlock its full potential.

Vasilescu et al. (2010) elucidated the transition from Corporate Social Responsibility in universities to University Social Responsibility by introducing a conceptual framework that emphasizes the need for universities to adopt social responsibility strategies to meet stakeholder expectations, such as current and future students and supporters.

Dahan & Senol (2012) in their analysis of Istanbul Bilgi University's social responsibility practices, found that for an institution to achieve success in its CSR strategy, it is essential to internalize CSR actions and receive strong support from the management.

Mishra, G. (2013) suggested various initiatives that can be adopted by higher education institutions, such as - incorporating CSR in recruitment and selection by promoting diversity and bridging skill gaps; keeping the faculty updated on social and environmental issues; including CSR in performance management; addressing work-life balance and offer benefits to employees; enhancing CSR awareness among students by revising the curriculum and organizing events; aligning missions and values with CSR; and promoting CSR through symbols and discussions on campus.

Lozano et al. (2015) found that there were instances of sustainable development initiatives within the higher education system, however, these efforts often operated in isolation. Their research emphasized the strong connection between an institution's commitment to sustainability and its actions, including signing sustainability declarations, charters, or initiatives. The findings suggested that leadership's dedication to sustainability played a significant role in these actions.

According to Tandon (2017) community-university engagement extends beyond individual benefits and serves the greater public good and socioeconomic development. He underscored key steps for effective engagement, including giving students credit for field placements in communities, providing mandatory training in community-based participatory research for all researchers, integrating locally generated research materials into the curriculum, and evaluating faculty based on their contributions to community engagement.

Panjwani (2020) stated that deepening the links between institutions of learning, corporates and government bodies will go a long way in tackling major societal issues such as unemployment, poverty and economic decline. It will also help in upskilling staff, knowledge dissemination, and lead to the formation of better and more people-centric policies. These measures will produce socially sensitive and proactive global citizens and organisations that, together, will bring wellbeing and upliftment to the community.

Ali et al. (2020) examined the various social responsibility initiatives undertaken by universities and assessed their impact on stakeholders. Their findings emphasized the importance of integrating social responsibility into universities' administrative policies and management procedures, with active stakeholder involvement for long-term and meaningful social transformation.

Lamdaghri & Benabdelhadi (2021) covered various aspects of University Social Responsibility (USR), discussed the significance of university governance and stakeholder involvement, and used PRME to incorporate socially responsible practices.
Sharma & Sharma (2021) explored the impact of USR initiatives taken up by twenty private and state universities of Rajasthan towards Society and the environment and found that universities are into more USR initiatives towards Society rather than the environment. They found that USR initiatives have effectively improved students' skills, including fundraising, project management in challenging situations, diverse forms of learning, and teamwork.

Omar *et al.* (2022) studied the viewpoint of students and lecturers of a private university in Malaysia and found that participants are somewhat aware of the university's efforts in education, social, and philanthropic initiatives as USR. However, students are more familiar with the term CSR (Corporate Social Responsibility) than USR. Nevertheless, the university's efforts to promote personal growth among students have yielded positive outcomes. Students also believe that USR has positively influenced their mindset, making them more socially responsible in their daily lives.

Leko et al. (2022) studied the perception of students from Indian and Croatian universities towards USR and highlighted the need for Indian universities to create greater awareness among students about social responsiveness and the benefits of USR. They suggested that both Indian and Croatian universities should focus on building high-quality relationships with their local communities, actively involving students in socially responsible activities, and promoting the idea of social responsibility to internal and external stakeholders.

Fauzi et al. (2023) aimed to assess University Social Responsibility (USR) through bibliometric analysis, given its relative novelty compared to Corporate Social Responsibility (CSR). Their study identifies current themes and anticipates future trends by analyzing 306 publications and 9,530 cited references from the Web of Science database. The findings emphasize the central role of USR in enhancing Higher Education

Institutions (HEIs). USR is seen as a valuable tool for HEIs to build their reputation, engage with local and global communities, and enhance their brand in the competitive higher education environment.

**'Social Responsibility' in the Ancient Indian Education**

Ancient India's education system exemplified social responsibility through its inclusive nature, moral values, and community-oriented approach. The 'gurukula system', for instance, welcomed students from all backgrounds, fostering a sense of equitable access to knowledge. Education instills moral and ethical values, encouraging individuals to become responsible, compassionate, and virtuous members of society. The concept of "seva" emphasized selfless service, and knowledge was generously shared, contributing to collective learning. Education extends beyond academics, teaching students to respect nature, engage in community service, and address societal needs. This socially responsible approach emphasized that education's purpose was to produce responsible, service-oriented citizens who actively contributed to the welfare of society and the environment. These principles continue to serve as a source of inspiration for contemporary educational reform initiatives in India and on a global scale.

**Takshashila** , an ancient Buddhist center of learning, stood as a beacon of social responsibility for centuries. Its origins, dating back to at least the 5th century BC, highlight a longstanding commitment to knowledge dissemination. This venerable institution was more than just a place of academic pursuit; it was a melting pot of diverse disciplines, nurturing students in areas ranging from the Vedas and the Eighteen Arts, which included practical skills such as archery, hunting, and elephant lore, to a dedicated law school, medical school, and a school of military science. Takshashila's role as a center of learning, attracting students from across the ancient world, underlines its commitment to the social upliftment of individuals from various backgrounds. Its long history as a center of education underscores its commitment to social responsibility and the enrichment of human understanding.

**Nalanda**, the ancient center of higher learning in Bihar, India, exemplified a profound commitment to social responsibility throughout its existence from 427 to 1197 AD. This renowned institution, initially dedicated to Buddhist studies, went far beyond imparting religious knowledge. It played a vital role in nurturing a diverse range of disciplines, including fine arts, medicine, mathematics, astronomy, politics, and the art of war. Nalanda University was unique in its approach to education, offering accommodations for 10,000 students and 2,000 professors, pioneering the concept of student dormitories. Its social responsibility extended to the preservation and dissemination of knowledge through a nine-story library where monks diligently copied books and documents.

Moreover, the university's global appeal, attracting students and scholars from regions as far-reaching as Korea, Japan, China, Tibet, Indonesia, Persia, and Turkey, showcased a commitment to cross-cultural exchange and the sharing of wisdom. Nalanda's legacy as a hub of scholarship and Buddhist studies underscores its profound dedication to social responsibility, knowledge, and cultural enrichment, leaving an indelible mark on the history of education and intellectual exchange.

**Vikramaśīla** in Bihar (800-1040 AD), was an ancient center of learning in India. Founded by King Dharmapala in the late 8th century, Vikramshila became a renowned seat of Buddhist scholarship and intellectual exchange. It attracted students and scholars from various parts of the world, making it a vibrant hub of education and knowledge dissemination. The university's curriculum encompassed a wide range of subjects, including Buddhist philosophy, grammar, logic, and tantric studies.

**Manyakheta**, a city of historical significance in Karnataka, became the capital of the Rashtrakutas during the 9th century under Amoghavarsha I. It served as the capital for the Kalyani Chalukyas until around 1050 CE. Notably, it was home to two significant educational institutions: the Uttaradi Matha, a prominent center of Dwaita philosophy and the Jain Bhattaraka Math, housing the ancient Neminath temple. Manyakheta's enduring significance lies in its historical, philosophical, and cultural contributions to Indian heritage.

**Pushpagiri**, is an ancient Indian mahavihara or monastic complex. Mentioned in the writings of the Chinese traveller Xuanzang and other historical sources, it was initially believed to be part of the Lalitgiri-Ratnagiri-Udayagiri group of monastic sites. However, archaeological excavations conducted in the 1990s led to the discovery of a distinct site with inscriptions referring to the local monastery as puṣpa sabhar giriya, which has now been identified as Pushpagiri. The site holds historical significance as an important Buddhist center in ancient India, thriving between the 3rd and 11th centuries AD.

Numerous other ancient Indian universities, each with their unique contributions to society, embraced social responsibility and facilitated the dissemination of knowledge. Odantapuri, situated in Bihar (circa 550 - 1040), thrived during the Gupta period and into the early Muslim conquest era. Jagaddala, in Bengal (from the Pala period to the Muslim conquest), Nagarjunakonda, in Andhra Pradesh, Sharada Peeth, in modern day Kashmir, Valabhi, in Gujarat (from the Maitrak period to the Arab raids), Varanasi, in Uttar Pradesh (from the 8th century to modern times) were esteemed centers of scholarship and intellectual pursuit. Such centers were not limited to the mainland; they extended to neighboring regions – Somapura Mahavihara, a centre of learning, in Naogaon district of Bangladesh built by king Dharmapala (781-825 AD), a ruler of Pala Empire;

Sunethradevi Pirivena, Sri Lanka, founded circa 1415 AD, served as a center of Buddhist learning and cultural enrichment.

The above mentioned institutions collectively exemplify the deep-rooted commitment to education, enlightenment, and the broader social good in ancient India.

**Present Higher Education Scenario in India**

The post-independence education scenario was marked by significant reforms and developments. The University Education Commission (1948), under Dr. S. Radhakrishnan marked the beginning of comprehensive educational reforms. It recommended the restructuring of the University Grants Committee into the University Grants Commission (UGC) and emphasized the importance of research and extension activities in addition to teaching. The Kothari Commission (1964-66), was established for a comprehensive review of the education system based on which the National Education Policy (1968) emerged aimed at a comprehensive overhaul of the education system in India. It emphasized the need for equal educational opportunities to foster national integration and boost cultural and economic development. The post-independence period saw a significant expansion of technical and professional education institutions, including the Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs). The NEP of 1986 and the Programme on Action of 1992 were instrumental in setting the direction for India's educational development. They aimed to make education more inclusive, of higher quality, and better aligned with the country's developmental needs while addressing issues of access, equity, and diversity.

National Education Policy (NEP, 2020) considers the role of higher education as a crucial component in advancing both individual and societal well-being in India. Under Para 9.1 it states - *"Higher education plays an extremely important role in promoting human as well as societal wellbeing and in developing India as envisioned in its Constitution - a democratic, just, socially conscious, cultured, and humane nation upholding liberty, equality, fraternity, and justice for all. Higher education significantly contributes towards sustainable livelihoods and economic development of the nation. As India moves towards becoming a knowledge economy and society, more and more young Indians are likely to aspire for higher education."*

NEP (2020) under Para 9.1.3 further emphasizes the role of quality higher education - *"At the societal level, higher education must enable the development of an enlightened, socially conscious, knowledgeable, and skilled nation that can find and implement robust solutions to its own problems. Higher education must form the basis for knowledge creation and innovation thereby contributing to a growing national economy. The* *purpose of quality higher education is, therefore, more than the creation of greater opportunities for individual employment. It represents the key to more vibrant, socially engaged, cooperative communities and a happier, cohesive, cultured, productive, innovative, progressive, and prosperous nation."*

The UGC established a Subject Expert Group in 2018 under Unnat Bharat Abhiyan (UBA) which developed a report on "Fostering Social Responsibility and Community Engagement in Higher Education Institutions (HEIs) in India". This report highlights the importance of socially relevant courses that help students understand rural society and government development initiatives. Subsequent to the announcement of NEP 2020, this document has been revised to include key recommendations of NEP, as well as the deliberations of the Review Committee, Expert Group and feedback received from the stakeholders. The 'UGC Guidelines for Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India 2.0' aims to transform rural development through HEI involvement in rural communities and curriculum reform. The UGC's Subject Expert Group (SEG) on Curricular Reforms and Educational Institutions Social Responsibility is tasked with integrating community engagement into undergraduate and postgraduate curricula, emphasizing its role in societal development. These guidelines outline the framework for HEIs' social responsibility and community engagement, considering recommendations from the National Education Policy 2020 and experiences from the COVID-19 pandemic, stressing the role of HEIs in socio-economic development and the need for holistic engagement encompassing teaching, research, and service.

**Need for University Social Responsibility**

The goals of ensuring inclusive development, democratic governance, and sustainable growth can be meaningfully achieved through a process of broadening and deepening the involvement of institutions of higher education in societal development. In the process, the idealism and dynamism of the youth can be harnessed in a more meaningful manner. The following ***goals*** can be realized through the promotion of such community engagements:

- Bridging the gap between theory and practice, in order to make theory more relevant and practice more informed, where community knowledge systems are seen as legitimate partners in the process of development of innovations and trained human resources.
- Promoting deeper interactions between higher educational institutions and local communities for identification and solution of real-life problems faced by the communities in a spirit of mutually agreed interest and interaction.

- Facilitating partnerships between local communities and institutions of higher education so that students and teachers can learn from local knowledge and wisdom, thereby democratizing knowledge production.
- Engaging higher institutions with local communities in order to make curriculum, courses and pedagogies more appropriate to achieving the goals of national development as described in the 12th Plan.
- Catalysing acquisition of values of public service and active citizenship amongst students and youth alike in the process of such engagements, which would also encourage, nurture and harness the natural idealism of youth.
- Undertaking research projects which are need-based and community-oriented, including the community as research partners, leading to policy formulation for societal development.

**Forms of Community Engagement prevalent in India**

In recent years, several innovative forms of such engagement have already begun to take place in different institutions of higher education in the country. These have been largely individual efforts as a result of pioneers and champions inside the institutions, and support from certain civil society actors from outside. To achieve the objective of societal development through community engagement, it is important that institutional mechanisms are developed to adopt a holistic and functional approach to community engagement based on the following core principles:

(a) Mutually agreed interests and needs of both communities and institutions be articulated and respected
(b) Engagement must encompass all the three functions of institutions of higher education—teaching, research and outreach/practice/extension
(c) Institutional engagement cutting across disciplines and faculties should be mandated, including natural sciences, and not restricted to social and human sciences alone
(d) Participation in community engagement projects by students should earn them credits and partially meet graduation requirements and it should be integrated into their evaluation systems
(e) Performance assessments of teachers, researchers and administrators in such institutions should include this dimension of community engagement.

To be an integral part of the objectives of higher education, university-community linkages have to be integrated into the processes of making and sharing knowledge, into teaching-learning, research and practice. Strengthening higher education-community linkages means that we place the connection between community and the university at the heart of the educational process in order to ensure the continuing relevance of higher education.

The following are illustrative ***forms*** of such engagement:

- **Linking learning with community service**
  In this approach, students and teachers apply their knowledge and skills in a chosen community to improve the lives of people in that community. This can be achieved through 'adoption' of a specific village or slum, and then providing engagement opportunities to students from various disciplines and courses to apply their knowledge to address the challenges of that specific community (examples: the Samarth Bharat Abhiyan of Pune University and CSUIR of BPS Women University)

- **Linking research with community knowledge**
  In this approach, various faculties and programmes of higher educational institutions devise joint research projects in partnerships with the communities. In this approach, the community's own knowledge is integrated into the design and conduct of the research. New research by students and their teachers gets conducted and students complete their thesis/dissertation and research papers to complete their academic requirements (which can later be published), and at the same time the community's knowledge is systematised and integrated in this research (eg. PRIA/Garhwal University Mountain research Centre).

- **Knowledge Sharing & Knowledge Mobilisation**
  The knowledge available with students and teachers in various disciplines is made available to the local community to realize its developmental aspirations, secure its entitlements and claim its rights from various public and private agencies. These can take the forms of enumerations, surveys, camps, trainings, learning manuals/films, maps, study reports, public hearings, policy briefs, engagement with urban homeless shelters, teaching and health services in poor communities, legal aid clinics for under-trails etc. (IRRAD-JGLU's Good Governance Now Initiative & Mysore University's women's empowerment programme; legal aid cells in V. M. Salgaocar Law College; the Legal Aid Society of the W.B. National University of Juridical Sciences, BPS Women University etc).

- **Devising New Curriculum and Courses**
  In consultations with local communities, local students, local community-based organisations and local government agencies, institutions of higher education can develop new curricula in existing courses as well as design new courses. This will enrich the curriculum of existing courses through locally-appropriate subject-matter

(which interests local students most); this will also create new, locally appropriate educational programmes that will interest new generation of students (CSUIR at BPSMV's Courses on Micro-financing, Integrated, Energy Resource Management and folk Medicine; Dayalbagh Educational Institute's courses etc)

- **Including practitioners as teachers**
  Local community elders, women leaders, tribals and civil society practitioners have enormous practical knowledge of a wide variety of issues—from agriculture and forestry to child-rearing, micro-planning, water management and project management. This expertise can be tapped by inviting such practitioners inside the institution to co-teach courses both in the classrooms and in the field. Such instructors should be duly recognized, compensated and respected for their knowledge (Women slum leaders as instructors in urban planning courses, SPARC, Mumbai).

- **Social Innovations by Students**
  In consultation with student unions, associations and clubs, student initiated learning projects which have a social impact can be supported. Such social innovation projects by students can also have meaningful links to curriculum and courses (example: TISS-Koshish efforts on justice for beggars; and homeless shelters with Aman Biradari)

  In practice, the above **six** forms can be integrated together in an organic and dynamic manner for each institution and its surrounding communities. These are illustrative of what can be further innovated upon, adapted and evolved by higher educational institutions in partnership with their communities and civil society actors.

**USR Initiatives in Indian Institutions: Some Examples**

**Unnat Bharat Abhiyan (UBA)** is an ambitious initiative rooted in Mahatma Gandhi's vision of self-sufficient rural communities spearheaded by IIT, Delhi. It recognizes the shortcomings of centralized urban-focused development and aims to bridge the rural-urban gap in India. UBA encourages higher education institutions to collaborate with rural communities, addressing development challenges, fostering sustainable growth, and promoting a deeper understanding of the rural development agenda. It emphasizes the importance of hands-on fieldwork, rigorous reporting, and knowledge exchange, creating a virtuous cycle that benefits society, academia, and rural India. The initiative welcomes participation from various stakeholders, including academic institutions, subject experts, voluntary organizations, government agencies, philanthropists, students, and volunteers, all contributing to the goal of transforming rural India. The Unnat Bharat Abhiyan (UBA) program in India has an organized structure that involves multiple key components. The Ministry of Education (MoE) provides funding and support for the program.

**The National Service Scheme (NSS)** is a Central Sector Scheme in India, fully funded by the Central Government, aimed at engaging students at various educational levels in community service activities. It is focused on developing the personality and character of youth through voluntary service, promoting "Education through Service." NSS was launched in 1969 and has expanded to cover numerous universities, colleges, and schools across the country, benefiting over 74 million students. The motto of NSS is "NOT ME BUT YOU." NSS volunteers have the opportunity to become accomplished social leaders, efficient administrators, and individuals with a better understanding of human nature.

**The National Cadet Corps (NCC)** is a prominent youth organization in India, established by the National Cadet Corps Act of 1948. It has evolved to become the world's largest uniformed youth organization, with 13 lakh cadets. The NCC focuses on developing character, discipline, leadership, courage, and a spirit of service in young individuals. It operates in schools and colleges, offering training in various activities, including drill and shooting.

**Bharat Scouts and Guides (BSG)** is a prominent youth organization in India, founded by Sir Baden-Powell in 1917. It is affiliated with the World Organization of the Scout Movement and the World Association of Girl Guides and Girl Scouts. BSG focuses on character development, leadership skills, and community service, with over 62 lakh members. The organization is divided into sections for different age groups and promotes values like patriotism, selfless service, and community engagement. It has a history of significant contributions through community service, disaster relief, and international events, playing a crucial role in character building, leadership development, and personal growth among Indian youth.

**Tata Institute of Social Sciences (TISS), Mumbai:**

TISS, established in 1936, is renowned for its commitment to social responsibility and community engagement. It runs several outreach programs, including the National CSR Hub, which connects corporate social responsibility (CSR) initiatives with social organizations. TISS offers various courses and programs in social work, community development, and public health, addressing critical social issues in India. TISS is regularly involved in critical research in diverse areas such as education and literacy, family and children's issues, HIV/AIDS, rural and urban development issues, displacement, youth, and human development, and the rights of Dalits, indigenous peoples, minorities, and other marginalised groups.

**Amrita Vishwa Vidyapeetham, Coimbatore:**

Amrita Vishwa Vidyapeetham engages in numerous USR activities, including providing healthcare services to rural communities, conducting environmental sustainability projects, and offering educational opportunities to underprivileged students. Amrita SeRVe's mission is to empower villagers with the skills necessary to create prosperous, self-reliant, healthy, and educated communities where people can live with dignity in a clean environment. The organization aims to revive traditional wisdom and self-reliance in Indian villages, emphasizing the use of local resources for sustainable development. While cities draw many from villages due to material issues, the essence of India is deeply rooted in its rural areas, and Amrita SeRVe strives to encourage rural youth to remain in their villages. They work in various locations across India, addressing common issues like the lack of quality healthcare and education, which are prevalent in rural areas, home to the majority of the country's population.

**The Kalinga Institute of Social Sciences (KISS), Bhubaneswar**

The Kalinga Institute of Social Sciences (KISS) is a comprehensive institution consisting of KISS Foundation, KISS School & College, and KISS University, all based in Bhubaneswar, Odisha. This initiative operates at the intersection of education, food, and empowerment with a mission to create a better world devoid of hunger, poverty, and illiteracy. KISS provides free education, accommodation, food, and healthcare to more than 30,000 indigenous students at its main campus and has a substantial alumni base of 40,000. In addition, KISS extends its services to an additional 10,000 students through satellite centers, embodying its commitment to educational and social transformation.

**Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot**

The University has a mandate to develop human resources and rural technology for the betterment of rural communities. Its vision encompasses socio-economic development, the improvement of quality of life for marginalized populations, and the use of education to bring about spiritual and social transformation in rural areas. It emphasizes problem-solving action research and the dissemination of practical technologies to address rural challenges.

**BPS Women University**

The BPS Women's University has taken the initiative of re-linking the University with its social and natural environment by involving; women outside the University and their knowledge in the diverse fields, and engaging women students of the University with the life and activities of the society. A Centre for University Society Interface and Research has been established to bridge the gap between the university and rural society. The disconnect between society and the university is removed through carefully designed courses for students, wherein, 50% of the course is imparted in the classrooms and 50% in the villages. It is a two-way process to learn from and teach the community at the same time. Small time technologies for direct use to the rural community *are* developed to benefit the community. The near by villages are adopted for their overall development in terms of awareness, medical facilities, infrastructure, sanitation, education etc. A demonstration centre based on Indo-Israel project of the state government has been setup to demonstrate to the rural community, various means of enhancing agricultural production by 3-4 times by adopting modern farming techniques of vertical farming in the poly houses rather than traditional horizontal farming.

However, these are individual efforts made by the universities at their own micro level. At macro level, a policy decision has to be taken for the nation as a whole to give it a structural base. This would allow the nation to reap the benefits of University- Society linkages.

**Institutionalizing University Social Responsibility**

A more structured approach to University Social Responsibility (USR) is required to make it an institutionalized effort rather than an individualistic attempt. The following must be kept in mind, while doing it:

**(a) Integral Approach:** Community engagement should not be seen as an 'addition' to learning and teaching, but intrinsic to it. This is essential if education is to be a vehicle for social transformation and attainment of social justice, rather than as means to individual prosperity alone. For this, institutions of higher education need to locate their learning and teaching in the communities in which they are located, and to harness the idealism and dynamism of the youth.

**(b) Establishing Alliance for Community Engagement**: A membership-based network primarily engaged in promoting ideas and practices of community engagement throughout the country can be created. This mechanism can be an independent Alliance for Community Engagement (ACE) that comprises champions of such engagement from the sectors of higher education (including students) and civil society. It can serve as a platform for community engagement by institutions of higher education and act as a steering mechanism and a vehicle for sharing knowledge and good practices. This Alliance can encourage, promote, catalyse new initiatives in community engagement by a wide diversity of post-secondary educational institutions of the country by regular sharing of information; document, synthesise and disseminate existing and emerging models, approaches, best practices and lessons of change and transformation through various media; create a web-based platform for the dissemination and communication of practices and models, as well innovations and challenges; create mechanisms for sharing such experiences and knowledge through national and regional conferences, workshops, field exposures and newsletters and web-based platforms; evolve benchmarks and standards of quality, monitoring mechanisms and recognition/awards of effective and sustainable community engagements in the country; disseminate knowledge internationally in a proactive and mutually responsive manner; invite, scrutinize and fund innovative proposals from institutions of higher education in respect of fulfilling the above goals; generate new schemes of funding as per requirements, including student and researcher fellowships, engaged scholars fellowships; create funding schemes for community-university research projects, and guidelines for promoting the same through various existing research funding councils and define policy elaborations and criteria for effective integration of such goals in the national, provincial and local systems of higher education in the country. The Alliance can thus act as a motivator, facilitator, encourager, and recognizer of new initiatives in this field in a spirit of partnership; it can generate demands for engagement; it can act as a funding mechanism pressure group for implementation of policy in this regard.

**(c) Curricula Flexibility**: Flexibility in devising new systems of curriculum design, review, and pedagogy that incorporate elements of community engagement should be encouraged. Universities and other Higher Education institutions should be provided autonomy to make their programs, courses, and initiatives more relevant to the needs of society. Such curricula flexibility would enable the enhancement of the quality of knowledge produced by the university about communities and also help create new programs. This includes various forms of incorporating community engagement and linking teaching, research, and practice to better reflect the following:

- Linking learning with community service
- Linking research with community knowledge
- Knowledge sharing and Knowledge mobilization
- Devising new curricula and courses as well as focus on pedagogy
- Including practitioners as teachers
- Social Innovations by students

**(d) Crediting Community Engagement in Higher Education Institutions:** Credits for community engagement in Universities and other Higher Education institutions should be given while conducting evaluations. This includes credits for teachers, students, and visiting faculties who choose to engage in community-based work and perform vital roles of public intellectual engagement. Student-initiated community engagement work (including internships, fellowships, and coursework) should be particularly encouraged to leverage the dynamism and idealism of youth.

**(e) New Community Institutions**: It is also necessary to establish a few educational institutions that will primarily engage in community-based and common knowledge traditions. These institutions can be in vital aspects of community health, community cultures (arts, crafts, music, etc), community practices in sustainable development/ natural resources, and other aspects of community knowledge production, application, and dissemination.

A clear requirement for the effectiveness of these recommendations and various forms of engagement and their sustainability is an **interface structure** within each institution of higher education to act as a communicator, mediator, and coordinator of institutional linkages and partnerships with the communities and civil society. The structure should be inside the institution, led by a champion of community engagement from the current faculty members, and report to the head of the institution. Its governing mechanism should have representatives from within the institution and outside, including certain community leaders from the region. It should have some resources for operational, communication, and coordination activities.

## Conclusion

In conclusion, University Social Responsibility (USR) needs to be created as a formal structure on the pattern of Corporate Social Responsibility (CSR) with mandatory participation by every institution of higher education. Indian Higher Education system with about 40 million students and 1.5 million faculty can make a major impact on the programs of societal development through its active and positive involvement and community engagement. Collaboration among stakeholders, including government bodies, institutions, and civil society, is key to implementing these strategies effectively.

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# 6
# TECHNOLOGICAL UNIVERSITIES OF FUTURE – AGENDA FOR TRANSFORMATIVE REFORMS

**Dr. Onkar Singh**

*It dates to 1847 when India got its first engineering college – Thomason College of Civil Engineering in Roorkee which became the University of Roorkee and is currently in the service of nation as Indian Institute of Technology, Roorkee. In 1854 came the Poona Engineering Class and Mechanical School which is the College of Engineering Pune at present. All India Council for Technical Education (AICTE), New Delhi was set up in the the pre-independence period in 1945 to advise the country about technical education and technical human resources. Post-independence, many engineering institutions came to cater to the specific requirements of technical human resources for carrying technological advancements forward.*

**Keywords:** *Higher Technical Education, Technological Universities, Affiliation Framework, Private Universities, Interdisciplinary Education, Industry Interventions, Technology-Assisted Learning, Ethics in Education, Sustainable Development, Research, Innovation*

## Introduction

All the Institutions were started under affiliation with the University that was near to them. It worked very well till the number of higher technical education institutions affiliated to a particular University was limited. As the number of private institutions started growing due to the increasing demand for technical human resources, there was a concern for varying quality and difficulty in maintaining uniformity in examination and assessment processes. This led to the birth of the affiliating Technological University which was enacted through Acts of respective state in most of the states of the country at different times. The affiliating technological university of the respective state with its jurisdiction as prescribed by the act was mandated to affiliate the AICTE-approved technical institutions in their jurisdiction. With the number of Institutions increasing exponentially, the technical affiliating Universities are now burdened reasonably for carrying out admissions, examinations, and also standard setting in the institutions affiliated to it. Howbeit, the affiliated institutions are gradually getting matured for becoming free from the affiliation framework and starting their independent functioning as state private universities through suitable legislation in their state or deemed to be universities. This is the reason for the 434 state private universities and 81 private deemed to be universities out of a total 1238 Universities in the country as per the AISHE dashboard. As per the AICTE dashboard, the number of approved institutions has been constantly declining from 10974 in 2019-20 to 8925 in 2022-23 and further to 8264 in 2023-24. The current approved intake in technical courses as per the AICTE dashboard are 1365200 in undergraduate level and 614209 in postgraduate level programmes which does not include the intake in the programs run in universities that do not require AICTE approvals. These numbers highlight the size of stakeholders and the inclination of a sizeable population of the country toward technical education. It also evinces that every change in technical and professional education will create a great impact not only within the country but also across the world. Therefore, it is ineluctable to devise strategies and action plans for transforming higher education institutions engaged in offering technical and professional education. The onus lies on the Universities that are taking care of such education. Undoubtedly, numerous initiatives have been taken, but the quality of education remains challenged with respect to employability. Before spearheading any transformation in higher technical education, it is necessary to dissect the indicators for good quality of education in the new normal post-COVID-19.

To deliver up to the expectations of the stakeholders namely, students, employers, and society, technical Universities have to set an agenda for transformative reforms that are aligned with the evolution of technology and the expectations of the community. Some of the key transformations that are necessary for technical universities in the present circumstances are as below.

**Internationalization**

Knowledge exchange across borders is not new in higher technical education, rather it has been prevalent for quite some time. But in the present circumstances of the whole world getting closer seamlessly, it is becoming inescapable due to the desired versatility in technical human resources and global exposure to students. World ranking of HEIs and the considerations for internationalization in the ranking frameworks may compel Universities for it.  Also, the awareness amongst the admission seekers about these influences the quality of admissions. It is necessary to have international collaborations for student/teacher exchanges to expose students to the global perspective and challenges. Technical Universities may have to create enabling provisions in the programme ordinance/regulations for facilitating international exchanges. Ensuring the proficiency in English language should be given special attention for smooth mobility.  The mandatory provisions for doing so upon all the HEIs across the world can only help in realizing India's mandate for Vasudhaiva Kutumbakam (The whole world is a family). The cost of internationalization is likely to be a deterrent for a larger section of students in higher education and calls for suitable strategies from the Government for doing so. Public spending on internationalization can be a solution provided the beneficiaries are constrained to pay back to the nation. The strengthening of capabilities in Indian HEIs will be eventually useful for the country and humanity at large. The availability of demographic dividend creates inherent charm for the foreign HEIs to start their operations in India but the same should be facilitated with certain caveats to protect the innocent native students from getting pulled for these at a heavy cost within the country and abroad. The Technical universities have to devise bilateral provisions for internationalization. The strengths of Indian higher technical education must be capitalized appropriately with foreign HEIs.

**Interdisciplinary education**

There has been a fast proliferation of high-speed computing for simulation, modelling, and analysis in all disciplines of engineering, technology, management, pharmacy, etc. This is also making it possible to integrate different domains through ready-to-use applications and tools across the disciplines. As a result, the curriculum for higher technical education programs at the undergraduate level has to provide ample exposure for understanding the processes, practices, products, and equipment across the disciplines. HEIs have to evolve postgraduate degree/diploma level programmes that are interdisciplinary in nature so that the crosscutting applications can be dealt with suitably. Choice-based credit system with options of major and minor degrees can assist in interdisciplinary education to a large extent but the requirement of teachers to teach new domains is a challenge. As a result, the philosophy is not being implemented fruitfully, despite provisions being put in place by the Universities. HEIs have numerous limitations in hiring teachers in sufficient numbers for catering teaching of new subjects across disciplines. Therefore, for interdisciplinary education, the strategies for teaching interdisciplinary subjects are either single teacher or by a group of teachers from different domains. Nevertheless, the curriculum and teaching-learning for the respective disciplines should be constantly upgraded to meet contemporary and future challenges.

**Industry interventions**

HEIs must engage the end users of the graduating students during the course of programme so that the prospective employers have the opportunity to give inputs for quality enrichment at the appropriate time. Industry participation in curriculum framing, course designing, research, and other allied domains is becoming critical for rolling out job-ready professionals. It eventually suits the industry and other potential users of professional human resources too as they get a chance to tweak the education processes a little bit as desired. Undoubtedly, industry interventions have been sought after for quite a long but the gaps are still persisting which means either such involvement is only superficial or the industry does not provide inputs or the academics do not find such inputs worthwhile. In the larger interest of academics, it will be apt for every HEI to rope in industry partners into curriculum preparation and its effective delivery. Certain upcoming domains essentially require industry expertise to supplement the prescribed curriculum with the field and hands-on experiences. A robust operational framework is incumbent to ensure that regular teaching gets adequately enriched with the ongoing and upcoming feasible real-life applications of content taught through curriculum. For this, the synergetic efforts of teachers from HEI and field professionals may work provided it is executed religiously with due tradeoff such that the core of the subject does not get lost in the abundance of field inputs. Industry interventions are also necessary for pushing students to live problem-solving and active learning in the era of Industry 4.0 and Industry 5.0 where the role of automation is likely to play a pivotal role. It will help in envisaging the technological advances, research directions and the current focus areas of current study concerning ensuing industrial revolutions.

**Technology-Assisted Learning**

Teaching–learning–assessment processes are now amply assisted with technology. Post-COVID-19, there have been significant interventions of digital processes such as online lectures, online assessments, online examinations, virtual laboratories, etc. The online mode of teaching-learning-assessment has now become the new normal due to the ease of reaching out to those having internet connectivity and optimal utilization of time. However the prevailing digital divide and widely varying socio-economic conditions are to be corrected to ensure access to online resources and processes to all. Further, because of the huge market potential and acceptance of such technological assistance due to mammoth numbers the upgradations in technology-assisted learning are constantly pushed by the market. Undoubtedly, these interventions appear attractive and create optimism about the enhancement of the quality of education delivery, but the same does not happen in all cases. At times, the students get lost in a flooding of content due to the ease of its availability and access. Blended learning comprising online and on-campus activities in appropriate proportion will be having a large share in teaching-learning processes. Future technological institutions must upgrade teaching pedagogies utilizing technology available but the rigour of teaching should not take a backseat in the predominance of technology in assisting teaching. Equity and access to IT resources are a must for creating educational opportunities for all. In days to come virtual reality (VR) and augmented reality (AR) technologies are likely to create immersive learning experiences. VR-powered laboratories in science, engineering, and technology will provide better hands-on experiences in a virtual setting. Integration of artificial intelligence into learning platforms will personalize the pace, style, and preferences of individualized learning. AI-powered chatbots or advanced tools may guide students in making up the learning gaps as technology matures. Similarly, big data analytic techniques will assist in analyzing student performance, predicting chances of success for facilitating timely corrections and identifying areas of improvement in course design and deliveries.

For quite some time gamification has been helping to increase student engagement for a better understanding of content taught through it which will become much more intense and make learning more interactive. Blockchain technology will enable higher education institutions from the perspective of strengthening the record-keeping and allied processes. The conventional landscape of teaching traditional courses for major credentials will have to be augmented by special purpose short duration programmes yielding requisite micro-credentials, badges, certifications, etc. to meet the contemporary requirements. Sharing of teaching resources for such focused short-term courses may emerge in dominance due to the evolution of the gig economy. Educational technology will be empowering higher technical institutions with digital platforms that will pave accessible education with equity.

**Ethics and development**

In the fast-changing value system in the society, it is pertinent to highlight the ethics and values with the development. The curriculum ought to be explicitly integrated with ethics and innovations. For holistic development, the technological advancements and allied developments of civilization should not be devoid of high ethical standards and moral values. Through appropriate strategies, educational institutions must engage students in bridging the gap between ethics and development as the two have to go together. The ethical use of technologies such as artificial intelligence, biotechnology, data analytics, etc. is imminent for safeguarding humanity. Issues like breaching personal privacy, personal data, deep fake, etc. have already started puzzling society as to whether the technology is a boon or bane. Education has to demonstrate inclusivity and must be accessible to all irrespective of their socio-economic background, physical disabilities and other natural limitations. During the internationalization of education processes, high values and ethics should be adhered. It is not only in teaching-learning-evaluation rather in the case of research activities too the respect for integrity, individual contributions, humanity, transparency, accountability, and a high-value system is extremely essential. Future educational institutions will have to emphasize upon the social responsibility of students and teachers for positively contributing to community engagement, outreach activities of service and learning programs, and research activities that address societal challenges.

## Sustainable development

The journey from the Stone Age to the present digital age ushering the cyber-physical systems in all walks of life calls for an in-depth assessment of challenges faced by sustainable development. The frequent threats to human civilization have emboldened sustainability as the keyword in the present time. Any development or transformation that cannot be inherited by future generations fades off with time as it is not sustainable. Therefore, technical institutions have to ingrain the philosophy of sustainable development in every pursuit. The principles of sustainability have to be integrated into the curriculum and practiced as well. The research and innovation initiatives should embed sustainability by choice along with setting up a compelling framework for the same. Undoubtedly, the upgrades for enhancing ease and productivity through the application of knowledge and learning are to be embedded with the essential attribute of sustainable development. All operations in educational institutions have to become green and environment-friendly by the use of suitable techniques and practices. Learning material creation, its transactions, tools for assessment, outcome management, etc. are to be remodelled from the perspective of sustainable development.

## Research and innovation

Higher technical education institutions have the primary mandate of providing technical professionals who have adequate knowledge to sustain and take the technology further. The research and innovation activities are to be put high on the agenda so that the students and teachers collectively capitalize on them. Technology creation and its transfer is required to have an edge over other nations in the world. Developing due understanding of intellectual property rights and incentives associated with it will certainly strengthen the research and innovation culture in the institutions. With this, entrepreneurship will also be boosted in educational institutions and students will be getting acclimatized to research and innovation during the course of study in the institution. The earlier realization of the relevance of the integration of research and innovation fairly in the curriculum will pave the way for the overall strengthening of the institutions and great service to society. Future technical institutions must hook up with industries for carrying out sponsored research activities that suit the industry and add value to the institution / faculty research outcomes. Industry sponsored laboratories for specific R&D activities can be conceived in the institutions. Involvement of students and teachers along with industry professionals will sufficiently improve the research contributions. Special attention will be required for seeking patents for capitalizing on the intellectual patent rights available with any institution. Though efforts are made by the technical universities in this regard, much more will be required in the future universities.

**Flexible and continuous learning**

Given the rapidly changing aspirations of society and technological upgrades, technical institutions must implement a flexible education model that caters to professionals getting equipped with non-traditional knowledge as well as constantly changing technologies. The curriculum taught should imbibe the ability to continually learn and adapt the ongoing developments. The provisions for short and long-duration courses for the professional development of working persons have to be created by the technological universities. Also, it will be inevitable to have acceptable and robust mechanisms for recognizing and accrediting prior learning and field experiences. For ensuring lifelong learning abilities in technical human resources, the sound fundamentals happen to be a prerequisite and the institutions have to strategize for it. Flexibility and continuity in learning as envisaged in National Education Policy 2020 is being brought in practice through the Academic Bank of Credits. The perpetuity in maintaining the credits in the repository will allow the individual to get back to the path of formal education at any time with due consideration to the past credits earned. The choice-based credit system (CBCS) permits a significant degree of flexibility for the end of students to choose the subjects of their choice and pursue their passion as per their latent abilities and interests. In the larger interest of the students, the CBCS must be made much more robust and virtuous by ensuring that the institutions do have the provision for teaching the subjects as prescribed by the respective University. It's time to unshackle the compartmentalization of technical education which has already started with the major and minor philosophy, but the similar interdisciplinary strengthening of professionals will be critical in the future and technical universities should acknowledge the changing paradigm.

**Diversity, Equity, and Inclusion**

Technology is the backbone of the present civilization and the role of technical education in it cannot be overlooked. Evidently, technical education providers have to foster a diverse and inclusive learning environment for the participation of all human beings with equity. Still, a large gap exists in the targeted participation of underrepresented groups and those from social-economically disadvantaged groups in higher education. Constant mentoring and incentivization should be inculcated in the operational framework of technical institutions. Looking into the exposure and real hands-on of this human resource, there exist enormous possibilities of getting creative ideas for nucleating innovations and product/process upgradations. Technical universities should foresee the expectations of the community around them and empower them with vocational and skill education relying upon their expertise. Mentoring of underrepresented students and roping in of the faculty members from the inequitably represented groups will make technical education relevant and worthwhile.

**Agile governance**

To match the pace of Generation Alpha, the Universities have to adopt agile principles to become much more responsive, stakeholder-friendly, and efficient in decision-making and operations. The constantly evolving landscape of technology has to be supported by education for its further growth as well as sustainability. Academics have to envision and adopt a culture of their upgradation based on information available from stakeholders. The decision-making has to be objective and technology-centric so as to avoid subjectivity. With the intrusion of digital technology in managing academic and associated activities, there is a possibility of having all virtual online transactions and academic institutions getting reduced to a set of computers and web portals with strong internet connectivity. But, the institutions cannot set aside the offline processes to maintain realism in the happenings as well as overcome the digital divide.

**Community engagements**

The technological universities of the future will have to maintain active engagement with the local community to capture the regional challenges and involve students and teachers in resolving them. The outreach programs will help in a community partnership that also strengthens learners and their mentors with field experiences. Institutions should promote a sense of social responsibility in all of their stakeholders for creating a future responsible society. Affiliating universities can significantly contribute by mandating the institutions associated with them to enrich community engagement in different ways along with integrating them in the curriculum. The Western model of Universities with huge townships acting as the hub for development and the ancient Indian model of Gurukuls will be guiding forces for the present universities with respect to their community-centric operations.

There is no dispute about the potential role of Universities in shaping society. But it is up to the universities to strategize for contemporary onerous responsibilities towards a healthy society. Technological universities are reeling under the severe challenge of the skewed interest of students towards job-centric educational programmes which is posing a threat to the availability of competencies in all sectors. The institutions have to counsel their students for equitable opportunities and attract the best minds in all disciplines of technical education. The imbalance in abilities of professionals in different domains will disrupt the seamless integration of all for resolving the problems faced by humanity as on date. The presence of committed teachers also calls for urgent interventions so that the best is delivered with respect to the teaching-learning-evaluation system which is core to the education. Along with the institutions, the regulating bodies and Government have to come forward and assist the academics in meeting the challenges through supportive regulatory framework, infrastructure, and financing.

**Concluding Remarks**

The evolution of higher technical education institutions in India has seen significant changes, particularly with the rise of private institutions and the creation of affiliating Technological Universities to ensure quality and uniformity in education. As the number of institutions grew, maintaining standards became challenging, leading to the establishment of state private universities and deemed universities. The total number of universities in India has reached 1238, with a declining number of AICTE-approved institutions over recent years.

Given the substantial stakeholder base and the impact of changes in technical education, transformative strategies are crucial. Key areas for transformation include: Internationalization, Interdisciplinary Education, Industry Interventions, Technology-Assisted Learning, Ethics and Development, Sustainable Development, Research and Innovation, Flexible and Continuous Learning, Diversity, Equity, and Inclusion Agile Governance and Community Engagements.

To address these areas, universities and regulating bodies must collaborate to support academics with appropriate regulatory frameworks, infrastructure, and financing, ensuring the delivery of high-quality education.

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# 7
# IMPLEMENTING NEP-20 –
# A ROAD MAP FOR HEIS

**Dr. Vijay Kant Verma**

*It is three years plus since the National Education Policy-2020 (NEP-20) was introduced. It aimed at restructuring and reforming the entire Education System to facilitate and fulfil our commitment towards Sustainable Development Goal 4 (SDG 4). India committed in 2015 to make education affordable, assessable, world class, inclusive and which could provide lifelong learning opportunity in a multi-disciplinary and collaborative environment by 2030. While intent of NEP-20 was quite good, there is lot to be done on implementation front. Efforts have been made at various levels but picture remains quite hazy. There are issues related to regulatory bodies. Education being in concurrent list of state and centre, at some places political issues posed problems. Besides resources and funding, it needed strong will at management level. State to state, institute to institute it lacked level playing field, with the result that some institutes claim to have implemented some part of the policy where as others put the blame on governance level for hold ups. Still if there is will and resources implementation of major part of NEP-20 does not need approval from others and there is possibility for HEIs to implement most of the spirit of NEP if not complete words. This article examines the current status of implementation. It also tries to provide a blueprint of the road map to implement NEP-20 effectively at HEI level within their own resources, and provides ABC of NEP implementation in practical terms for HEIs.*

***Keywords-*** NEP-20, Sustainable Development Goal, Global Education Development Agenda 2030, Regulatory Framework 1+ EIs., GER

## Introduction

The National Education Policy -2020 (NEP-20) was introduced in Aug 2020 and it was widely accepted that the policy was the biggest game changer for the Indian education system. The very foundation on which NEP-20 was framed, was Global Education Development Agenda 2030 which was accepted by India in 2015. It precisely called for inclusive and equitable quality education and promotion of lifelong learning opportunity for all by 2030. NEP -20 is very nicely crafted road map to achieve this lofty goal. In last three years, number of conclaves, conferences, seminars, workshops and webinars done on NEP-20 has been phenomenal. Directives, guide lines, documents, orders and instructions issued on NEP-20 at all levels of governance indicated seriousness and urgency for implementing the new policy. On one hand there was race amongst states and institutions to implement the policy at the earliest and on the other hand there were some opposition ruled states like Tamil Nadu, Kerela, Bihar etc who refused to accept the new policy. States like Karnataka, Madhya Pradesh and Uttrakhand were first who declared in Aug 2021 that they have implemented NEP 20.

Recently with change of Government, Karnataka is reviewing their earlier stand. Despite all the urgency and euphoria for implementation of NEP-20 in words and spirit, it looks a distant dream. One has to understand that the total change in the educational framework as called by NEP-20 in a big country like ours with the third largest education system after China and America, is not an easily task. Then NEP-20 has many aspects which depend on agencies external to the HEI. Also as it happens with big policy documents, interpretations of various aspects in NEP-20 is taking its toll. So its too early to say as to what is the status of implementation of NEP-20, some people are calling it NEP-23 due to delay caused by Covid-19. But one thing is sure that the HEIs who have really understood the NEP-20 and drew their road map and put sincere effort to implement will be immensely benefited in the long run.

**Indian Higher Education Landscape**

The Indian Higher Education Sector is a massive system of 40.15 million students, 15.2 million teachers, 1113 universities, 51650 colleges, 150 Institutes of National Importance, 11296 standalone institutes and these numbers are continuously growing at unprecedented pace. Then there are number of private coaching institutes who are also significant players in higher education system. Demographic, political, cultural, legal and social problems associate with such a massive number is another area which adds to complexity in implementing a policy like NEP-20 which calls for a total reform and effective transform of the current system.

At policy and governance level Indian Higher Education system is a multilayer system where the lowest level is collage/institute administration, which in turn has the affiliating University to exercise control. Then there are more than 15 Professional Regulating Bodies like AICTE, NCTE etc who regulate programmes run by the concerned Universities and colleges. There is UGC which acts as overarching regulatory body. Each state has a Regulatory Commission of its own for Private Universities and they have acts and ordinances which differ from one state to another. Education being in the concurrent list Governor and Chief Minister have also their say through various official bodies. HEIs have numerous categories with each governed by their own act, ordinance, policy document and rules. Colleges could be, govt colleges, private colleges, govt aided colleges or govt funded colleges. There are five types of universities i.e. central university, state university, private university, deemed to be university of general category and de- nov category then also Institutes of National Importance. This non cohesive, non-homogeneous educational environment prohibits any simple and uniform system of implementation of NEP-20. Picture looks bleak but challenges and hurdles only provide opportunity and innovative solutions and obviously one who is bent upon finding ways and means normally wins in such difficult environment.

**Revamping and simplifying regulatory framework**

It was proposed in the new policy to revamp the current large & complex regulatory framework and introduce an easier system with a Higher Education Commission of India (HECI) at the apex to regulate the higher education with only four verticals i.e. National Higher Education Regulatory Council (NHERC) in which all regulatory bodies excluding medical will merge, National Accreditation Council (NAC) to be a meta-accrediting body, Higher Education Grant Council (HEGC) for funding and finances and General Education Council (GEC) to frame learning out come from various programmes and also frame a National Higher Education Qualification Framework (NHEQF).

Once the revamping is done the regulatory system will become more simple, efficient and effective and help in achieving the goals of NEP-20. But as of now this has not happened. However legislative permission has been given to form some new bodies and concepts to facilitate easy implementation of NEP-20. These are National Education Commission (NEC) headed by the Prime Minister of India, National Research Foundation (NRF) to improve research and innovation. Academic Bank of Credit (ABC) a digital storage for academic credit Special Education Zone (SEZ) for education of underrepresented group/region and Gender Inclusion Fund (GIF) to assist female and transgender children. Not with standing above a lot of initiatives have been taken to streamline regulatory frame work in present form also.

**NEP-20 Present status**

Most of the states, ruled by the party in central govt have shown willingness to implement NEP 20. Some states like MP, UP, Karnataka, Telangana, Uttrakhand and Assam etc have gone ahead also in a phased manner to implement NEP-20. Introduction of 4-year undergraduate course with final year for research, option for teaching in regional language and formation of a task force etc are some of the major steps taken by them. NEP-20 rests on five pillars i.e. accessibility, equitability, affordability, accountability and quality. For the first four pillars major responsibility rests at governance level at state, central and off course at the management of HEIs. With emphasis on distance learning, vocational learning fast expansion of education sector, higher budget for education and various other schemes, the objective of 50% Gross Enrolment Ratio (GRE) by 2030 looks achievable. However, the biggest issue will be Quality which is the soul of NEP-20. Most of the provisions and directives in NEP are aiming at improving quality of education to make it world class. The onus of quality mostly rests with HEIs only. NEP-20 provides the path, ways and means but implementation depends however on HEIs.

If we look at the implementation status of NEP-20 there is a lot to do if the goal of sustainability (SDG-4) is to be achieved by 2030. At state govt and Regulatory Bodies level however, there is need to approve ordinances and directives related to NEP-20 on a priority basis and also provide the required support to HEIs in terms of e-infrastructure and quality teachers. But the biggest problem in implement at HEIs is twofold. First the mindset at management and the faculty who have natural resistance for change. The second and most important problem is that most of people have not even read the NEP-20, if read they have not fully understood, if understood there is certain fear that it required up skilling, learning new techniques and above all it demanded lifelong learning and new competencies at teacher's level – for which they are not ready.

**Role of HEIs in implementing NEP-20 – the way ahead**

HEIs have the major responsibility to address the core issues of NEP-20, i.e. making quality of academics and research world class, providing opportunity for lifelong learning and achieve global acceptability. The road map to achieve these lofty goals in the core areas has been provided in the NEP-20 document. Irrespective of the support and go ahead from regulatory bodies/government level, many premium institutions and tire I HEIs have started implementing provisions of NEP-20.

There is need for tire II & III HEIs or HEIs in tire II & III cities to start implementing NEP as there are many provisions which may be implemented without any external support/ approval. Besides the support of government and regulatory bodies, HEIs require four things – Understanding NEP-20 and forming a dedicated Task Force, will to act, Resources and Efforts with dedication and Continuous monitoring & Feedback system. In Implementing NEP-20 the gap between tire 1 institutes and tire 2 & 3 is widening. Almost 70% of the students come from tire 2 and 3 institutes/cities where NEP implementation is getting least attention. For implementing NEP-20 these HEIs may proceed with the following suggestions: -

(a) **Task Force-** HEI should form a task force who should study NEP-20 document thoroughly and prepare a road map for the institute with a time frame, mile stones and monitoring system. Sensitizing all teachers is a must.

(b) **Ordinances/Regulation-** Wherever there is a need to change the ordinance/ regulation for HEI or drafting of a new one, it should be done and followed up on priority.

(c) **Transparency-** Such big reform and transformation of structure cannot be done in isolation. There is need to involve the entire staff of HEI to be a part of it. So the road map needs to be shared with all staff and task force should share the progress periodically with frequency of at least every month. There is need for academic leadership and top management to actively involve in the process. Each mile stone of NEP implementation must be clearly spelt out and status shared.

(d) **BoS and Academic Council-** These bodies are to play very important role in NEP-20 implementation. Routine meetings and copy past of syllabus and course curriculum need to be given up. Serious frequent meetings will be required, because with NEP 20, there will be requirement of frequent updating, upscaling and continuous evaluation of courses to not only make them outcome based, but also as per the future needs of the industry/society with an effective feedback mechanism. HEI should also ensure a strong Academia- Industry Interface in the institute.

(e) **Faculty Competence-** Teachers are the most important key to the effective implementation of NEP-20. Unfortunately, this is most weak link too. There is urgent need for all teachers to first understand NEP then prepare for the change. Upscaling, up skilling, re skilling, lifelong learning and capacity building of teachers is the key for success NEP. HEIs have to invest in this with a formal audit of competency balance sheet of the faculty. Effective recruitment of the faculty, security of job, good pay structure, empowerment of faculty and their development/accountability are some areas in which top educational leadership and management will have to look into. Effective appraisal system, inhouse and outside continuous planned training of faculty and will of management to liberally invest in faculty will also be the key factors to effective implementation of NEP-20.

(f) **Transform from Programme to Course-** NEP-20 aims at **making the education, course oriented and not programme oriented and student centric instead of institute or placement centric.** In the new era a student will have freedom to design his/her own degree and institutes will offer courses to choose from. This flexibility needs strong courses with employability and skills associated. Also courses need to be aligned to the industry needs and should be based on future skills. This will require a very competent BoS and a very vibrant Industry- Institute interface closely linked to BoS. Industry members in BoS cannot be just few non playing names but they have to be active members and contribute with a strong documentation system to record their contribution.

(g) **Information Cell and Think Tank-** With fast change of technology and frequent changes in policies and new initiatives every day, the information has really become power. The formal bodies like Academic Council, BoS, IQAC have their own routine work and there is need for a high power **NEP-Information Cell** who should gather all information collate them and take out useful operative portions and disseminate in a usable format in a formal manner, may be through IQAC or any such authorize body so that implementation could be monitored. Similarly, a Think Tank of some top academic leaders in HEI should be formed who should make a formal road map on infra, teaching, research, sports, skill and examination work etc and implement/monitor the progress regularly. This should be not part of routine leadership meet but a separate exercise to provide right importance and priority to this task.

(h) **Gurukul Ways-** To improve quality, HEIs may think of introducing some of gurukul pedagogies. In Gurukul the philosophy was **'n is equal to one'.** That means student was treated as one individual. In present system we have moved to **'n is equal to 30 or 60'",** i.e. students are treated as a group or as a class. HEI will have to find ways and means to build individual profile of each student and bring back 'n is equal to one' mind set.

(i) **Indian Knowledge System-** The Indian history reveals that we have a very rich treasure of knowledge system and tradition which had made this country a world leader in ancient time. There is strong need to make new generation aware of our rich heritage, knowledge system history and traditions. NEP-20 also advocates this. Universities are autonomous in many ways to modify the syllabus and introduce skill courses, optional electives and take this route to include Indian Knowledge System and traditions in formal education frame work. HEI may think of at least one PhD or other type of research project in some aspect of Indian Knowledge System & Traditions every year.

(j) **Multidisciplinary Approach** – NEP-20 has opened the path for breaking the boundaries between disciplines. Science, arts, humanities and other non tech subjects in future will play important role in professional degrees. NEP-20 envisages holistic development of student and a well-rounded personality outcome from the education system. Design of course curriculum will be a tricky subject and has to be dealt carefully. Routine curriculum design has to be given up. Student should have a wide option to choose from and decide his major, minor and skills.

(k) **Skill Development-** NEP-20 aims at producing skilled work force from educational institutions irrespective of disciplines to which it belongs. Skill electives should be so designed that after going through the skill course/courses the student should be competent enough to take up a job in the specific skill after one-year certificate or two-year diploma in a multi exist environment during degree programme.

(l) **Multiple Entry Exit System-** This is part of the lifelong learning aspect of the reform that NEP-20 wants to bring. There is a fear with HEIs, that this will invite exodus and jeopardize economic viability of HEIs which is certainly unfounded. Option to leave after one year of course with a certificate, two years with a diploma, if implemented properly will motivate the person to come back even if he/she leaves, but for this, minimum two employable skills must be given to student every year in each discipline by experts who could be enlisted from outside also.

(m) **Holistic Development-** Education should be equally for all four parts of an individual i.e. mind, body heart and soul with appropriate credits for each in the curriculum. The current system consumes maximum part of curriculum for the mind, with least scope of critical thinking and experiential learning which were part of ancient Indian education system. Skill delivery and hands on training which is food for the body also finds less part in current curriculum. Social concern and spirit-de-corpus provide emotional fulfilment and enlighten heart. It comes from extension and social connect activities in the curriculum with multidisciplinary approach. These have no organized space in the current curriculum. Character and values awake the soul and it should be most essential part of any education system. Current curriculum devotes almost 90% part to the first part i.e. mind, that too through rot learning only. Practical classes contribute a little for skill development in the present system. It is most important duty of BoS now to include all four parts in curriculum with proper credit for each part with a provision to asses and award system with credits for each part. There will be need to spend in skill infrastructure, sports field and skill facilities.

(n) **Returns to Workshop and Lab Culture** – On this not much need to be said. Labs, workshops, hobby clubs and filed work have almost closed down. With virtual plat forms and edu Tech companies the culture of video games is now in thing. Physical work in academics need to be brought back.

(o) **Technology-** Technology will be a significant facilitator to implement NEP-20 efficiently. Design and establishment of e-structure i.e. smart class rooms, virtual platform for on line learning system, management information system will be very important. Use of disruption culture, new age software tools, and AI support on a continuous basis will propel or push back a HEI depending on how it invests in such facilities. It may be noted that in next 2 to 3 years AI will change the entire culture of research writing, experimentation, analysis and application in a very big way. Fathe r of modern AI, Geoffrey Hinton has already warned that in next 5 years AI industry may reach super human robot stage. HEIs sans AI will be left behind. Requirement is not only on installation of infrastructure but more important will be training of faculty, changing their mind set. Sensitizing faculty and students to the new system and continuous updation will be required. Use of simulation and virtual labs will play a great role in improving the pedagogy and delivery system. HEIs will have to gear up and embress the new approach with a strong will.

**(p) 4-year Degree Course and Regional Language-** Some people have restricted the entire NEP to these two issues only. A half baked initiative to introduce professional degree in regional language has received poor response with very low admissions. 4-year degree course which has been designed in a hurry, has brought back M Phil in the grab of fourth year. For creation of quality resources in regionals language it need to be out sourced to independent private agencies with adequate budget for authentic translation or to experts within and outside HEI with adequate budget and time frame. HEI may take up task of translation of text books for some specific courses in a phased manner within their own resources. Research orientation and aptitude cannot be identified by a high score (7.5 or more) in three-year degree course which is planned now. Also research cannot come as the fourth year matter only. Students with research aptitude and entrepreneur skill have to be identified in the first year and groomed with appropriate subjects in remaining 3 years to take up PhD work after 4 years for start a business venture. HEI may design their own methods to identify such students in first 2-3 semesters and provide them with additional electives and skill courses so that they are effectively groomed as research scholars or potential entrepreneurs.

**(q) Apprenticeship/Internship Embedded Programmes-** UGC has issued the guide lines and made such programmes at par with any other UGC programme. HEIs must make an effort and collaborate with – Sector Skill Council FICCI, CII, AICTE and industries and enter in to MoU to start these programmes.

**(r) Continuous Evaluation System-** NEP-20 aims at reducing stress of examination on students and promote a continuous evaluation system. Formal examination load need to be reduced by at least 70%. This could be done by effective use of technology online examination as per convenience of the students and inbuilt periodical tests, assignments and projects. There is need to come out of only pen and paper test system and introduce experiential learning, project based learning, assignment based tests and application/research orientation in the curriculum.

**(s) Academic Bank of Credit (ABC) –** This digital platform provides seemless mobility for students to gather credits from different institutions, and design their own degree and expertise/skill sets. This platform is going to provide the flexibility desired by NEP-20 in formal recognition, credit accumulation, credit transfer, and above all paper less plastic transactions. HEIs must create facilities for Digilocker and ABC platform registration for their students as the first step towards transformation.

**(t) Research Activities and Research Environment-** In research publication Indian Education Sector has made a definite mark in terms of numbers but in International Ranking poor performance of HEIs shows that there is a lot to be done on quality. A lot has been said about this on various platforms. HEIs can make a beginning by following action; empowering and facilitation of faculty with research potential, generating research environment by providing good weightage for quantified quality teaching and research outputs in appraisal, making research credits in the curriculum effective and realistic, making it mandatory for faculty to earn some minimum credits in research, paper writing, project submission etc. Every year, investing effectively in research infrastructure, introducing an effective research audit for each faculty and dept in quantified terms, making compulsory for faculty to work with either industry or social organisation or with any other body external to HEI and produce a report every year and above all HEI must invest in infrastructure and motivation for research with a plan.

**(u) Collaboration-** Inter/intra discipline and multi-disciplinary approach in NEP-20 calls for collaboration not only within the HEI departments but also outside in the country and outside the country. Blind MoUs for record will not do. Each department will need to focus on area for collaboration and look for collaboration within and outside the institute and identify the people, process and place (ogranisation) and make a plan of activities with goals. In internationalization collaboration is going to play a big role.

**(v) Diversity and local Context-** Irrespective of the discipline, curriculum must have a strong combination of technology related part, business related part and soft skill related part so that student is equipped on all three front in addition to the core knowledge of his/her chosen field. Introducing technology related subjects in arts, humanities is a tricky field on which BoS has to work, Business and management skill is an essential need for everybody in the current era and so is the soft skill. The curriculum should look in to all diverse requirements at the same time make the learning relevant to current and futuristic needs of the society not only at local level but also relevant at global level BoS may modify existing curriculum or include them in the curriculum as skill credits.

**(w) Ethics, Values and Character Building-** Assignments, group activities and projects with the objectives to address these issues need to be designed and included in the curriculum and credit be awarded.

**(x) Social Connect/Extension Activities/Sport/Events –** Normally there will be a small group in HEI mostly from NSS or NCC etc who will undertake social work. There will be a small group of students who will be working in sports ground. Similarly, there will be a small group of faculty members supported by some students who will indulge in extracurricular activities/event/conferences. Almost all student minus these small groups mentioned above, will be spectators only in such events. There is need to move from this situation to the system of **"By students for students and all students".** This can be done if some credits are allotted for these three activities in the curriculum. HEIs may think of some ways and means for this within their own rights.

**(y) Feedback System –** There is a culture of fake feedback records in many HEIs to hood wink regulatory bodies. With advancement of technology there is need to enforce e-based feedback and analysis system by the HEIs with a transparency for all the five stake holders students, faculty, employers alumni and visitors.

**(z) NEP –Audit –** HEI may think of regular NEP-audit in addition to normal academic and admin audit periodically from an external expert to find out the real progress.

**Concluding Remarks**

Effective implementation of NEP-20 will pay rich dividends in long run. HEIs may draw their own road map because regulatory bodies may take quite some time for mandatory enforcement HEIs may have many excuses or scope for manipulation and delaying the implementation but this will be detrimental. With implementing NEP-20 on their own, HEIs will not only contribute to overall good of the Higher Education Sector as a whole but also reap the benefit in following term-

**(a)** Improved quality of academics, research and outcomes.
**(b)** Well rounded professionals and worthy citizens with good values will come out as pass outs and work as brand ambassador for the institute.
**(c)** Will establish the institute as a Center for Knowledge Creation and not only as knowledge dissemination.
**(d)** Will inculcate habit of lifelong learning in faculty and students.
**(e)** Will take the faculty and students closer to the cultural roots of India and at the same time enhance their global acceptability.
**(f)** HEI will be able to contribute significantly in GER
**(g)** Research quality will improve and it will be able to benefit society in a bigger way. In addition to **"Lab to library"** there will be **"lab to land"** benefits out of research work.
**(h)** A collaborative and multi-disciplinary team culture will develop in the institute.

It can be easily seen that faculty is key to implementing NEP. Their awareness, initiatives, readiness for change, willingness for upscaling, capacity building, learning new skills and above all understanding NEP-20 and acceptance for in a hard work and dedication sustained manner can only pave the way for successful implementation of NEP 20. Willingness of the management to invest is also very important, so a joint effort of management/academic leadership and faculty can only yield effective outcome.

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# 8
# UNIVERSITIES AS CRADLE OF KNOWLEDGE AND INNOVATION

**Dr. W. Selvamurthy, Dr. Vaibhav Singh Bhugra, Ms. Sneha Nair**

*The Universities play an important role in the tapestry of innovation, collaboration, and societal advancement. The article envisions the future where universities are more than centres of learning and contribute actively to India's transformation into a global innovation hub. The pivotal role played by the universities in fostering an environment promoting innovation & societal transformation along with the opportunities & challenges inherent in this journey has been discussed in the article. It also discusses the challenges and opportunities that lie ahead, offering insights and strategies for propelling India and its academic institutions to the forefront of global innovation and knowledge creation. Technological self-reliance, the cultivation of high-end technological domains, and the necessity for a sustainable and inclusive approach to research and development has been stressed upon. The funding landscape, industry-academia synergy, and the cultural shift required to align university research with industry demands has been examined. Global collaborations have been heralded as a vital component of India's innovation strategy, with the country's G20 presidency spotlighting its role as a leader in the global south. This future is built on robust connections between science and society, as advocated by national policies. The need for an integrated approach involving government, industry, and academia to foster a culture of innovation that is aligned with societal needs and global standards is highlighted.*

## Historical Perspectives

Over 5000 years ago, India was already the hub of knowledge and innovation [1]. Within its historical treasure trove, lie the remnants of institutions like Nalanda and Takshashila, pillars of intellectual prowess that illuminated the world with their erudition and scholarly pursuits. The famed Nalanda University housed thousands of students and revered scholars, fostering an environment conducive to intellectual exchange and exploration. Takshashila and Nalanda University were the knowledge temples where the global community came to seek knowledge in India [2]. These Universities and Institutions of higher learning were not only churning out innovation and ways by which the quality of life on this planet can be improved but they were also the repositories of knowledge, skills, and competencies.

Delving deeper into India's heritage unveils the invaluable treasure of the Vedas, the ancient scriptures that form the cornerstone of Hindu philosophy and spirituality. The Vedas, too, endure as a guiding light, influencing not just religious practices but also various fields like philosophy, science, and art. Their teachings are resonated in the practices of Upanishads, Bhagvad Gita, Yoga, Meditation, and Ayurveda, which have gained global recognition for their holistic approach to well-being [3,4]. The significance of India's heritage, encapsulated in Nalanda, Takshashila, and the Vedas, extends beyond geographical borders. It represents a testament to the human quest for knowledge, spirituality, and the continuous pursuit of wisdom.

India also boasts a remarkable history of scientific advancements that have significantly contributed to the world's knowledge base [5]. Among these inventions, one of the most influential is the concept and symbol of zero which revolutionized mathematics and laid the foundation for modern numerical systems. Ancient Indian mathematicians made significant strides in geometry, algebra, and arithmetic. Aryabhata, a renowned mathematician, and astronomer from the 5th century, formulated the concept of the number system and made crucial contributions to trigonometry. Bhaskara II, in the 12th century, pioneered solutions to indeterminate equations and made advancements in calculus. India was able to build ships for protecting coastal areas as well as do maritime trade across the nation hundreds of years ago.

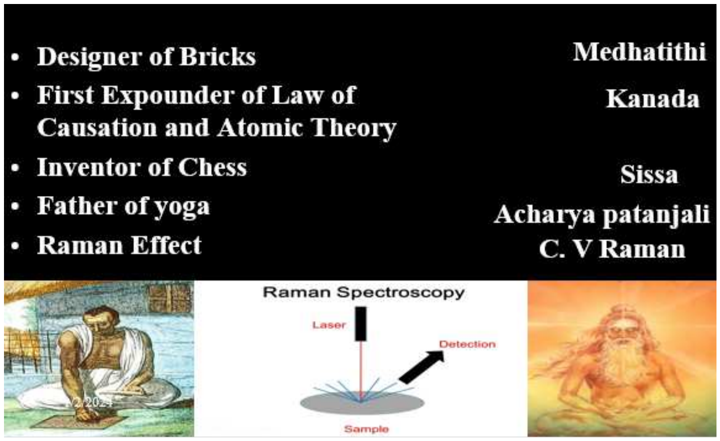

*Figure 1: Some important landmark inventions by Indians*

The ancient Indian system of medicine, Ayurveda, dates back thousands of years and remains relevant today. Ayurveda emphasizes holistic health, herbal remedies, and a comprehensive understanding of the human body, mind, and spirit [6]. The nation in those periods produced Charaka, Sushruta, Magadha who devised innovative ways to provide healthcare to the public by using traditional knowledge and wisdom. Sushruta, often referred to as the father of surgery, contributed to the field of surgery with his 'Sushruta Samhita,' which detailed surgical techniques and medical procedures [7]. These scientific contributions from ancient India laid the groundwork for advancements across various disciplines **(Figure 1).** The Indian scientific legacy continues to inspire researchers and scholars globally, underscoring the rich heritage and enduring impact of Indian innovation on the world's scientific landscape.

Such is the scenario which needs to be revisited when we are talking about India becoming a Knowledge Superpower by generating new knowledge, securing the knowledge through IPR protection, disseminating the knowledge through scientific communication and publication, and applying this wealth of knowledge to address the needs of the society and creating wealth for humanity. Thus, India has a rich heritage of being the knowledge lighthouse of the whole globe and the DNA exists in every Indian citizen.

**India: The Emerging Knowledge Superpower**

India's journey towards becoming a knowledge superpower is a narrative woven with innovation, resilience, and a deep-rooted commitment to education and technology. Over the past few decades, the country has made significant strides in innovation and related aspects, although its rankings vary across different global indices that measure innovation, research, and development. Global merit of India in S&T is 3rd in publications, $9^{th}$ in patents and $3^{rd}$ in start-ups. With its Global Innovation Index (GII) reaching the $40^{th}$ position from $81^{st}$ position a few years ago showcasing improvements in innovation considering inputs and outputs [8]. The expenditure on research and development is also increasing steadily. We have seen a rise in patent filings and research publications reflecting increased innovation activities.

The Nation has seen a steady growth in various aspects which are summarised below: -

- ***Education and Research:*** India's education sector has witnessed significant expansion and evolution. The country is home to premier institutions like the Indian Institute of Science (IISc), Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs) with a blend of Private Universities such as Amity University, Amrita Vishwapeetham, SRM University, Vellore Institute of Technology, Sastra University etc with world class teaching and research facilities [9]. These institutions have produced exceptional talents in diverse fields, contributing significantly to the global workforce.
- ***Scientific Research and Development:*** India has made significant investments in scientific research and development across various sectors, including space exploration, biotechnology, pharmaceuticals, and renewable energy [10]. Institutions like the Indian Space Research Organisation (ISRO) have achieved remarkable feats, such as Chandrayaan III, Aditya-L1, Mars Orbiter Mission, showcasing India's scientific capabilities.
- ***Technology and Innovation:*** India's technology prowessness in IT and software services has been a cornerstone of its emergence as a knowledge superpower. The country's IT industry, characterized by software development, outsourcing, and innovation, has earned international acclaim. Indian IT professionals have played pivotal role in global technology companies and startups, shaping technological advancements worldwide. Addressing the challenges faced globally and leveraging emerging technologies like artificial intelligence, biotechnology, Quantum and green energy technology can further propel India's trajectory towards becoming a global leader in knowledge creation and innovation.
- ***Start-up Ecosystem:*** India has fostered a vibrant start-up ecosystem, particularly in technology and innovation. Cities like Bengaluru, Hyderabad, and Pune have emerged as hotspots for entrepreneurship and technological innovation. The country's young population, coupled with a growing culture of innovation and risk-taking, has propelled India's start-up landscape onto the global stage.
- ***Skilled Workforce:*** India's demographic dividend, with a large and young workforce, presents immense potential. Efforts to enhance skill development, vocational training, and higher education have aimed to equip this workforce with the skills needed to excel in the knowledge economy.

- ***Global Collaboration:*** India actively engages in international collaborations, research partnerships, and knowledge exchange programs. Collaborative efforts with other national and multinational organizations have facilitated the sharing of expertise, resources, and technology.

## 1.4 National Education Policy 2020

The National Education Policy 2020 (NEP 2020) is a comprehensive roadmap aiming to transform India's education system, aligning it with the needs of the 21$^{st}$ century [11,12]. The aspirational India is striving to remerge as a knowledge hub which is clearly reflected in the recent NEP 2020 aligning and harmonising the educational system for global requirements and transforming Institutions of higher learning as a cradle of Innovation. Inclusivity in education and opportunities for every citizen seeking higher knowledge has also been the spirit behind the policy. India today with more than 1100 Universities and more than 50000 Colleges and Institutions has built the necessary Infrastructure for academics and research. The Government of India has also envisioned in the NEP 2020 policy document the establishment of National Research Foundation (NRF) which shall aim to provide reliable base of Merit-based and at the same time equitable peer-reviewed research funding on Public – Private Partnership mode [13].

Its implementation requires concerted efforts from all stakeholders, including government bodies, educational institutions, teachers, parents, and students. If effectively implemented, the policy has the potential to revolutionize the education landscape in India, fostering creativity, innovation, and holistic development among learners.

### Government patronage for innovation

Government patronage for innovation is crucial for fostering a culture of innovation, creativity, research, and development. Several initiatives and policies have been introduced to support and encourage innovation across various sectors. Besides the National Education Policy, the Science, Technology and Innovation Policy (STIP) and missions like Aatmanirbhar Bharat, Make in India, Start-up India and other such Government initiatives drive and propel Universities to transform them as a cradle of innovation. Indian industries during the British colonial rule and subsequently have been doing trade, license production through technology transfer and hardly the indigenous technologies were allowed to flourish [14, 15].

The Government of India provides financial support through grants, subsidies, and funding programs to encourage research and development. Schemes like the Atal Innovation Mission (AIM), Startup India, and grants from agencies like the Department of Science and Technology (DST) and the Department of Biotechnology (DBT) aim to nurture innovation-driven enterprises and research projects. The Government has also started setting up a large number of incubators and innovation hubs across the country to support budding entrepreneurs and innovators [16, 17, 18].

The government focuses on protecting intellectual property rights to encourage innovation. Policies and legal frameworks safeguard patents, copyrights, and trademarks, provide innovators with the confidence to invest in new ideas. It also facilitates collaboration between academia, industry, and research institutions. Public-private partnerships encourage knowledge sharing, technology transfer, and joint innovation projects [19].

Government initiatives in education and skill development programs aim to nurture a skilled workforce capable of driving innovation across sectors. Programs like Skill India focus on enhancing skills relevant to emerging technologies and industries. Organizing innovation challenges, hackathons, and competitions encourages participation and promotes out-of-the-box thinking. Initiatives like the Smart India Hackathon and Grand Challenges have supported innovative solutions to societal problems [20].

These government initiatives aim to create an ecosystem that supports innovation, entrepreneurship, and technological advancement. By fostering a conducive environment, providing resources, and incentivizing creativity, the government plays a pivotal role in nurturing and sustaining innovation in India.

**Why Universities need to be the cradle of innovation**

The academic environment encourages critical thinking, foster interdisciplinary collaborations, and nurtures creativity, leading to the generation of novel ideas and approaches. The universities and colleges have certainly played an important role of the academic delivery for knowledge dissemination, but igniting passion for research is equally important.

India has already been named the next Knowledge Superpower by the international scientific community (New Scientist, 2005). However, to further strengthen our economy, we must cultivate and promote our own technology and innovation. We need to make sure that as a Nation we are producing high-caliber knowledge workers who can fill sought jobs in technical, academic, and corporate organizations, as well as in businesses. Even in education, research and innovation are the driving forces [21].

Earlier, the Universities were primarily focussing on quality teaching and preparing the students for employment opportunities through on-campus placements. However, the Universities now are the major players driving research and innovation aiming towards sustainability. To become the cradle of innovation. the university ecosystem needs to create an innovation culture blending teaching with research giving research equal emphasis irrespective of the disciplines. Teachers and faculties need to be groomed, trained or retrained to adapt to this new culture in all universities. The policies and practices should foster such a conducive ecosystem to promote and propagate as a culture.

Universities are hubs of research and development, where scholars and students engage in cutting-edge research. This environment fosters innovation by encouraging the exploration of new ideas, technologies, and methodologies. They contribute significantly to the creation of new knowledge. Through academic research, universities expand the boundaries of human understanding and generate insights that can lead to innovative solutions in various fields. The curriculum design, the pedagogy, and the method of delivery of education should be research driven promoting creativity, innovation and problem-solving ability among the students.

Universities bring together experts from diverse fields and disciplines. Interdisciplinary collaboration encourages the exchange of ideas and perspectives, leading to innovative solutions that draw on the strengths of different academic domains [22]. A strong industry connect in this endeavour could be very helpful to bring industry-oriented innovation. Many universities engage in technology transfer activities, where research findings and innovations are shared with industries and society. This process helps bridge the gap between academia and the practical application of knowledge, fostering innovation in the broader community. Nowadays, Universities support entrepreneurial activities and the creation of startups. They provide resources such as incubators, accelerators, and mentorship programs to help students and faculty turn their innovative ideas into viable businesses. In summary, universities serve as vital catalysts for innovation by fostering a culture of research, education, collaboration, and entrepreneurship. The ideas and breakthroughs that emerge from universities have the potential to drive technological, social, and economic advancements on a global scale [23, 24].

**Research in Universities**

Research at universities, encompassing undergraduate, postgraduate, and doctoral studies, is not just a statutory requirement but a foundational pillar for research and innovation. A culture of research and innovation is of paramount importance and should be cultivated.

It is the driving force inspiring continuous growth, exploration, and discovery in an academic ecosystem. Faculties, research scholars and students can contribute to a wide array of fields through this scholarly pursuit. Research is multifaceted and involves basic, applied, and translational studies. Each of these, whether aimed at understanding fundamental principles or at immediate application, is directed towards tangible deliverables. These deliverables could be in the form of innovative products, groundbreaking technologies, efficient processes, or viable solutions to societal issues [25].

It is important to inquire into robust, creative answers and acceptable concepts and practices to new questions of education and research of the unknown tomorrow. The importance of blue-sky research cannot be overstated as this type of research focused on fundamental and futuristic concepts is crucial for the long-term expansion of knowledge and the continued evolution of university-led innovation.

The research should align with local and regional needs while resonating with national priorities and global challenges. This alignment ensures that the research is relevant & impactful and foster solutions that are not only innovative but also sustainable, frugal, affordable, and accessible. The researchers should ensure that the benefits of their work extend to the broader society. However, it's equally important to invest in the exploration of unknown frontiers, securing a place for profound discoveries that shape the future [26, 27].

The Universities should thrive as incubators of innovation and knowledge and for that, comprehensive research policies should be established. Necessary infrastructure for research and development should be provided; intellectual property rights should be protected, and the maturation of technologies from low to high Technology Readiness Level (TRL) should be facilitated. The mechanisms for the seamless transfer of technology to industry should be devised, that should also include the presence of innovation and business incubators for necessary support to researchers and young entrepreneurs [28].

By prioritizing these aspects, universities reinforce their role as cradle of innovation and new knowledge, preparing society for the challenges and opportunities of the future .

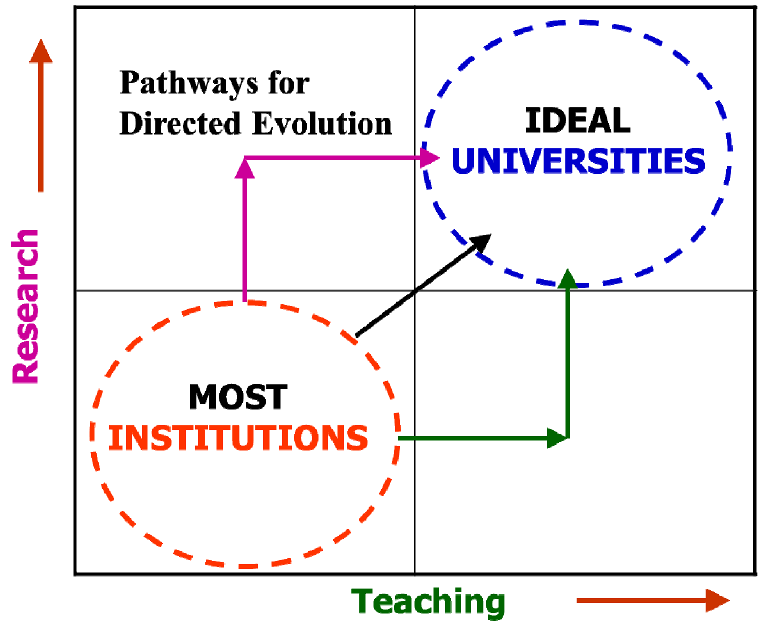


*Figure 2: The relationship between teaching and research to transform institutions to ideal universities*

**Opportunities**

India has aspired to position itself among the top three global economic powers during the Amritkaal (next 25 years) and hence the pursuit of technological self-reliance becomes crucial. It is a saying that "Technology drives doctrines of a nation in War and Peace" which underscores this imperative. In line with the Aatmanirbhar Bharat (Self-reliant India) initiative, the nation is focused on achieving autonomy in critical Defense technologies, spanning both strategic and tactical sectors [29].

Universities are at the forefront of this ambitious journey, entrusted with the responsibility of developing high-end and futuristic technologies. These include advanced fields such as Artificial Intelligence, Machine Learning, Deep Learning, Quantum Technologies, Space and Defence Technology, Material Science and other critical domains that are vital for national security and nation building. Academic Institutions churn out qualified and skilled knowledge workers in these areas. Universities constantly foster expertise in these fields, thus significantly contributing towards building a robust technological foundation for the country [22, 26].

The research focus extends to other critical scientific areas including Atomic Energy, Industrial Research, Food Security, Health Security, and Energy Security. To ensure a sustainable development path, the universities also have to prioritize the development of green and clean technologies with the evolution of these sectors which is crucial for the technological advancements alongside contributing to the nation's self-reliance and strategic strength but also to a sustainable development path.

During this nurturing journey, universities are steering the country towards technological sovereignty and economic prosperity. The critical role played by the Universities are aiding towards a secured future of the country where India is not only a participant but a leader in the global technology landscape, ensuring peace, security, and sustainable growth for the nation and beyond.

**Synergy**

The endeavours of conducting valuable research calls for creative thinking, formulation of plans and strategies for implementation and addressing critical questions as well as the commitment to societal betterment. While universities are powerhouses of knowledge and innovation, the complexities and scale of contemporary research challenges necessitate partnerships beyond the confines of any single institution.

Collaboration emerges as a pivotal factor in this context. It's about building a socially valuable, practical, and transferable body of knowledge that extends its benefits to both scientific advancements and societal applications. The effectiveness of university-led innovation significantly multiplies when there's a robust network involving industry, national laboratories, government-funded institutions, and private entities. Such dynamic collaborations act as a force multiplier, enhancing the scope, scale, and impact of research outcomes [23, 28].

Hence, strong industry connections and synergy with national laboratories, government funded Institutions as well as networking among the private Institutions will be vital for bringing force multiplier effect on the outcome of the innovation. The growing competitiveness and global reach in engineering sectors are prompting both industrial and academic entities to enhance their collaborative efforts. It is essential to build a future where government-funded and private institutions work together without barriers and have a seamless partnership flourish. To achieve this, equitable access to funding schemes and grants for both government and private universities is essential [22, 23, 26].
Public-private partnerships in research and innovation are crucial as they bring the necessary resources and investments. Government of India acknowledges this need and has put concerted efforts to foster industry-academia collaboration through various programs. One such initiative is the 'Industry-Academia Collaboration' program, aimed at promoting cooperation between them. Furthermore, the National Education Policy (NEP)

2020 serves as a facilitator, ensuring that researchers are well-informed about the nation's urgent research needs and encouraged to contribute to national initiatives like 'Make in India.' [11, 12]

Through the bridging of gap between industry and academia, an environment of seamless collaboration can be fostered, which shall contribute towards enhancing the nation's innovative capabilities and securing its position as a global leader in research and technology. This synergy acts as transformative force that propels the nation toward sustained growth and development.

**Challenges**

When one looks at the funding scenario at the national level, it still remains a significant challenge. A considerable portion of research funding is provided by the government under their various schemes, but industries are often hesitant to invest in research and innovation, particularly with universities. This reluctance is partly due to a perceived dichotomy between the research culture in academic institutions and the industry's demand for speed and timely achievement of research milestones. The confidence among industries regarding university-led research is not at the level it needs to be. Thus, bridging this gap is crucial and requires a cultural shift within universities, aligning their research endeavors more closely with industry requirements.

We as a nation need to bridge this gap between University culture and industry requirements by bringing a cultural change in our universities. The academia through this association gets an opportunity to solve real-world problems by applying their theoretical and practical knowledge, hence making their research relevant and impactful. Moreover, such collaboration grants the researchers access to industry-standard R&D facilities, enabling cutting-edge research and fostering innovative solutions to complex challenges.
The investment made by the Government in Science and Technology is relatively modest, with only 0.8% of the GDP invested in Research and Innovation, and the share allocated to universities is even lower, but the strategies are in place to augment this investment through public-private partnerships and corporate Social Responsibility (CSR) funding.

To cultivate a spirit of pride and ownership in indigenous products and technologies, there is a clarion call for patronage for indigenous products in domestic market. Echoing the Hon'ble Prime Minister's slogan to be "vocal for local", there is a need for a national movement supporting and promoting innovations. This will foster a sense of national pride, and also encourage the growth & development of local industries and technologies [30, 31].

To address the challenges, there is a need for increasing investment in research, fostering a culture of collaboration between universities and industry, and promoting local innovation. It will help the nation to pave the way for a future where universities are not just centers of learning but also cradles of innovation and knowledge, contributing significantly to the nation's progress and prosperity.

**Global collaborations**

The G20 Presidency during the Year 2022-23 has casted India as a leader for the global south, underscoring the country's growing prominence and the world's eagerness to collaborate with Indian Universities [32]. This enthusiasm is fueled by India's demographic advantage and its impressive strides in global rankings for science and innovation, including a significant jump in the Global Innovation Index from 81 to 40 and a notable standing in publications and patents.

Indian Universities are now becoming incubators of world-class scholars, many of whom hold prominent positions in institutions and industries globally. The whole world is looking towards India and Indian Universities to play a significant role for bringing new innovations through R&D endeavours especially from universities. We can learn from each other’s experiences and innovate for the betterment of humanity.

Acting as critical nodes in a global network of knowledge and innovation, Research universities attract scholars, researchers, and students from around the world, fostering a unique environment where ideas and knowledge transcend geographical and cultural boundaries. The power of collaboration between institutions is especially potent, allowing for the pooling of infrastructural resources, intellectual expertise, and research data to tackle complex societal problems. These partnerships have led to groundbreaking research outcomes that might not have been achievable in isolation.

Addressing global challenges through a collective approach is a fundamental aspect of these international collaborations. The global research partnerships bring diversity and inclusivity in research. Hence, research gives opportunity in bringing together individuals coming from different backgrounds, cultures, and academic disciplines. It enhances the quality and scope of research as researchers and students exposed to different cultures and ways of thinking are likely to develop a more holistic and nuanced approach to problem-solving. A collective expertise also develops solutions with a broader, more impactful reach. The collaborations extend beyond interinstitutional research involving industries, startups, and government agencies that further facilitate the transfer of knowledge and technology from academia to the market, fostering economic growth and entrepreneurship.

The global research institutions working together in the form of joint research projects and exchange programs benefit the entire academic community. The quality of research is enhanced, and faculty and student experiences is enriched through exposure to best practices from leading international research institutions. By sharing resources and expertise, a robust and comprehensive set of research outcomes can be achieved. International collaborations allow for the pooling of knowledge and funding to effectively tackle global challenges, embodying the spirit of cooperation and shared progress that is critical for advancing innovation and knowledge worldwide.

**The way ahead**

Honourable Prime Minister of India Shri Narendra Modi during his address at the 104th Indian Science Congress held in Tirupati on January 3, 2017. emphasized the need for a robust connection between science and society, leading to the formulation and release of the National Policy Guidelines on Scientific Social Responsibility (SSR) on 11 May 2022 (National Technology Day). The effective implementation of this policy shall significantly impact societal development through the application of scientific discoveries.

To envision the future where Indian Universities are not merely centers of learning but are instrumental in transforming India into a hub of innovation, the objectives of research should be defined keeping in mind the societal needs. The interdisciplinary collaboration should be encouraged, and a culture of innovation should be fostered. The Universities must ensure that their research has a tangible impact and is addressing the real-world problems alongside contributing to the nation's progress. The societal connections and community engagement must be strengthened to understand and address its needs. Universities can adopt a model where each institution takes responsibility for several villages in its vicinity. By doing so, they can directly bring innovation and science to the grassroots level, fostering a new culture of "land to lab and back to land." Hence, research requirements may emerge directly from the people's needs that are supported by the efforts of scientists to meet these demands and returning the benefits of innovation to improve the quality of life in these communities.

Universities should be supported through collaboration of various stakeholders, including government, industry, and civil society with a mutual vision of contributing to the nation's development through science and innovation. Driving India's transformation into a global innovation hub contributing to the broader goal of sustainable and inclusive development should be the force behind this evolution.

## Concluding Remarks

The author having seen the evolution of Indian universities, research laboratories and industrial base over a period of 7 decades has no hesitation in projecting India to become the next Knowledge Superpower and also a cradle of innovation with universities playing a pivotal role in this transformation.

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# 9
# A VISION FOR DOCTORAL RESEARCH IN THE UNIVERSITIES OF THE FUTURE

**Nisha Ilyas and Prof. Kamal Kant Dwivedi**

*"In future's universities, vast and grand,*
*Where minds converge, each one a strand,*
*Doctoral research, its beacon bright,*
*Illuminates paths in academic flight."*

*In this perspective Article, we aim to provide insights that can help academic institutions and transdisciplinary doctoral programs position themselves within a changing research landscape and prepare for future disruptions. We describe here how important is the quality of doctoral research in the university of future. India has a glorious past of knowledge generation and dissemination from Taxshila, Nalanda to Vikramshila etc. During medieval time the Universities in European countries grew and evolved modern educational programs disciplinary perspectives and gender and cultural experiences. By the turn of 20th century, the doctoral program in India followed the patterns of foreign universities. Here, we cover, a brief description of Doctoral Programs in USA, UK, Germany, and France. Establishment of Global Academy of Doctorates, quality concerns, Internal and external factors attributed to quality of doctoral research, policy framework, best practices and sustainability, collaborative eco-system, scholar and supervisor relationships, factors responsible quality in doctoral research and Universities of Future.*

**Keywords:** *Indian Knowledge System, Traditional Model, Interdisciplinary, Doctoral Education, Quality of Education, Innovation, Excellence*

## Introduction

We understand that doctoral research is the pinnacle of academic pursuit, representing the highest level of expertise in a particular field. As we envision the future of universities, it is imperative to consider the ever-evolving landscape of doctoral research and its role in shaping the knowledge economy. Here, we attempt to explore the how changing dynamics of doctoral research at global stage may shape the future of higher education that embraces innovation, collaboration, and transdisciplinary approaches.

Before we dwell on this topic in details, it is pertinent to discuss the historical aspects of doctoral program per se. The primary education in ancient India followed ***Gurukul*** system that based on ***Guru-Shishya Parampara*** which later continued to higher education in ***Mahavihars,*** *the universities*. The prominent ***Mahavihars*** of ancient India were ***Takshasila, Nalanda, Vikramshila, Odantapuri, Valabhi*** and others. Archival evidence show that the doctoral level programs were offered in variety of subjects at ***Takshasila, Nalanda*** and other Universities in ancient India.

During medieval era, the origins of doctoral research can be traced back to European universities, particularly in Bologna, Paris, and Oxford. The first degrees, such as the doctorate in law (Doctor of Laws) and Theology (Doctor of Divinity), were established in the 12th and 13th centuries. The early doctorate degrees were more focused on teaching and examination rather than on original research. Scholars were required to demonstrate mastery of existing knowledge.

However, during the Renaissance, there was a shift toward humanism and a revival of interest in classical scholarship. This period saw a growing emphasis on independent research and critical inquiry. The concept of defending a dissertation or thesis gained prominence during this time. Doctoral candidates were expected to contribute original ideas to their field.

The 19th century witnessed the establishment of research universities, such as the University of Berlin by Wilhelm von Humboldt in 1810. These universities emphasized the integration of teaching and research. The Doctor of Philosophy (PhD) degree emerged as a distinct academic credential during the 19th century. The University of Göttingen in Germany awarded the first modern PhD in 1810.

In the 20th century, doctoral programs became more specialized, aligning with the professionalization of various disciplines. The doctorate became a prerequisite for academic and research careers. Doctoral research became increasingly international in scope, with scholars from around the world pursuing advanced degrees in leading research institutions.

By the turn of $20^{th}$ century, the first doctorate degree (D.Sc.) was awarded by Allahabad University in 1904 to Annoda Prasad Sircar in India. And by 1920, India had only 13 doctorates. Most of the time we talk about sheer number of doctorates produced by Indian universities and tend to neglect their quality aspects. An estimate reveals that in

India about 2,05,000 students are registered in Ph.D. programs and 40,000 - 42,000 scholars are awarded Ph.D. degree annually.

Ph.D. is globally considered to be the highest University degree. Every year some 4-5 hundred thousand doctorates are produced globally. Out of these India's share is only 10% (about 42k Ph. Ds in 2019), China and USA contribute 16-18% each, Germany, and UK about 6-8%. Nearly 4-5 million doctorates live in the world (1 doctorate amongst 1700 population). Global shortage of Ph. Ds is 2-3 million. India needs 0.2 million University/College faculty every year for the next 5 years.

India is a stunning Kaleidoscope, a blend of diverse cultures and traditions, geography and history, sights and sounds, flavours, and feelings. We believe in **"Life is Education and Education is Life."**

The traditional model of doctoral research has seen significant transformation over the years, influenced by technological advancements, globalization, and the demand for practical solutions to complex societal problems. Here we discuss the need for a reimagined vision that aligns doctoral research with the challenges and opportunities of the 21$^{st}$ century.

In recent decades, there has been a growing emphasis on interdisciplinary research, breaking down traditional academic silos. Advances in technology have transformed the landscape of doctoral research, making information more accessible and enabling collaboration across borders. Efforts to promote diversity and inclusion have influenced doctoral programs, with a recognition of the importance of varied perspectives in research. There is an increasing emphasis on applied and translational research, with a focus on addressing real-world problems and contributing to societal development.

***Structures of Doctoral Program: Global Scenarios***

The structure of doctoral programs can vary significantly between countries, reflecting differences in educational systems, academic traditions, and research expectations.

**(a) Admission in Doctoral Program**

Admission to a doctoral program varies depending on the country, university, and specific program requirements. However, there are some common steps and components in the doctoral admissions process. One must keep in mind that this is a general overview, and one should always check the specific requirements of the program and institution scholars are interested in. Here's a typical process:

Identify your field of interest and potential research topics. Explore universities and doctoral programs that align with your research interests. Look for faculty members whose research aligns with your interests, as you may need to find an advisor / guide.

Review the admission requirements for each program you are interested in. These may include academic qualifications, standardized test scores (such as the GRE or GMAT), letters of recommendation, a statement of purpose, and a resume or curriculum vitae (CV).

**(b) Prepare Application Materials**

You must obtain transcripts from your previous educational institutions. Prepare a resume or CV outlining your academic and professional background. Write a compelling statement of purpose, explaining your research interests, goals, and why you want to pursue a doctoral degree. Obtain letters of recommendation from professors or professionals who can speak to your academic abilities and potential for research.

Some programs may require standardized test scores. For example, in the United States, the Graduate Record Examination (GRE) is commonly required for doctoral programs. Complete the online application form provided by the university. Make sure to submit all required documents, such as transcripts, test scores, and letters of recommendation, before the application deadline.

Some programs may require an interview as part of the selection process. This may be conducted in person, over the phone, or via video conferencing. In some doctoral programs, finding an advisor or mentor is crucial. This advisor will guide your research and academic progress. Some programs may require you to identify a potential advisor as part of the application process. After submitting your application, you will need to wait for the admission committee to review your materials and decide.

If you are accepted into the doctoral program, you will typically receive an acceptance letter. Follow the instructions provided to confirm your acceptance and complete any additional enrolment requirements.

It is essential to carefully review the specific requirements and deadlines for each program, as they can vary widely. Additionally, contacting the admissions office or department of the university you are interested in can provide more personalized information and guidance.

Here is an overview of the typical structure of doctoral programs in the United States, the United Kingdom, Germany, and France:

**United States:** United States has one of the most rigorous doctoral programs.
**(i) Coursework:** In the U.S., doctoral programs often start with a period of coursework to provide students with a solid foundation in their field of study. Courses may cover both general and specialized topics, depending on the program and the student's chosen field.
**(ii) Qualifying Exams:** Following coursework, students typically take qualifying exams to demonstrate their mastery of the subject matter. Successful completion of these exams allows students to advance to the next stage of their doctoral studies.
**(iii) Research Proposal:** Doctoral candidates must develop a research proposal outlining their intended dissertation topic and methodology. Approval of the proposal is usually required before the student can proceed with their research.
**(iv) Dissertation Research:** Most of the doctoral programs are dedicated to original research for the dissertation. Students work closely with an advisor and often form a committee of faculty members to guide and evaluate their progress.
**(v) Dissertation Defence:** The program culminates in a dissertation defence, where the candidates present and defend their research findings before a committee. Successful defence leads to the award of the doctoral degree by the university in US.
**United Kingdom:** UK doctoral programs, often known as PhDs, are more research-focused from the outset.
**(i) Research Focus and training:** Candidates typically begin their research project almost immediately. Some programs may include research training components to develop necessary skills. This can include workshops, seminars, and other activities.
**(ii) Thesis:** The core of the UK doctoral program is the development and completion of an original thesis. The thesis must make a significant contribution to the existing body of knowledge.
**(iii) Viva Voce Examination:** The final assessment involves a viva voce (oral examination) where the candidate defends their thesis before an examination panel.
**Germany:** Similar to the U.S., German doctoral programs may begin with coursework, although this varies by discipline.
**(i) Coursework:** In the Germany, doctoral programs start with a period of coursework to provide students with a solid foundation in their field of study. Courses may cover both general and specialized topics, depending on the program and the student's chosen field. Many programs proceed directly to research.
**(ii) Research and Dissertation:** The primary focus is on original research, and the completion of a dissertation (Doktorarbeit) is the central requirement.
**(iii) Rigorous Examination:** Doctoral candidates typically undergo a rigorous examination (Rigorosum or Disputation) in which they defend their thesis.

**(iv) Publication:** In Germany, there is often an expectation for doctoral candidates to publish their research in academic journals.
**France:** French doctoral programs may begin with a combination of coursework and research.
**(i) Coursework and Research:** French doctoral programs often include a combination of coursework and research. The focus shifts gradually towards independent research.
**(ii) Research Proposal:** Similar to other countries, candidates are usually required to submit a research proposal for approval.
**(iii) Publication:** Like Germany, there is an expectation for candidates to publish part of their research in peer-reviewed journals.
**(iv) Thesis Defence:** The culmination of the program is the defence of the doctoral thesis (thèse de doctorat) before a jury of experts.

**General Observations:**

- The duration of doctoral programs can vary, with U.S. programs typically taking 5-7 years, UK programs 3-4 years, German programs 3-5 years, and French programs around 3 years.
- Funding mechanisms and financial support for doctoral students vary between countries.
- While the basic structure is outlined here, individual programs within each country may have specific requirements and variations.

**Birth of the Global Academy for Doctorates**

The "Global Academy of Doctorates" is an International academic organization of accomplished people having highest university degrees (Ph.D. or equivalent) in all fields of studies. This Academy is dedicated to ***"Empowering Scholars with Boundless Opportunities."*** The Academy is duly registered under the Society Registration Act XXI of 1860 no. 462/2022 on July 20, 2022, in Delhi, India with global authority of operation.
The main idea behind creation of this Global Academy of Doctorates is to offer a worldwide platform to all members to share their experiences and to network as a powerful academic body for social good. The Academy will also recognize its members for their outstanding contributions in various fields by nominating them as Fellows of the Academy. The members will work together to improve the quality of doctoral research and award the best doctoral work. A closer interaction between doctorates, industries and academic institutions which will expand opportunities for employment, collaboration, and consultancy.

To earn a doctorate is a matter of pride. All of You are great achievers. You belong to an exclusive group of academicians holding the highest university degree. One must perform an exciting journey to earn a doctorate. It may be rough, bumpy, dark, endless, lonely but at times thrilling and rewarding. It is felt that the Ph.D. is not merely a degree, but it is a process that equips us with skills to deal gainfully with demanding situations in life.

**(a) Quality Concerns in Doctoral Research**

In India it has been felt that in last few decades there is a sharp decrease in the quality of doctoral research. To attract best minds in research and to augment the quality of Ph. D research work, a Global Network of Doctorates was mounted on LinkedIn platform in 2012 which is joined by about 5900 academicians from 55 countries. In July 2022, the Global Academy of Doctorates has been established with some major objectives viz.

(a) To encourage and propagate high standards in teaching and research,
(b) To motivate meritorious students for undertaking Ph.D. program and take career in academia,
(c) To recognize excellence in research,
(d) To create research database in major disciplines,
(e) To ensure very high standards of Ph.D. Degrees across various disciplines,
(f) To uphold high ethical standards in all public activities and works and private endeavors,
(g) To promote a spirit of understanding and good fellowship among the people,
(h) To advance sustainable development and social progress in the world,
(i) To offer consultancy to educational institutions, government and private organizations and industries,
(j) Any other object which may be added with the approval of the Executive Committee from time to time.

Since 2012, the Academy has been organizing **World Doctorates Day every year on August 25$^{th}$** and an **International Conference on Issues and Challenges in Doctoral Research** (ICICDR) at different venues involving more than 2500 top academicians and 5000 research scholars so far.

***Factors attributed to quality of Doctoral Research***

**(a) Interdisciplinary and Transdisciplinary Collaboration:**
The universities of the future will emphasize breaking down disciplinary silos to foster collaboration across diverse fields. Doctoral research programs will encourage scholars to explore intersections between disciplines, promoting a holistic understanding of complex

issues. It is felt that interdisciplinary and transdisciplinary collaborations in will certainly boost the quality of doctoral research.

**(b) Cross-Institutional Partnerships:** Global challenges require universal solutions. The importance of cross-institutional partnerships in doctoral research, allowing students to access resources, expertise, and perspectives beyond their home institutions. The emergence of virtual research communities and collaborative platforms are crucial necessity for this vision.

**(c) Technology Integration**

Digitally Literate Doctoral researchers in the future will be equipped with advanced digital literacy skills to navigate and leverage emerging technologies. The integration of technology in research methodologies, data analysis, and communication is essential for quality research. Here it is important to explore the role of artificial intelligence and machine learning in shaping the research landscape.

**(d) Virtual Research Environments**

The traditional physical boundaries of research institutions will blur as virtual research environments become integral to doctoral programs. One envisions a future where doctoral researchers can collaborate seamlessly in virtual spaces, accessing shared resources, attending virtual conferences, and engaging in real-time discussions with peers and mentors from around the world.

**(e) Internal and External factors:**

Improving the quality of doctoral research involves a complex interplay of internal and external factors. These factors contribute to creating a conducive environment for rigorous scholarship, fostering innovation, and ensuring that doctoral candidates receive the support and resources needed to excel in their research endeavours.

**Internal Factors:**

**(a) Faculty Expertise and Engagement:**

- **Strength of Supervision:** The expertise, availability, and engagement of faculty members as research supervisors are critical internal factors. A strong mentor relationship enhances the quality of doctoral research.
- **Research Culture:** A positive and collaborative research culture within academic departments promotes knowledge-sharing, peer review, and a vibrant intellectual community.

**(b) Institutional Support:**

- **Infrastructure:** The availability of state-of-the-art facilities, laboratories, libraries, and research centres within the institution contributes significantly to the quality of doctoral research.

- **Financial Support:** Adequate funding, scholarships, and research grants help students focus on their research without the distraction of financial concerns.

**(c) Curriculum and Training:**

- **Research Methodology Courses:** Offering comprehensive courses on research methodologies equips doctoral candidates with the necessary tools to conduct high-quality research.

- **Interdisciplinary Training:** Encouraging interdisciplinary coursework fosters a holistic approach to problem-solving.

**(d) Ethical Standards:**

- **Research Ethics Training:** Ensuring that doctoral candidates are well-versed in research ethics is crucial for maintaining the integrity of their work.

- **Institutional Review Board (IRB):** Having robust IRB processes in place ensures ethical oversight for research involving human subjects.

**(e) Student Selection and Support:**

- **Admissions Process:** A rigorous admissions process helps select candidates with strong academic backgrounds and research potential.

- **Mental Health and Well-being Services:** Providing support services for mental health and well-being creates a healthier and more productive research environment.

**External Factors:**

**(a) Peer Review and Collaboration:**

- **Publication in Reputable Journals:** External validation through publication in reputable journals and conferences enhances the credibility and impact of doctoral research.

- **Collaborative Opportunities:** Encouraging collaboration with researchers and institutions outside the home university broadens perspectives and enriches the research experience.

**(b) Funding Agencies:**

- **Grant Opportunities:** External funding from government agencies, private foundations, and industry sponsors supports research projects, enabling doctoral candidates to pursue ambitious and impactful studies.

- **Competitive Fellowships:** Securing prestigious fellowships and grants recognizes the quality and potential impact of doctoral research.

**(c) Industry Engagement:**

- **Industry Partnerships:** Collaboration with industries provides doctoral candidates with real-world challenges, ensuring the relevance and applicability of their research.

- **Internships and Placements:** Opportunities for internships and industry placements allow students to apply their research skills in practical settings.

**(d) Government Policies:**

- **Research-Friendly Policies:** Supportive government policies, such as research funding initiatives and incentives for academic industry collaboration, can positively impact the quality of doctoral research.

- **Visa and Immigration Policies:** Attracting international talent through favourable visa and immigration policies contributes to a diverse and vibrant research community.

**(e) Global Research Networks:**

- **International Collaboration:** Building and fostering international research networks facilitate knowledge exchange and exposure to diverse research methodologies and perspectives.

- **Conference Participation:** Encouraging doctoral candidates to present their work at international conferences enhances visibility and feedback.

Balancing and optimizing these internal and external factors is crucial for creating an environment where doctoral research can flourish and contribute meaningfully to the academic community and society at large.

***Policy Framework***

Developing a policy framework for high-quality doctoral research involves considering various aspects that contribute to a supportive and conducive environment for scholars. Although, it is not possible to design a single policy framework for quality Doctoral Research across all the disciplines, here, we propose a few important policy parameters that institutions and policymakers can adopt to ensure the excellence and impact of doctoral research:

**(a) Admissions and Selection:**

- Establish transparent and merit-based admissions criteria to ensure the selection of candidates with strong academic backgrounds and research potential. The policy must focus to attract best minds in Academia.
- Implement a rigorous evaluation process that considers not only academic achievements but also research experience, motivation, and potential contributions to the field.

**(b) Faculty and Supervisor Guidelines:**

- Develop guidelines for faculty engagement, emphasizing the importance of active and supportive supervision.
- Encourage mentorship training for faculty members to enhance their ability to guide and mentor doctoral candidates effectively.

**(c) Research Training and Methodology:**

- Integrate comprehensive research training into the doctoral curriculum, including courses on research methodologies, ethics, and interdisciplinary collaboration.
- Provide resources for advanced training in innovative research tools and technologies.

**(d) Interdisciplinary Collaboration:**

- Foster interdisciplinary collaboration by creating joint programs, research centres, and initiatives that encourage doctoral candidates to engage with scholars from diverse fields.
- Develop mechanisms for cross-disciplinary supervision and co-tutelle agreements with other institutions.

**(e) Infrastructure and Resources:**

- Ensure state-of-the-art research infrastructure, laboratories, libraries, and computing resources are available to doctoral candidates.
- Establish mechanisms for access to external databases, research journals, and collaborative platforms.

**(f) Financial Support:**

- Provide competitive and transparent financial support, including scholarships, stipends, and research grants, to alleviate financial burdens on doctoral candidates.
- Establish mechanisms for travel grants to facilitate conference participation and collaboration.

**(g) Publication and Dissemination:**

- Encourage and support doctoral candidates in publishing their research in reputable journals and presenting at national and international conferences.
- Implement policies that promote open access to doctoral theses and publications to maximize the impact of research.

**(h) Ethical Oversight:**

- Implement robust ethical oversight mechanisms, including well-functioning Institutional Review Boards (IRBs), to ensure the highest ethical standards in research involving human subjects.
- Provide mandatory training for doctoral candidates on research ethics.

**(i). Industry and Community Engagement:**

- Establish partnerships with industries and community organizations to facilitate collaborative research projects and address real-world challenges.
- Encourage doctoral candidates to undertake internships or placements in relevant industries to gain practical experience.

**(j) Global Collaboration:**

- Foster international collaboration by promoting joint doctoral programs, exchange programs, and collaborative research projects with institutions around the world.
- Support initiatives that facilitate the mobility of doctoral candidates for research purposes.

**(k) Monitoring and Evaluation:**

- Implement regular monitoring and evaluation processes to assess the progress, quality, and impact of doctoral programs.
- Use feedback from doctoral candidates, faculty, and external stakeholders to continuously improve the program.

**(l) Diversity and Inclusion:**

- Develop policies and programs that promote diversity and inclusion in doctoral programs, ensuring equal opportunities for candidates from diverse backgrounds.
- Implement strategies to address gender imbalances in doctoral research.

**(m) Professional Development:**

- Provide professional development opportunities for doctoral candidates, including workshops, seminars, and training on academic writing, presentation skills, and career development.-‘
- Encourage participation in teaching opportunities to enhance pedagogical skills.

**(n) Health and Well-being:**

- Prioritize the mental health and well-being of doctoral candidates by offering counselling services, stress management programs, and creating a supportive and inclusive academic culture.

**(o). Feedback Mechanisms:**

- Establish feedback mechanisms, including regular surveys and forums, to allow doctoral candidates to provide input on the program and suggest improvements.

Implementing and consistently revisiting such a policy framework can contribute to the creation of an environment that supports high-quality doctoral research, cultivates a culture of excellence, and prepares researchers to make significant contributions to their respective fields.

***Collaborations as Drivers of Innovation and Excellence in Universities of Future***

In the ever-evolving landscape of higher education, collaborations have emerged as essential components for driving innovation, excellence, and relevance. As universities seek to adapt to the changing needs of society and academia, collaborations play a crucial role in shaping the universities of the future. This section explores the transformative potential of collaborations in higher education, highlighting their role in fostering interdisciplinary research, enhancing access to resources, and promoting global engagement. Through examples of successful collaborations, we will demonstrate their impact and potential for driving transformative change.

**(a) Interdisciplinary Research**

Collaborations are key in fostering interdisciplinary research, which is critical for addressing complex societal challenges. For example, the Massachusetts Institute of Technology (MIT) Media Lab brings together researchers from various disciplines to explore innovative solutions to global issues. By facilitating collaborations across disciplines, universities can drive innovation and develop holistic solutions to pressing problems. Another example is the collaboration between the University of California, Berkeley, and the Lawrence Berkeley National Laboratory, which has resulted in groundbreaking research in fields such as energy, climate change, and biosciences. These collaborations highlight the transformative potential of interdisciplinary research in higher education.

**(b) Access to Resources:**

Collaborations provide universities with access to a broader range of resources, including funding, facilities, and expertise. For instance, the Stanford Bio-X program and Bio-design program at Stanford University brings together researchers from biology, medicine, engineering, and other disciplines to collaborate on interdisciplinary research projects. This collaboration also involved scientist from India and has led to significant advances in fields such as bioengineering and biomedical research. Similarly, the collaboration between the University of Oxford and the pharmaceutical industry has resulted in the development of new drugs and treatments for various diseases. By leveraging collaborations with external partners, universities can enhance the quality and impact of their research and educational programs.

**(c) Global Engagement:**

Collaborations with international partners are crucial for fostering global engagement in higher education. For example, the Erasmus+ program in Europe facilitates collaboration between universities across European countries, promoting student and staff mobility, as well as joint research projects. This collaboration has enriched the academic experience of students and faculty, promoting cross-cultural understanding and collaboration.

Another example is the Global University Leaders Forum (GULF), which brings together university leaders from around the world to collaborate on global challenges in higher education. Through these collaborations, universities can prepare students for success in a globalized society.

**(d) Future Directions:**

As universities look towards the future, it is essential to prioritize and cultivate a culture of collaboration. This involves promoting interdisciplinary collaborations, strengthening partnerships with industry and government, and enhancing collaborations on a global scale. By embracing collaborations, universities can drive innovation, enhance research quality, and prepare students for success in a rapidly changing world. Collaborations are fundamental in shaping the future of higher education. Through examples of successful collaborations, we have seen how they can drive transformative change and innovation in universities. By prioritizing interdisciplinary research, enhancing access to resources, and promoting global engagement, universities can shape a future where higher education is innovative, impactful, and inclusive.

***Best Practices and sustainability ecosystem in Doctoral program***

Developing and sustaining a high-quality doctoral program requires a robust ecosystem that nurtures research excellence, promotes interdisciplinary collaboration, and supports the holistic development of doctoral candidates. Here are some best practices and components for building a sustainable ecosystem in a doctoral program:

**(a) Faculty Excellence:** Attract and retain faculty members with strong research profiles, a commitment to mentorship, and a passion for fostering the next generation of scholars. Support ongoing faculty development in research methodologies, mentorship, and pedagogical skills.
**(b) Research Infrastructure:** Access to cutting-edge laboratories, libraries, computing resources, and collaborative spaces must be ensured. Embrace and integrate emerging technologies that enhance research capabilities and methodologies.
**(c) Mentorship:** Develop structured mentorship programs that pair doctoral candidates with experienced faculty mentors who guide them through their academic and research journey.
**(d) Interdisciplinary Collaboration:** Interdisciplinary research by fostering collaborations between departments and research centres must be encouraged.
**(e) Adequate Infrastructure:** The institution must provide adequate research infrastructures for quality research.
**(f) Publication and Dissemination:** Implement open access policies for doctoral theses and research publications to maximize the impact of research. Offer workshops on academic writing, publishing, and effective communication of research findings.
**(g) Industry and Community Engagement:** Foster collaboration with industries through joint research projects, internships, and placement opportunities for doctoral candidates. Engage with local communities and organizations to address real-world challenges and promote the societal impact of research.
**(h) Global Collaboration:** Facilitate international collaboration through exchange programs, joint conferences, and collaborative research initiatives. Establish partnerships with global institutions to create a diverse and interconnected research community.
**(i) Technology Integration:** Embrace virtual research environments and online collaboration tools to facilitate global and remote collaboration. Equip doctoral candidates with digital literacy skills relevant to their research disciplines.

**(j) Work-Life Balance:** Promote a healthy work-life balance through flexible schedules and policies that prioritize well-being.

By incorporating these best practices, institutions can create a sustainable ecosystem that not only supports high-quality doctoral research but also prepares scholars for impactful and diverse careers. Continual evaluation and adaptation are essential to ensure the program remains responsive to the evolving needs of the academic and research community.

***On Ph.D. Scholar and supervisor relations***

The relationship between a Ph.D. scholar (or doctoral candidate) and their supervisor is a crucial aspect of the doctoral journey. This relationship is not just about academic guidance but also involves mentorship, support, and the overall well-being of the student. Here's a detailed exploration of the Ph.D. scholar-supervisor relationship:

**(a) Quality of Good Research Scholars**

- A research scholar largely contributes to his/her Ph.D. work; hence the quality of research depends on various quality attributes of the scholar.
- Have sound knowledge of his subject and shall reflect with inquisitive mind.
- should be intelligent, methodical, and hard working.
- should have a strong aptitude for research.
- Should possess maturity, analytical ability, and a flair for innovation.
- Should exhibit scholarship, patience, honesty (no plagiarism) and integrity towards his work and profession.

**(b) Quality of Good Research Supervisor**

- A good research supervisor must transition to ‘subject index’ from ‘authors index’ for his/her excellent work.
- Must possess scholarship abilities.
- Should be free from bias and prejudices.
- Should be self-motivated and accepted as an authority in his chosen field.
- Should have a tendency to give his best and in plenty.
- shall maintain optimum interaction with his students and supervise their work with keen interest.

**(c) Establishing Expectations**

Early meetings are crucial for setting expectations. The supervisor should clearly outline academic requirements, communication preferences, and general expectations for research progress.

**Mutual Understanding:** Both the scholar and the supervisor should discuss and agree upon the goals, timelines, and milestones for the Ph.D. project.

**Research Planning:** Supervisors assist scholars in developing a clear and feasible research plan. This includes defining research questions, methodologies, and potential challenges.

**Literature Review:** Supervisors guide scholars in conducting a comprehensive literature review, helping them understand the existing knowledge in their field.

**(d) Research Support**

**Access to Resources:** Supervisors should facilitate access to necessary resources, such as laboratories, libraries, and collaborative networks.

**Research Funding:** Support in securing research funding, grants, and scholarships enhances the scholar's ability to conduct high-quality research.

**(e) Feedback and Evaluation**

**Regular Meetings:** Regular, scheduled meetings allow for progress updates and discussions on challenges. These meetings serve as a platform for the supervisor to provide constructive feedback.

**Timely Responses:** A responsive supervisor contributes to the scholar's confidence and progress. Timely feedback on drafts, proposals, and research findings is crucial.

**(f) Mentorship and Professional Development**

**Career Guidance:** Supervisors mentor scholars on potential career paths, networking opportunities, and professional development.

**Skill Development:** Encouraging scholars to attend conferences, present research, and engage in collaborative projects enhances their skills and visibility.

**Work-Life Balance:** Recognizing the stress and challenges of doctoral research, supervisors should encourage a healthy work-life balance.

**Stress Management:** Providing emotional support during challenging periods fosters a positive and resilient scholar.

**(g) Ethical Considerations**

**Research Ethics:** Supervisors guide scholars on ethical considerations in research, emphasizing the importance of integrity, honesty, and adherence to ethical guidelines.

**Publication Ethics:** Supervisors educate scholars about responsible authorship, publication practices, and avoiding plagiarism.

**Networking Opportunities:** Supervisors facilitate scholars' participation in academic conferences, workshops, and collaborative projects to expand their professional network.

**Interdisciplinary Collaboration:** Encouraging collaboration with researchers from other disciplines broadens the scholar's perspectives.

**Open Communication:** Establishing open lines of communication is essential. Both parties should feel comfortable discussing concerns or conflicts openly and constructively.

**Conflict Resolution Strategies:** Supervisors should be equipped with conflict resolution strategies to address any issues that may arise during the research process.

**(h) Completion and Transition**

**Thesis Completion:** Supervisors guide scholars through the final stages of thesis writing, editing, and preparing for the defence.

**Transition to Post-Ph.D.:** Support does not end with graduation. Supervisors can assist scholars in transitioning to post-Ph.D. endeavours, whether in academia, industry, or other sectors.

**Alumni Relations:** Maintaining a connection after graduation fosters a long-term professional relationship. Alumni may continue to seek advice and collaboration from their former supervisors.

**(i) Inclusive and Diverse Mentoring**

**Inclusivity:** Supervisors should be mindful of creating an inclusive and diverse research environment, welcoming scholars from different backgrounds and perspectives.

**Cultural Competency:** Understanding and respecting cultural differences contributes to effective mentorship in a diverse academic community.

**Feedback from Scholars:** Supervisors should actively seek feedback from scholars about the mentoring process, adapting their approach based on the needs and preferences of each individual.

**Professional Development for Supervisors:** Just as scholars continue to develop, supervisors should engage in ongoing professional development to stay informed about evolving best practices in mentorship and research.

A healthy and productive Ph.D. scholar-supervisor relationship is built on mutual respect, effective communication, and a shared commitment to academic and professional growth. It's a dynamic partnership that evolves throughout the doctoral journey and beyond.

***Factors Responsible for Quality in Doctoral Research***

**(a) Role of Competence for quality in doctoral research**

The role of competence is paramount in ensuring the quality of doctoral research. Competence in this context refers to the possession of the necessary knowledge, skills, and abilities required to conduct rigorous and meaningful research at the doctoral level. A competent researcher is one who is well-versed in the subject matter, possesses methodological expertise, and demonstrates critical thinking and analytical skills. Here are several key aspects highlighting the role of competence in ensuring the quality of doctoral research.

**(b) Role of Passion for quality in doctoral research**

The role of passion and flair for research is indispensable when it comes to ensuring the quality of doctoral research. While competence provides the foundation for sound methodology and academic rigor, passion and flair inject enthusiasm, dedication, and a genuine love for the subject matter into the research process. Here are several key aspects highlighting the role of passion and flair for research in achieving high-quality doctoral research.

**(c) The importance of rigor for quality in doctoral research**

The importance of rigor in doctoral research cannot be overstated, as it serves as the bedrock for ensuring the quality, reliability, and credibility of the research study. Rigor encompasses a commitment to meticulousness, precision, and methodological soundness throughout the research process. Here are key reasons why rigor is crucial for maintaining high quality in doctoral research

**(d) On the importance of originality in maintaining of quality in doctoral research**

Originality is a critical factor in maintaining the quality and significance of the research endeavours. Originality refers to the novelty and uniqueness of the research contribution, demonstrating that the study adds new insights, perspectives, or knowledge to the existing body of literature. Here are key reasons why originality is crucial for the quality of doctoral research.

**(e) How Challenging status quo may contribute to the quality of doctoral research?**

Challenging the status quo is a powerful and transformative approach that can significantly contribute to the quality of doctoral research. The status quo represents the existing state of affairs, conventional wisdom, and established practices within a particular field of study. By challenging these norms, doctoral researchers can bring about innovation, foster critical thinking, and enhance the overall quality of their research in several ways.

**(f) Role of innovation in improving the quality of Doctoral Research**

Innovation plays a crucial role in improving the quality of doctoral research by fostering creativity, addressing research gaps, and contributing to the advancement of knowledge.

**(g) How the relevance of the topic is important for improving quality of Doctoral Research?**

The relevance of the topic is a critical factor in improving the quality of doctoral research. The significance and practical applicability of the research topic contribute to the overall impact and value of the study.

**(h) How the factor novelty plays a role in improving quality of the Doctoral Research?**

Novelty is a crucial factor in improving the quality of doctoral research, as it signifies originality, uniqueness, and the introduction of new knowledge to the academic community. The presence of novelty in research contributes to the advancement of a field, enriches scholarly discourse, and enhances the overall quality of the doctoral study.

**(i) The importance of ethics and human values in maintaining quality of Doctoral Research.**

As we delve into the realm of doctoral research, it becomes imperative to emphasize the profound importance of ethics and human values in upholding the quality and integrity of scholarly endeavours. The pursuit of knowledge is not only a noble endeavour but also one that demands a commitment to ethical conduct and a solid foundation in human values.

The backbone of any doctoral research lies in its integrity. Adhering to ethical principles ensures that the research process is transparent, honest, and reliable. Maintaining the highest standards of integrity contributes to the credibility of the research outcomes, fostering trust among peers, mentors, and the wider academic community. For research involving human subjects, ethical considerations are paramount. Respecting the dignity, rights, and well-being of participants is not only a moral obligation but also a legal and professional responsibility. Upholding ethical standards in participant recruitment, informed consent, and data collection is fundamental to the quality and validity of the research.

Ethics and human values are intertwined with academic rigor. Rigorous research design and methodologies, coupled with ethical considerations, enhance the robustness of the study. Adhering to ethical guidelines promotes thoroughness in data collection, analysis, and interpretation, contributing to the overall quality of the research.

***Universities of Future***

Universities serve as hubs for knowledge creation, dissemination, and for developing a culture of critical thinking. Through research, education, and innovation, they can drive positive change in various aspects of society. The universities of the future are expected to be dynamic, responsive, and adaptable to the evolving needs of learners and society. They will likely play a crucial role in addressing global challenges, fostering innovation, and preparing individuals for a rapidly changing world. These transformations are already underway in many institutions, driven by a combination of technological advancements, societal changes, and a growing awareness of the need for more inclusive and sustainable education models.


***Figure 1:*** *Factors responsible for Quality in Doctoral Research*

Universities are often considered as "Engines of Societal Transformation." This is a two - way process where we search for evidence whether education impacts the changes in the world, or the global changes are driving the transformations in education sector.

The new world is getting ready for Artificial Intelligence dominating all sectors of work including Education. The future Universities are now seen as virtual entities away from the age-old brick and mortar structures. The programmes are moving towards online platforms where students are getting the benefits of lifelong learning anytime, anywhere. Likewise, the nature of work, role of teachers, type of research and innovation, social outreach and mobility are undergoing tremendous changes. The future world is not just AI driven but also more concerned about the changing ecosystems and saving the planet. The increased awareness towards sustainability also bringing much desired changes in the University systems. A University for the future will be focusing more on giving back to the society at large.

Universities have the potential to act as catalysts for positive societal change by shaping the minds of future leaders, professionals, and citizens. Their role in promoting sustainability through educational programs is instrumental in addressing the complex challenges facing the world today and in the future. Many universities are now adopting frameworks such as the United Nations Principles for Responsible Management Education (PRME) or other sustainability assessment tools to guide and measure their contributions to the SDGs.

***The future of doctoral programmes***

The doctoral degree programmes are at the epitome of formal knowledge in university set up. These programmes are also aiming for a complete overhaul to sync with changing Universities and the world.

Envisioning a doctoral degree program in 2050 involves speculation and creative thinking, considering potential future trends and advancements. Here is a speculative vision for doctoral programs in 2050.

**(a) Holistic Development:** Doctoral programs may place a strong emphasis on the holistic development of students, focusing not only on academic excellence but also on mental health, emotional intelligence, and interpersonal skills. Programs could integrate well-being practices into the curriculum to support the overall health of researchers.
**(b) Global Collaboration Platforms:** Doctoral candidates might engage in global collaborative research through advanced virtual reality platforms. These platforms could facilitate real-time collaboration, enabling students from different parts of the world to work together seamlessly.
**(c) Augmented Intelligence in Research:** Doctoral candidates may work alongside advanced artificial intelligence systems that assist in data analysis, hypothesis generation, and simulations. Human-AI collaboration could redefine the research process.
**(d) AI-Enhanced Research Advisors:** Doctoral students may work closely with AI-enhanced research advisors that provide personalized guidance, offer literature reviews, and assist in project management. These AI systems could help streamline the research process and enhance productivity.
**(e) Personalized Learning Pathways:** Each doctoral candidate might have a personalized learning pathway, tailored to their unique skills, interests, and career goals. Adaptive learning technologies could continuously assess individual progress and adjust the curriculum accordingly.
**(f) Transdisciplinary Research Hubs**: Traditional disciplinary boundaries may disappear, and transdisciplinary research hubs could become commonplace. These hubs

may bring together experts from various fields to collaboratively tackle complex problems that require multifaceted solutions.
**(g) Interdisciplinary Core Curriculum**: Doctoral programs may feature a strong interdisciplinary core curriculum, encouraging students to draw from multiple fields in their research. The ability to navigate and integrate knowledge from various disciplines could be a key competency.
**(h) Experiential Learning in Virtual and Augmented Reality:** Virtual and augmented reality technologies could provide immersive, hands-on learning experiences. Doctoral candidates might conduct experiments, simulations, and fieldwork in virtual environments, enhancing their practical skills.
**(i) Ethics and Responsible Research Integration:** A strong focus on ethics and responsible research conduct could be embedded in every aspect of doctoral education. Students might undergo extensive training in ethical considerations, ensuring the responsible use of emerging technologies and methodologies.
**(j) Dynamic Funding Models:** Funding for doctoral programs may evolve, with dynamic models that allow for increased collaboration between academia, industry, and government. Students might have opportunities to engage in real-world projects and receive financial support from a variety of sources.
**(k) Continuous Peer Review and Feedback:** Doctoral research could undergo continuous peer review through advanced online platforms. This iterative feedback process could accelerate the pace of research and ensure high-quality outputs.
Sustainable Research Practices: Sustainability may be a key consideration in doctoral research. Given the increasing importance of sustainability, doctoral programs may have a strong focus on research that contributes to environmental, social, and economic sustainability. Programs might prioritize projects that address global challenges such as climate change, resource depletion, and social inequality.
**(l) Life-Long Learning Support:** Doctoral programs might provide ongoing support for life-long learning, helping graduates adapt to evolving career landscapes. Alumni networks and professional development opportunities could be integral components of the doctoral experience.
**(m) Community Engagement and Impact Measurement:** Doctoral candidates may be encouraged to actively engage with communities, ensuring that research has a positive impact on society. Programs could incorporate mechanisms to measure and communicate the societal impact of research projects.

The actual evolution of doctoral programs will depend on a complex interplay of societal, technological, economic, and educational factors. The future of doctoral education will be shaped by a combination of innovation, adaptability, and a commitment to addressing global challenges.

## Concluding Remarks

To summarise, the article demonstrates the evolving landscape of higher education, emphasizing the role of collaborations in driving innovation, excellence, and relevance in universities. Interdisciplinary Research plays a crucial role in research collaborations. Collaborations across disciplines foster innovation, with examples like MIT Media Lab and partnerships between universities and national labs. Collaborative efforts provide access to diverse resources, amplifying research impact, as seen in Stanford University's Bio-X program. Programs like Erasmus+ and GULF facilitate international collaborations, enriching academic experiences and global perspectives. The article also emphasizes on the best practices for sustaining high-quality doctoral programs, emphasizing faculty excellence, robust infrastructure, mentorship, and global collaboration. It highlights the crucial role of the Ph.D. scholar-supervisor relationship, focusing on establishing expectations, research support, feedback, mentorship, and ethical considerations.

The key factors contributing to quality research, include competence, passion, rigor, originality, and ethics. It underlines the significance of challenging the status quo, innovation, relevance, novelty, and ethical conduct in maintaining research quality. The future universities are envisioned as dynamic, adaptive, and AI-driven entities focusing on lifelong learning, sustainability, global collaboration, and societal impact. The article also speculates on the future of doctoral programs in 2050, envisioning holistic development, global collaboration, AI-enhanced research, personalized learning, interdisciplinary hubs, ethics integration, and sustainable practices. Overall, the article underscores the transformative potential of collaborations, outlines best practices for sustaining doctoral programs, emphasizes key factors ensuring quality research, and envisions the future of universities and doctoral education. It advocates for a collaborative, innovative, and globally engaged approach to higher education.

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# 10
# SCIENCE EDUCATION AND SCIENTIFIC RESEARCH FOR VIKSIT BHARAT@2047

**Prof. P B Sharma**

*The transformation of India into a developed nation, or Viksit Bharat, is underway, driven by impressive economic growth and robust infrastructure development. This vision is bolstered by advancements in physical infrastructure, urbanization, semiconductor technology, defense, manufacturing, and green energy, all contributing to a surging economy. A pivotal element in this transformation is the enhancement of science and technology education and research. With a significant number of students enrolled in science disciplines across numerous universities, particularly in government-funded institutions, there's a critical need for increased investment in these areas to empower the youth. The expansion of prestigious institutions like IITs and AIIMS underscores the government's commitment to high-quality technical and medical education. Aligning scientific research with national development goals, especially in high-tech areas and renewable energy, is imperative. Redefining the purpose of science education to focus on societal benefits, human development, and sustainability is essential for economic prosperity. This article explores the integration of scientific research with sustainable development, the role of innovative technologies, and the importance of regulatory frameworks and green incentives. The aim is to foster a green economy, enhance employment opportunities, and ensure inclusive growth, positioning India as a global leader in scientific and technological innovation by 2047.*

**Keywords:** *Innovation, Research, Technology, Science, Education, Development, Sustainability, Viksit Bharat*

## Introduction

The making of a new India, the Viksit Bharat of our dream is no longer debatable. The impressive growth of the Indian economy and the rate at which the infrastructure push is being provided for the Viksit Bharat all goes to demonstrate a steely resolve of the Government of India to create robust contours of economic growth for the nation's economy in the coming years. Along with the physical infrastructure of expressways, bridges, and high-tech buildings and the increasing thrust on the urbanization of Indian habitat alongside a major push to semiconductor technology, defense science and defense technology, world class manufacturing and green energy technologies is going to cause massive surge to the already booming Indian economy. Surely science and technology education and research shall play a highly important role in deciding the futuristic trends of development and shall have a profound impact on the contours of development of the economy.

***Impressive Growth of Science Education and Research***

It is worth recalling that of the 43.3 million students currently enrolled in over 1043 universities and 50,000 plus colleges in India, an estimated 5.72 million students were enrolled in 2021-22, at UG, PG, and PhD levels in Science Stream, with female students (2.98 million ) outnumbering male students (2.74 million). Government-funded Universities constituting 58.6% of the total Universities in India, contribute 73.7% of total enrolment while Private Universities account for 26.3%. As such a much greater investment in science education and scaling up the quality and quantum of scientific research in government Universities would be required in the coming years to empower the talented youth of India who look towards cost-effective quality science education and scientific research in public funded universities, that include the central and the state universities and also the institutions of national importance such as the IITs, IIITs and IISERs.

It is also heartening to note that there has been a significant growth of the IITs, from 7 in 2014 to 23 in 2024 and likewise from 7 AIIMS for medical education and research in 2013 to 23 AIIMS, a phenomenal growth in public sector during the last ten years. This gives clear signals of the government firm resolve to spend more on world class technical education and scientific research for which the IITs have a proven track record of accomplishments.

Likewise, world class medical education and research in AIIMs shall continue to empower India in the field of medicines and healthcare.

***Aligning scientific research to National Development Goals a Must***

It would, however, be imperative for the IITs and other leading universities in public and private sectors to align their scientific research to national goals and also to address the global challenges. We are in great times as the Aatmanirbhar Bharat is providing positive impetus for great advancements in hi-tech areas like Semiconductor technologies, defense technologies, and also new and renewable energy technologies besides AI applications in abundance in manufacturing as well as service sectors.

Investment in science education and scientific research in research-intensive institutions like the IITs need to be carefully planned to address the immediate and future challenges facing a nation like India that aspires to leapfrog, even pole vault in its developmental goals and achieve great economic growth along with ensuring it's a commitment to environmental sustainability.

***Redefine Meaning and Purpose of Science Education and Scientific Research***

The time is right for redefining the meaning and purpose of science education and research. We need to ask what science for society and science for national development means in the age of rapidly rising concerns for human development environmental health and economic prosperity. In this context it would also be important to realise that like technology science has its all pervading influence on the quality of life as well as wellbeing of people and of course, on the environmental health that decides the future of the planet.

***Accelerated Economics Prosperity demands Compliance to SDGs***

The new age of technology-intensive and innovation-driven industry and service sectors demand science education and research for achieving great goals of economic prosperity without sacrificing the interest of man and that of Mother Nature. It would therefore be absolutely necessary to delink science from mere career aspirations or for that reason, achieving scientific breakthroughs for increased productivity and increased production to a caring pursuit and an inbuilt concern for the quality of life of the people and reduced dependence on fresh natural resources for production systems to save the enormous exploitation of limited natural resources that the planet has for human consumption. This calls for creating a legitimate place in science education and scientific research for sustainability and sustainability sciences and technology innovations supportive of sustainable development.

***Productive Engagement of Youth Must for fostering Increased Opportunities of Employment***

As we move deeper into the 21$^{st}$ Century on the strength of increased automation and smart and intelligent manufacturing the service applications, it would be important to keep the productive engagement of people in mind to ensure that the intuitive and creative capabilities of people, in abundance in populous countries like India are given a focused attention by the policy planners and those responsible to charting the contours of economic growth for a nation of 1.45 billion plus people the India.

The opportunity in this respect for creating productive employment is truly great, given the creative and innovative potential of young India. As we prepare to move mountains to take the near 4 trillion dollars GDP of India in 2024 to over 30 trillion dollars economy of Viksit Bharat @2047, the opportunity to harness the scientific creative and innovative talent of young India is truly great and must not be undermined now that the 21st Century is being increasingly identified as India's century!

***Pursuit of Pathbreaking Scientific Research be mandated in IITs and Other reputed universities in India***

The scientific research in the new era of mind boggling technology innovations demand a sustained investment in path breaking scientific research and for creating interdisciplinary research clusters and international research coharts that would enable Indian scientists to devote their efforts for achieving major breakthroughs in areas that matter most for economic prosperity, environmental health, and inclusive growth of the nation together. It is a complex challenge, but it's not impossible. Here's how these goals can work together:

- Innovation for a Green Economy
- Transition to Clean Technology

Investing in research and development of renewable energy sources, energy efficiency solutions, and sustainable materials can create new industries and new green jobs, while reducing environmental impact. Whole lot new rural enterprises based on pathbreaking green energy research in areas like solar energy harvesting, green hydrogen and low wind speed turbine based wind energy farms. But here also our scientists need to develop pathbreaking science that shall enable a solar plant to operate at 98% efficiency as against 16-18% as at present. Likewise, producing liquid hydrogen at room temperature as against the current technologies for liquid hydrogen at -254 degrees Celsius! The time to engage scientists in India in such miraculous and future sciences is now and India, the Bharat can not afford to miss the opportunity now that we have taken a resolve for Viksit Bharat @2047. The National Research Foundation of Bharat should take such calls for supporting pathbreaking research now that Bharat is called upon to take leadership role in scientific research and technology innovations.

### *Making Circular Economy a big Business*

Transitioning to a circular economy where materials are reused and recycled minimizes waste and resource depletion, fostering long-term economic stability. But to make a big business sense for the circular economy, we need major breakthroughs in design and development of new smart and intelligent materials, new age systems of design and manufacturing are needed that shall make a big sense of 'design for life' like humans and natural plants are designed through 'molecular manufacturing'. It is then biodegradation shall become a rule for one and all and circular economy through recycle, reuse and remanufacturing shall become a revolution.

### *New Regulations and Incentives*

Environmental Regulations: Setting clear regulations on pollution and resource use encourages businesses to adopt cleaner practices, leading to a healthier environment and potentially lower long-term healthcare costs. In India we need to revisit our Water Act of 1974, Air Act of 1981, last amended in 1987, and Hazardous Waste Act of 1986. We also need a new and effective e-waste Act for India to prepare India to take on the monumental challenge of e-waste management. All these acts are to be redrafted in line with the current and future requirements of regulating air and water quality for a happy and healthy habitat for a populous nation like Bharat.

### *Green Incentives*

Providing tax breaks or subsidies for businesses that develop or use eco-friendly technologies can accelerate their adoption and make them more competitive. We need to now on realise that investment in green incentives is for securing a green future and thus incentives to usher a new Green Revolution 4.0, this time beyond agriculture shall prepare Bharat to move forward along the Green Highways of sustainable development.

### *Empowering People*

Education and Training: Investing in education and training programs focused on clean technologies and sustainable practices equips the workforce for the green economy and fosters innovation. Together, green technologies, green insentives and people propell Green businesses and create green and bright future for the people and the planet.

***Social Safety Nets***

Providing social safety nets like unemployment benefits or training programs during the transition to a green economy can ease the burden on workers and ensure inclusive growth.

***Some Examples of Successful Projects***

Many countries in Europe have successfully grown their economies on green highways of growth by reducing emissions through policies, incentives and innovations. California's cap-and-trade program has shown how environmental regulations can incentivize clean technologies and economic growth. The European Union has decided to ban production of petrol and diesel cars from 2035. Singapore had demonstrated great capabilities of wastewater treatment. Here in Bharat too the phenomenal success of Swachh Bharat 2.0 in city waste management in the most efficient way has demonstrated that Swachh Bharat mission has created a great people's movement. Further, the wastewater treatment plants at Kanpur and at Varanasi in UP under Namami Gange have demonstrated great capabilities of water technologies for cleaning our rivers and water bodies. These success stories need to be multiplied nationwide and with the pathbreaking scientific solutions, now that nanoscience and technology are opening up new horizons for clean water, clean air and clean energy technologies.

***Challenges Remain***

Although there always exists numerous challenges to have the path as desired

***Balancing Costs and Benefits***

Transitioning to a sustainable economy requires upfront investment, and striking a balance between environmental protection and economic competitiveness. Pathbreaking scientific research and mind-boggling technology innovations can make it possible. Global Cooperation: Effective solutions require international collaboration, as environmental challenges like climate change are global in scope. Coharts of scientists cutting across national boundaries need to be facilitated by policies and collaborative programs and these need to be supported to achieve big global goals of growth with sustainability.

Overall, achieving all three goals requires a major shift in mindset and a firm commitment and resolve to move along the strategic plans drawn by innovative and enterprising minds and patronized by top leadership. By focusing on innovation, smart regulations, and empowering people, we can build a future where economic prosperity and environmental health go hand-in-hand, and everyone benefits from the rapidly growing economy, that India, the Bharat currently is. Investment in science education and scientific research for the nation's development would necessitate much higher priorities now on as India prepares to leap from to Viksit Bharat @2047.

***Conclusion***

India's journey towards becoming a Viksit Bharat by 2047 is marked by a strategic focus on economic growth, infrastructure development, and advancements in science and technology. The government's commitment to expanding and enhancing educational institutions and research capabilities is crucial for achieving these goals. Aligning scientific research with national and global challenges, particularly in areas like renewable energy, defense, and manufacturing, will drive innovation and sustainable development. Redefining the purpose of science education to emphasize societal benefits and environmental sustainability is essential for creating a balanced approach to economic prosperity. Investment in green technologies, regulatory reforms, and incentives will pave the way for a green economy, fostering long-term stability and growth. The successful integration of scientific research, innovative technologies, and sustainable practices will not only propel India's economic growth but also ensure environmental health and inclusive development, making the vision of Viksit Bharat a reality.

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# 11
# ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, AND CUSTOMIZED CARDIAC CARE: NEW FRONTIERS IN THE FIELD

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*It has been a long-sought dream to have an error-free, cost-effective, and less time-consuming, and efficient healthcare system; with the help of artificial intelligence, machine learning, and developing allied methodologies, the realization of dreams is not far off. Expanding computer memories, and near-human-like cognitive abilities have given ideal opportunities in this regard. AI helps in strengthening health research, and drug development, as well as proposes public health interventions, such as disease surveillance, and outbreak response. There is now a global drive to maintain a computer-based database for every patient and it has allowed the collection of large, heterogeneous electronic datasets (EMR/EHR) and imaging from patients with cardiovascular disease (CVD), and it has modified the prospects of diagnostic, therapeutic, and rehabilitation cardiac medicine. AI-based techniques provide the integration of a large set of information to make a hypothesis that can be converted into a best-suited personalized plan for the individual patient. Common cardiovascular data sources from patients include genomic data, cardiovascular imaging, adoptive micro-sensors, and electronic health records (EHR). Therefore, modern cardiac medicine may have an accurate image interpretation and possible diagnosis for clinicians, improved workflow an error-free, efficient healthcare system for all, and the medical language enabled to match patient's understanding of medical terminologies and readable prescriptions. This article deals with a birds-eye view of this interesting topic and addresses the developing concepts related to AI-assisted cardiac care systems, future pros and cons of these technical advances.*

***Keywords:*** *Cardiac care, Artificial intelligence (AI), Precision medicine, ,machine learning (ML), deep learning (DL), cardiovascular imaging (CI) Artificial intelligence, machine learning, and customized cardiac care: New frontiers in the field.*

## Introduction

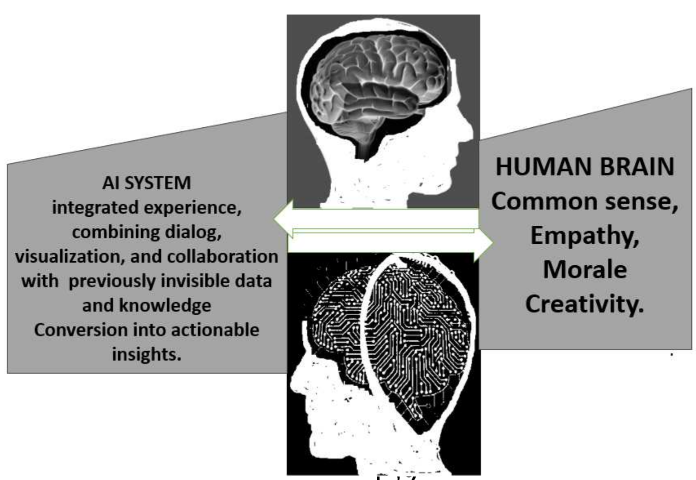
### Spectrum of cardiac disorders

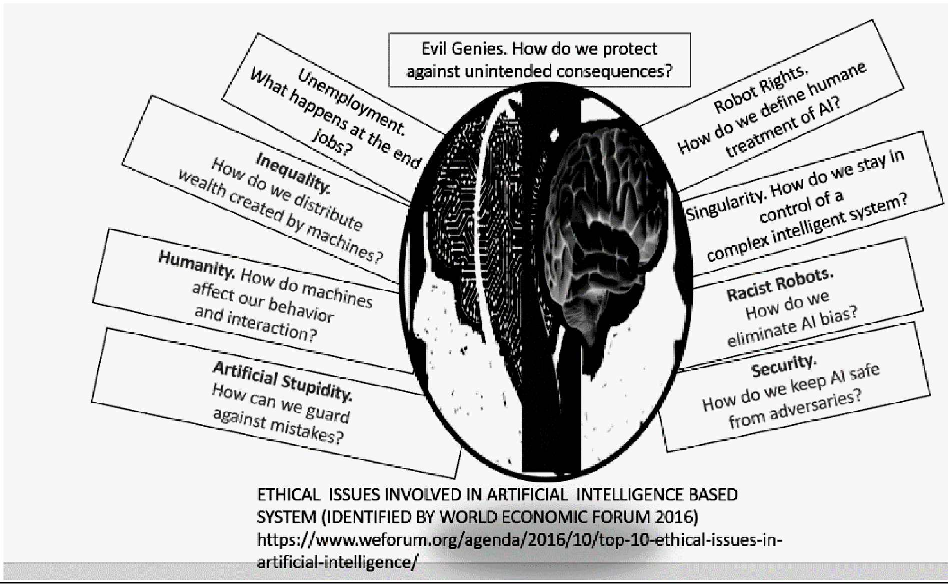
Changing patterns of lifestyle, dietary habits, and environmental factors have seriously affected the health of modern mankind and cardiovascular disease (CVD) remains a major cause of health expenditure as well as premature mortality, as has been highlighted by the global burden of diseases studies. Post-pandemic increase in coronary events and stroke has been documented. Recent histopathological data have proved that the COVID-19 pandemic has also led to sustained inflammatory changes in coronary arteries.

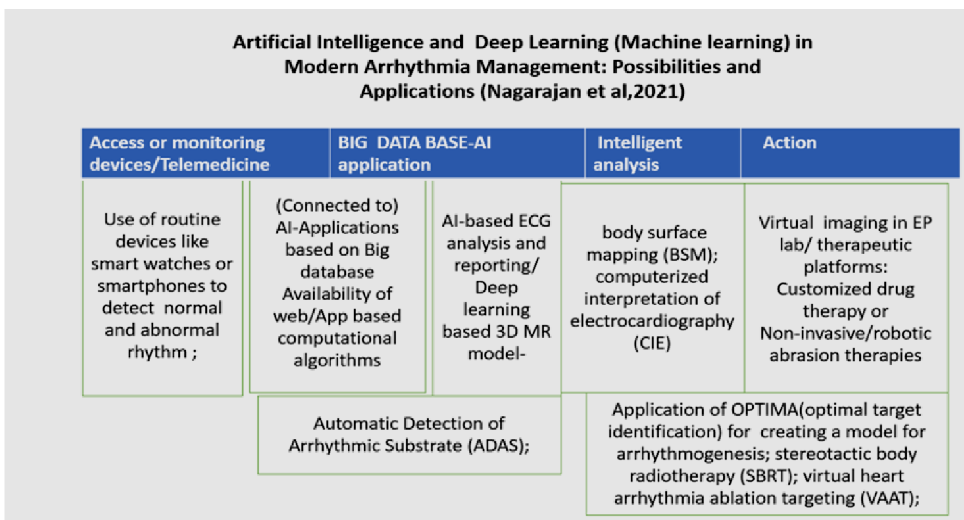
> *"Like all new technology, artificial intelligence holds enormous potential for improving the health of millions of people around the world, but like all technology it can also be misused and cause harm,"* - ***Dr Tedros Adhanom (WHO)***

Besides, Kawasaki disease and a few autoimmune arteriopathies, familial lipid disorders are the additional causes in children and young adults. The bicuspid aortic valve which one of the commonest congenital numerical anomaly affecting approximately 2% of the general population has the potential to cause valvular malfunction aortic aneurysm, dissection, perforation and coarctation of the aorta.

Congenital heart disease, valvular heart diseases, cardiomyopathies, rhythm disorders, and cardiac tumors are other serious diseases. The heart may also be affected due to multiple diseases like inflammatory disorders, cancer metastasis or secondary to cancer therapy with drugs or radiation. Many of these diseases have an underlying genetic predisposition and need family screening at an early age. So-called lifestyle diseases like metabolic syndrome have also been attributed to diverse fetal factors.






***Scope of Cardiac care in modern world***

The scope of cardiac Care in the Modern era contains multi-faceted, multilayered etiopathology and interventions. Furthermore, it has been found in studies that medical errors do happen inevitably due to various reasons like inexperience, lack of knowledge towards evolving new hypotheses of diseases, communication gaps, cognitive biases, long hours of work, duality of thoughts, etc. among the doctors and nurses. Additionally, lack of community awareness, resistance to opt for treatment, high cost, and inertia to undergo routine screening test also contributes.

Needless to say, delayed diagnosis usually leads to no or very small window period to act and henceforth death ensues which would have otherwise been preventable.

The interventions, on the other hand, can be stratified as prophylactic or preventive when risks for the cardiac events can be pre-empted and acted upon, or therapeutic when a disease process is recognized and a management plan can be spelled as medical, Catheter-based or surgical interventions.

From the aforesaid discussion, it can be derived that we have a system in place that needs to be modernized in a way so that diagnostic procedures can be more efficient and may dodge medical errors, and can provide a substantially large window of opportunity so the optimized care can be provided at an affordable cost. While the interventions can be less needed or may become less invasive.

This is well established that medicine with the current collection of facts and data, is a large canvas with a gigantic number of dots that need to be connected to have a hypothetical portrait etched in the minds of the service providers, for ultimate appropriate action.

***Influencers of value-based cardiac care system (IVCCS)***

The explosion of scientific research and the rising capacity for quick adoption of these research-based solutions into the health sector has benefitted the population on one hand, while on the other, it has created a massive financial burden for countries and individuals. Like in any business model, the realization of any concept in the form of positive results of the research would need a series of variable tools like financial and logistical support for implementation, creation of mass production units, public awareness campaigns, marketing, etc. it would also need the recruitment of hospitals as well as medical personnel.

There are four components of an advanced IVCCS:

(a) Finding the cost-effective and efficient tools for timely detection (diagnosis) of onset of disease;
(b) Finding or developing suitable tools for therapeutic (drugs/cath/surgery) intervention based on available data;

(c) post-intervention care (rehabilitation), which includes patient education, so a patient can live up to his or her maximum potential and can be attended to timely in case of cardiac events.
(d) risk stratification of the population through, questionnaire-based inquiry and screening of high risk through a cost-effective screening tool.

These components need an individualistic value-based cost-effective business model as discussed above, based on available data. They need to undergo cost evaluation from conception to application. We will be examining the role of technology in achieving these components in the subsequent sections of the article.

**Artificial Intelligence-Modern tools to handle health and cater to cardiac care: Conceptualization and evolution of AI**

Eventually, human Cognitive abilities are responsible for comprehending this vast scenario through a group of mental processes that would sort it out in a meaningful way and troubleshoot the problems by providing an appropriate customized response. The imagination of human-like intelligence outside the human body was deep-rooted in ancient philosophical and mythological literature. In the early 20$^{th}$ century, the so-called golden era of fiction, the concept of outsourced human intelligence and abilities was often thought over. Famous literary characters like the heartless Tin Man (Wizard of Oz) or humanoid robot (Maria in Metropolis) are such examples. The idea of artificial intelligence may have started as a figment of artistic imagination but it also found a solid foothold in the minds of philosophers, mathematicians, and scientists. Alan Turing introduced the concept of a machine that could achieve human-level performance in thinking in 1950;

Artificial intelligence (AI) is a term that describes the use of computers to imitate intelligence and critical thinking comparable to humans, and it was first mentioned by John McCarthy during a conference held in 1956. From 1957 to 1974, AI flourished because computers were able to store more information and became faster, cheaper, and more accessible. This fact needs to be appreciated that artificial intelligence is a mechanism where computers may utilize mathematical data to learn (machine learning) or adopt the aforementioned specialized functions of the human brain and may develop a capacity to effectively understand a problem and generate a solution (problem-solving capacity) for it without any direct instruction. While doing so through AI, it is expected not only to improve operational efficiency and faster decision-making in every field of routine life but also to bring down the cost of the whole procedure. Machine learning (ML) is a compliant mechanism for AI that actually makes a computer comprehensively intelligent. In a nutshell, AI has the all-encompassing aptitude through mathematical algorithms to train machines (i.e. Computers) to mimic human intelligence. In the United States of America, it was observed that despite the high health expenditure of over $3 trillion, diagnostic dilemmas and medical errors were pervasive. Therefore, constant effort was made to find an algorithm-based solution to mitigate human errors and also bring down the cost, and create a unified system, across the country.

Conversely, multiple algorithms were used in the 70s and 80s, to generate a diagnosis based on a computer-based analysis. In 1972, a MYCIN expert system was developed by Stanford University in California to diagnose blood infections. MYCIN used about 500 production rules, and roughly revealed similar competence as human specialists in diagnosing blood infections and performed better than general physicians. In the 1980s' another system called ITERNIST-1 and QRM program were used with good results. ITERNIST-1 used data from a computerized knowledge base of 570 diseases in internal medicine and the QMR program had the ability to assist users with generating hypotheses in complex patient cases. RX project was worked upon by Blum et al in the 1980s. It was an early example of data mining or exploratory data analysis using AI control. RX's Study Module provided RX Knowledge Base that was used to attempt control for known remote confounding variables, under the mathematical models consisting of acyclic graphs and multiple regression.

The neural network model was another crucial evolution in the field of medicine in the 1990s. MIMIC-III ('Medical Information Mart for Intensive Care') was a large, database from a critical care unit, of a large tertiary care hospital. It comprised vital signs, medications, laboratory measurements, observations and notes charted by care providers, fluid balance, procedure codes, diagnostic codes, imaging reports, hospital length of stay, survival data, etc. The Evolution of AI has also been designated as the fourth industrial revolution. Jhao et al., summarised AI from an evolution perspective, into three stages: (1) The knowledge-driven approach or Symbol AI; (2) A data-driven approach, based on machine learning or deep learning; (3) the Third Generation AI–which combines knowledge and data-driven theory.

It is obvious that machine learning and expanded computer memory to absorb large set of data has been the mainstay of AI in the field of health. The introduction of electronic health/medical records (HER/EMR) was a major milestone in the field because it provided much-needed medical data. It was financed generously when the US govt adopted a massive affordable health care program named "Obama Care".

**The electronic medical record (EMR) and electronic health records**

These were developed as digital collections of data related to patient care. These records played an important role in the evolution of AI in health care. Along with blockchain integration and natural language processing. Today EMR/HER are potent tools for the growth of AI in the modern healthcare landscape. It is speculated that eventually, EMR/EHR, will lead to cost reduction and usher in, overall greater transparency, and efficiency in hospitals by reducing medical errors and giving the opportunity for quality analysis of procedures. Additionally, it will bring uniformity to the national /global healthcare system. RPA (Robotic process automation), a newer tool in AI-kit, has helped in computerizing and digitalizing data in recent eras and it ensures the accuracy and reliability of data by reducing dependence on manual work.

EMR/EHR is being used globally as the USA passed a law in 2009, to complete the process up to 2015 and the UK had committed to go for paperless records by 2020. Other countries have been also fast-pacing for adopting the EMR.

Hospitals in India are increasingly using EMRs. The Rules of Clinical Establishments (Registration and Regulation) Act 2010 (notified on May 23, 2012) has declared mandatory registration, maintenance, and provision of EMR or EHR for every patient.

***Newer AI tools***

There are multiple newer tools added to AI that have allowed it to handle big data, and gave it colossal analytic power, better language capabilities, and intuitive capacities. The name of few of these new tools are as follows, - Generative AI, Edge AI, automated machine learning, IOT (internet of things) and digital twin, low code-no code AI, augmented analysis, and features of cybersecurity.

***Application of Artificial Intelligence in Cardiac Care***

An AI-based system is cognitive in nature because it shows capabilities of understanding, reasoning, learning, and self-empowerment. It understands the material (structural and non-structural data) by reading, processing, and interpretation. Its capacity to reason depends on its understanding of a matter, connecting it with existing knowledge, deriving the inferences, proposing the hypothesis, and eventually comprehending the medical language in view of existing evidence. Now, the question arises, from where does this information reach the computer? These databases are created, as discussed above, from human subjects, at all levels by human experts who provide details about case histories, clinical findings, lab data, application of therapeutics, and overall outcomes mostly in an EMR system and keep on expanding this database for future use.

As discussed in the introduction, cardiac disorders are a heterogeneous group of diseases. In this section, we will have a bird-eye view of the subject.

***Cardiac Imaging and AI***

AI-based actionable insights have been used in the field of oncology by creating predictive algorithms for breast cancer by combining imaging and EMR data. Similar benefits can also be extended in other fields.

Routine echocardiography, or cardiac imaging with other high-end modalities like cardiac magnetic resonance imaging (CMR), and computed tomography (CT) are the methods of diagnosis and post-procedure evaluation in pediatric cardiology. With the use of programmed mathematical algorithms, machines are able to recognize images and analyze and execute decisions. Newer AI algorithms may process vast amounts of imaging data from multiple sources and may integrate the available information, leading to automated anomaly detection, precise measurements, and an accurate diagnosis of cardiac conditions. With the increase in available data, the functional capacity of the machine keeps on improving. A few of the cardiac imaging applications are being discussed in relevant sections.

*Detection of myocardial dysfunction:* In certain situations, myocardial dysfunction may remain masked for a long period, and a pre-emptive protective action gets delayed. These patients can be protected if actionable insight is obtained at an early stage of the onset of the process.

Similarly, if the ventricular morphology is other than the left ventricle, as is the case in complex CHDs, right ventricular myopathies, and Ebstein anomaly of the tricuspid valve (TV), the functional evaluation of the heart remains suboptimal from most conventional modalities. AI-assisted multimodality (ECG-Echo-CT-MR) algorithms may be valuable in recognizing these patients early and targeting them through appropriate management plans.

***Arrhythmia management with AI-DL-based multimodality imaging***

Complex arrhythmias though may be found in isolation (channelopathies, abnormal conduction system pathways, ectopic arrhythmic foci), they are generally integral parts of primary or secondary myopathies and in hearts burdened with chronic pressure and/or volume overload. They are the usual cause of sudden cardiac death in all subsets of these patients. Early recognition and appropriate medical or invasive intervention are said to be effective prophylaxis against mortality and morbidity. There are electrocardiography imaging systems available that integrate body surface mapping with non-contrast computed tomography (CT) in recording the electrode position in relation to the cardiac surface geometry. These electrodes can localise arrhthmogenic focus on 3D reconstruction that simultaneously records electrode location and geometry of cardiac surface can localize focal activation of atrial or ventricular ectopy on the 3D reconstruction of the patient's heart using an inverse solution approach.

***Congenital heart disease (CHD)***

The heterogeneity of CHDs among the same subset of defects results in varied outcomes and makes the pre-procedure prognostication difficult. It is true that enough data are not available for the complex lesions as well and there is a lack of knowledge and understanding about the use of AI in this subset of cardiac diseases. The greater multicentric data accumulation and collaboration between data scientists and pediatric cardiologists/cardiac surgeons may change the scenario drastically. Operated and unoperated adult patients with CHD are a challenging population for cardiac imaging. AI-assisted multi-modality imaging may be highly useful in getting adequate evidence and in improving the quality of care, saving time and cost of health care. In Fontan/TCPC surgery, AI-assisted technique may help in understanding the flow dynamics of superior, inferior vena cava, and pulmonary arteries that may help in optimizing conduit size.

Antenatal routine ultrasound scans may be used to get standard fetal cardiac views with the help of AI, letting to improve the CHD detection rate. Automating the 3D printing workflow by Combining 3D printing with AI in a complex CHD is expected to increase the performance by increasing precision and reducing the risk of errors. Faster and smarter algorithms will reduce the manual process performed by humans. Handling of big data with newer AI-powered algorithms, such as DL (Deep Learning) using CNN (Convolutional Neural Network) and RNN (Recurrent NN), federated learning, and digital twin, allows collaborative research to develop future prediction models and to get newer therapeutic methods.

***Tissue engineering and scaffolds in CHD surgery and AI***

In the management of complex congenital heart diseases, there is a vast requirement for synthetic, prosthetic materials that must not degenerate or calcify in the long run and may have the potential to grow and remodel.

Regenerative medicine is a field that deals with tissue engineering and is working to develop durable scaffolds possessing the ability to grow and remodel upon implantation into babies born with heart defects.

Now, 3D convolutional neural networks/AI has been applied to the prediction of different essential properties of tissue-engineered- scaffolds. Theoretically, if multidisciplinary research is promoted, there is a possibility that automated design or discovery of microstructures with desired mechanical properties can be obtained for future use.

***Coronary Artery Disease (CAD)***

With existing technical and imaging tools, it has been observed that approximately one-third of the patients with chest pain due to underlying coronary artery diseases fall in the 'indeterminate' zone and may not be diagnosed on time. In these patients, the calculation of ML-based fractional flow reserve from cardiac CT (CT-FFRML), as well as coronary plaque analysis, can clinch the diagnosis. These CT images can be further transformed into 3-D vascular images with the help of AI. The result of CT-FFRML is comparable to invasive FFR-E calculations. During coronary interventions, intravascular ultrasound (IVUS) and optical coherence tomography (OCT) have been used for coronary luminal imaging; It is helpful in assessing plaque burden and optimizing stent position; Also, evaluation of post-deployment length and luminal dimension of the stent may help in prognosticating the outcome and chance of re-stenosis.

***Valvular Heart disease (VHD)***

Artificial intelligence (AI) in the field of valvular heart disease, has unique applications like assistance in diagnosis by cardiac auscultation, heart sound segmentation, AI-assisted echo-interpretation, and medical image analysis.

AI assistance has led to the development of many commercial software for mitral Valve Quantification, mitral Valve Navigator, Auto Valve Analysis, and PISA Volume Analysis; all of them allow automation of the quantitative analysis of 3D echocardiography. The unique group of software reduces measurement time substantially, provides more accurate and reproducible results, and has validated their reliability in quantitatively measuring aortic and mitral valve apparatus parameters and regurgitation volume.

*Transplant Medicine and AI*

Heart or heart-lung transplant surgeries are on the rise in India. AI can be used to optimize organ utilization, prediction of complications, and potential pretransplant management, It may mitigate the need for transplant. Ongoing large-scale trials will provide a foundation for the development of artificial intelligence applications in transplant medicine. Furthermore, ANN and machine learning algorithms have been applied in the prediction of length of stay in intensive care units after cardiac surgery, postoperative complications, and both short-term and long-term mortality after heart transplantation.

*Cardiac Surgery - Preparation, Intraoperative Monitoring, Prognostication*

Cardiac surgery is a data-rich field, which has enabled the development of a variety of tools for risk stratification with the application of non-linear models and clinical scoring systems, to assist perioperative decision-making. AI and machine learning (ML) algorithms are great assistance as they can handle ever-increasing data with increasing complexity. Intraoperatively, the surgeon could then enhance the understanding based on real-time analysis of intraoperative progress that integrates EMR data with operative video, vital signs, instrument/hand tracking, and electrosurgical energy usage. Intraoperative monitoring of such different types of data could lead to real-time prediction and avoidance of adverse events. The potential automation of surgery is also a possibility in the next few decades. However, at present, augmentation rather than automation should be the priority.

*Robotic Cardiac Surgery*

Robotic cardiac surgery is now in vogue and has the advantages, of being tremor-resistant. However, currently, the robot here is subservient to the operating surgeon but efforts are there to integrate AI, and deep learning so that eventually, it can perform surgeries autonomously. It can be expected then, that the outcome of a surgery can be homogenized as inter-operator variability can be defied. Conceptually, intelligent robots exist in other fields of surgery. AI-driven robot has shown a better ability to do bowel anastomosis than expert surgeon when compared in suture spacing, lumen reduction, and procedure time.

However, fully autonomous robots in cardiac surgery are yet to be conceived. It is true that the surgical experience and intuition of an expert surgeon particularly in complex situations cannot be matched by an automated robot in the present era. ML cannot be error-free and may give nonsensical results.

Using such an evolved technology may lead to a huge financial burden, particularly in the developing world. Also, standardization of procedure and ethical implications will need to be considered.

### *Transcatheter Therapy and AI*

It has been accepted as an alternative to traditional cardiac valvular surgery especially in patients with high surgical risk in recent years. The precise navigation of catheters to the intervention site is a very challenging task in a beating heart. AI-assisted navigation systems are being experimented with, to be incorporated into these catheters.

**Table 1:** AI-assisted Cardiac Imaging: Actionable Insights

| S.No. | Data from EMR | Cardiac field | Actionable insights |
|---|---|---|---|
| 1 | Information from EMR Genetic Predisposition | Improving Image Quality | Image denoising, Deblurring |
| 2 | Information from EMR Genetic Predisposition | Coronary arteries: Detection of lesions, Risk stratification, therapeutics, prognosis | Detection of anatomical stenosis; functional CA stenosis:<br>FRC-CT (fractional flow reserve-CT);<br>EAT-(Epicardial adipose tissue) PVAT, (perivascular adipose tissue) analysis;<br>Plaque analysis<br>LV Myocardium analysis to know the ischemic changes. |
| 3 | Information from EMR Genetic Predisposition | Congenital heart disease | Intelligent imaging of the fetus by retrieving multiple images despite suboptimal positioning/images of the fetus.<br>Functional evaluation of ventricular mass, AI-based interpretation of complex CHD, particularly in older children.<br>Pre and post-evaluation of Fontan circuit. |

| | | | |
|---|---|---|---|
| 4 | | Myocardial disease Dilated, hypertrophic, restrictive cardiomyopathy | AI-based ECG, Imaging to characterize myocardium, and genomics-based prediction, have been employed. AI-based functional assessment of right/left /biventricular functional assessment; |
| 5 | | Pericardial disease | The AI-enhanced algorithm in the early detection of acute pericarditis (D/D acute STEMI) |
| 6 | | AI prediction in cardiac oncology | AI-assisted ECG and other modalities ti identify cardiac effects of cancer therapy. |
| | | Arrhythmia | AI-based ECG analysis /rule-based algorithms for cardiac devices are helpful for complex arrhythmic disorders. |

***Nanotechnology And Artificial Intelligence***

Nanoparticle-modified drug compounds and imaging agents have been used successful in targeted drug delivery and contrast efficiency. Nano-particles have been used to deliver different kind of drugs or drug combinations simultaneously which may be adversely affected due to factors specific to the patient, or due to dose-dependent, or time-dependent delivery. Assisting nano-technology with AI may help in overcoming these adverse factors. Besides drug/contrast delivery, Nanotechnology has been used in multiple ways in cardio-therapeutics.

Nanomaterials can also be used to create extracellular matrix which can be used further as the scaffolds. These scaffolds are reproducible and have better biomimetic structural and physio-mechanical signals. In coronary artery disease, nanoparticles may be used for the detection and removal of atherosclerotic plaque. Nanotechnology-based stem cell therapies are also being investigated for the regeneration of myocardial cells for ischemic cardiomyopathy. Regenerative medicine is now being assisted with AI in detecting reliable frameworks for iPSC(induced pluripotent stem cells) colony classification, cellular morphology identification, and non-invasive cell therapy characterization into healthy vs. unhealthy cells. Integration of AI with nanotechnology-based futuristic biosensors with wireless capabilities has given a better option for point-of-care cardiac diagnostics.

### *Precision Medicine, Pharmacogenetics, and AI*

Pharmacogenetics is an accumulation of pharmacology and genomics for tailored treatment. It is now known that adverse drug reactions may have a genomic/genetic predisposition and might result from drug-drug, drug-gene, and gene-gene interactions. For example, simvastatin may cause muscular weakness in a subset of patients, and therefore genetic testing for the SLCO1B1 gene is recommended. AI is the most promising tool in pre-empting the ADR in such a situation and may have a role in customized drug therapy.

Therefore, it can be derived that the application of precision medicine with AI assistance, is a synergistic blend in providing tailor-made personalized patient-specific care, which includes, therapy planning using clinical, genomic, or social and behavioral determinants of health, which in due course, allows the system to have better risk prediction/diagnosis and therapeutic outcomes.

### *Prevention of Sudden Cardiac Death*

With the increasing availability of sensor-tracking wearable devices, it can be expected that precise prediction and warning systems will be available in the future.

AI-assisted health care system is useful in 1. early identification of risk factors, 2. Early detection of onset of event, 3. Effective cardiopulmonary resuscitation, 4. Prognostication. Recently, many warning models have been in place. With more customized healthcare portfolios, for individual patients, probably the risk may be predicted years before the cardiac events.

### *Cardiac Rehabilitation, Medical Education, and AI: Chat GPT*

#### *AI and cardiac rehabilitation*

Home-based monitoring is an integral part of cardiac rehabilitation. AI-assisted home monitoring plans have great potential for early detection and prevention of cardiac events in such patients.

### *ChatGPT (Chat Generative Pre-Trained Transformer)*

It has the ability to 1. Customize the management plan of a patient based on analysis of patient records, health status, and requirements, 2. Promote research-based practices by a comprehensive review of existing clinical studies, 3. Remove the communication gap with the patients by offering medical knowledge in a language that can be interpreted by the person concerned, 4. Enhance the interaction between experts and can be integrated in future with the fully automated robots. The role of AI in medical education, preventive programs, consultation, triage, and intervention has been appreciated. (CHATGPT 4) has been tried for the delivery of individualized, and compassionate, healthcare. ChatGPT can provide real-time translation of medical terms and can facilitate communication between health personnel and patients. It allows patients to understand their diagnosis, treatment options, and medication prescriptions. It can be used for checking symptoms, and disease surveillance, and may provide a holistic view of disease trends and spread. It is particularly useful for distant patient monitoring, patient mental support, and provide relevant information on a particular drug and its pharmaco-genetics.

Despite all these virtues, Chat GPT lacks the human aspect of care that includes empathy, compassion, critical thinking, and decision-making. Therefore, this modality cannot replace a simple doctor/physician-patient interaction. There may be legal and ethical aspects brushing off of responsibility on the part of health professionals.

***Ethical Guidelines about the use of Artificial Intelligence in the field of Biomedical Research and Health Sector***

**Pros of AI:**

Artificial intelligence-assisted cardiac care has a promising future and that can create a cost-effective, efficient cardiac care system, as discussed in previous sections.

**Cons of AI:**

**(a) Limitations of use of AI in Health care Systems**

- **Medical error on an AI-based system is a possibility:** AI-based machines have the inherent potential to have fragmented information Unlike other places health sector data lack uniformity and are expected to be unevenly distributed in multiple formats, across the system and need to be retrieved from heterogeneous resources. The facts make data inherently prone to error.
- **Lacking interactive human care:** EMR and EHR are major sources of data in any healthcare system. In the real world, it diverts the attention of medical personnel compulsively, to computers. The lack of training of medical staff in typing etc, and the absence of specialized medical transcripts, in the hospitals, is

the potential source of staff inattention and patient dissatisfaction. Lack of eye-to-eye contact, hand-holding, and affectionate conversation deny human compassion which is an essential part of medical healing.

- **In an imaging machine, errors may multiply:** As discussed above, quality acquisition of data is a big challenge in the medical field, and medical imaging is no exception. It is known that, for the annotation of a single model approximately 10000 images may be required, and unless a newer method is available, even an automated machine remains a time-consuming and cost-ineffective modality.
- **Automated operating robotic systems:** As discussed before, robots have shown excellent ability to anastomose intestines with precise stitching in a few of published studies. Yet, the essential ingredients of an expert surgeon, that is 'touch', 'intuitions', 'perception', and the capacity to change the plans according to the new findings, are lacking completely. Therefore, human surveillance is absolutely mandated.

***(b) Social and Economic issues related to AI***

- **Economic implications for human resource utilization and health care inequalities:** The most obvious implications of relying upon AI technologies in the health care system are the risk of unequal access to such technologies and inequalities in the opportunity (digital divide) for the masses. Increased automation may be a dream to get error-free services all across the health care system, but there might be a lingering underlying story of swapping of jobs from humans to machines, job cuts, and decreased wages leading to overall economic inequalities for health care workers, across the globe phenomena described as "The Turing Trap" by Erik Brynjolfsson. It has been argued that swapping of manpower with automated machines has been taking place without accepting the fact that mirroring human intelligence exactly, hasn't been possible as yet.
- **Bread of privacy of medical data:** Till excellent privacy-enhancing technologies are in place, inadvertent or manipulative data leak remains a matter of concern. Patient data are sensitive matters as they have personally identifiable information (PII) (e.g., medical histories, identity information, payment information), which usually are protected by special provisions in Govt-regulations. In 2019 University of Washington reported a major database configuration error on 2019 December, 4-26$^{th}$. During this period, files of about 974,000 patients were leaked online. In Tamil Nadu, India, the personal information of 1.5 lakh patients was sold by hackers. This kind of incident may tarnish the trust of patients and patients may face Anxiety, depression, and post-traumatic stress. These data leaks may be manipulated by cyber-crime sources.

There have been incidences of hospitals and the government of the US providing patient data to data mining companies; these companies sold the data to other stakeholders like insurance agencies. The practice was prohibited in 2011, by an order from US supreme court.

- **AI augmenting inequality: Health and language issues:** AI depends on a certain database that has human resources and hence it may be inherently biased and may reflect in the values and judgments created by algorithms and may result in human-like semantic biases, including those that are discriminatory towards race or gender. Technically efficient AI may not be cost-effective, at least initially, and it may have differential access to various socioeconomic strata groups and may augment deep-seated patterns of discrimination in the health care system.

**Addressing the Ethical Issues in AI-Assisted Health Care system-**

**(Guidelines from World Health Organization and Indian Council of Medical Research -ICMR)**

AI with all its virtues and vices is the need of the hour and its use in the health sector is increasing by leaps and bounds. For the optimum functioning of the AI system, an adequate level of autonomy is desired; at the same time, it is critical that human autonomy remains supreme and humans should remain in control of healthcare systems, and decision-making.

It is also mandatory to avoid unintended or deliberate misuse of data as discussed before, by parties with business interests or by those who are involved in cybercrime. Any breach of privacy may lead to major adverse physical, psychological, and social consequences.

***The six Principles to govern AI in health by WHO (2021)***

After 2 years of consultations held by a panel of international experts on ethics to use AI in health, WHO has declared six principles to minimize the risks and maximize the benefits of AI-supported healthcare systems for its member countries; These principles are as follows:

**(a)** Protecting human autonomy.
**(b)** Promoting human well-being and safety and the public interest.
**(c)** Ensuring transparency, explainability and intelligibility.
**(d)** Fostering responsibility and accountability.
**(e)** Ensuring inclusiveness and equity.
**(f)** Promoting AI that is responsive and sustainable.

**ICMR guidelines for Artificial Intelligence use in the Health Care System (2023)**

India has a framework for the ethical use of information technology in health under the following rules/Acts:

- **(a)** The Digital Health Authority (under the National Health Policy -2017),
- **(b)** The Digital Information Security in Healthcare Act (DISHA) 2018
- **(c)** The Medical Device Rules, 2017.

Expanding these applications, ICMR has provided 10-point guidelines for an AI-assisted health care system, which is applicable in all fields including cardiac care:

- **(a)** Autonomy,
- **(b)** Risk minimization and safety,
- **(c)** Trustworthiness
- **(d)** Data privacy,
- **(e)** Accountability and liability,
- **(f)** Optimisation of data quality,
- **(g)** Accessibility and equity, inclusiveness
- **(h)** Collaborations,
- **(i)** Non-discrimination and fairness principles,
- **(j)** Validity and trustworthiness.

The ethical review process came under the domain of the ethics committee which assesses a host of factors including data source, quality, safety, anonymization, etc. Any research activity based on a database needs to be scrutinized rigorously and a procedure of informed consent from patients must be in place.

**Concluding Remarks**

In a cardiac care program, the highest capabilities are required to perceive, construe, and comprehend in order to create an appropriate diagnosis so that a management plan with minute details and minimal error can be conceived.

Despite these medical errors may happen and may culminate in catastrophes. The major medical errors causing death have been reported in up to 30-40% of cases in a few relevant studies.

Artificial intelligence (AI) is expected to refine the coordination and efficiency of healthcare delivery at all levels and is considered a major disruptive force in the future.
AI is going to reduce the time of a diagnostic or therapeutic procedure, lessen the complications, and is expected to promote less invasive interventions. Its capacity broadens the scope of non-invasive tools and quick algorithmic analysis of big data may pre-empt risk factors many years before the onset of disease and may allow the

application of non-invasive methods and prevent the disease process before the threshold of major hemodynamic mishaps.

The assessment of the value of these new technologies is still speculative, and no consensus guidelines have been proposed as yet. There exists a theoretical fear of machines overtaking the job of human resources. It may also be disastrous if patient care and rehabilitation have been left on machine applications like Chat GPT, completely. Any effort to shirk responsibility for machines may have ethical and medicolegal consequences. Last but not the least, the cost of AI-assisted healthcare systems may become more overbearing on financial resources.

Despite multiple fears, AI seems to have a promising future in the field of cardiac care and only the future can tell how these expectations will be responded.

“Life is so constructed, that the event does not, cannot, will not, match the expectation.”
— Charlotte Brontë , Villette

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# 12
# THE ACADEMIC AND RESEARCH IN UNIVERSITIES OF FUTURE – A NEW WORLD ORDER

**Prof. Tendai Padenga**

*A new global academic and research world order will arise and depolarize the poles from the usual north and south to a new global north (first world), global south (developing world) and global south-south (the bottom billion, poorest of the poorest) landscape. As the loud cry for the need for academic justice and academic equal rights, gets louder the global rich north corporates will have no option but use their monopoly, ill-gotten wealth and influence to enter into the global north academic and research ecosystem as a select group of private corporate universities thereby smartly defending, protecting and perpetuating their patented academic and research injustices. Academic and research monopoly will rise to unprecedented levels and will usher in the rise of global north academic and research mercenaries fully funded to institute, implement, monitor and evaluate the rise of new age death factories in line with the ideals and virtues of the few rich and influential global north corporate academic and research monopolies.*

***Keywords:*** *Global North, Global South, Global South-South, Patent Protected, Academic Justice, Academic Mercenaries, Research Institutions*

## Introduction

Global north academic and research institutions have been used as vehicles of mass human culling through controversial academic study and research patented outputs leading to a variety of possible ways to achieving human mass murder like never seen before, in human history. Hence, the rise of celebrated academic and research patented outputs for human culling ranging from our daily household cancer on the run products like genetically modified foods on our breakfast, lunch and dinner tables to modern day celebrated patent protected technological and engineering tributaries of death and destruction, ranging from guns, machine guns, atomic and nuclear bombs, biological warfare technologies, warships and all forms of fighter jets. We have become a blood thirsty, war hungry generation driven by hate, greed and power.

The microbe kingdom has not been spared either with the massive rise of industrial agriculture arraying weapons of microbe mass killing decorated and dispatched as patent protected and approved fertilisers, herbicides, pesticides, insecticides and all forms of suicides. Adding to these celebrated 'marvels' of patent protected academic and research output nuisances are the fully funded academic and research animal and human cloning projects.

The rise of the global north corporate academic and research university system will change the shape and nature of global governments born of democracy as we know them today. The new global north corporate academic and research university system world order will have the power, influence and control over how governments will plan, design and draft working national and foreign policies, they will hold the power to swerve or sway definitions to controversial terms like research ethics as and when it suits them.

## Preamble

### *A Proposal for Global Academic and Research Groupings*

Drawing key lessons from the United Nations conference on trade and development model for ranking countries along the lines of socio-economic and political characteristics they introduced a global north and global south balancing scale with the global north being dominated by Northern America, Europe, Israel, Japan and South Korea. The global south on the other hand forming the other side of the divide with countries like parts of Africa, Latin America, The Caribbean, parts of Asia, and parts of Oceania.

This setup then clarifies that the choice of the terms global north and global south do not, in any way refer to the standard cardinal directions of north and south. Developed countries, in this view, are referred to as global north countries while the developing countries on the other hand are considered global south countries. In borrowing these terms and their usage, it has been solely on the basis that the global north has to have better and far more complex academic and research ecosystems and working facilities than those of the global south and or otherwise.

However, there remains need to be very clear that in global academic and research ecosystems and or associated models the global south is too large and diverse a mixed bag to be considered a fair block of ranking equals. To that the future will prune the global south block, extract and separate 'the bottom billion' or the poorest of the poorest, to form a third global academic research group of competing equals hence the emergence of the global south-south academic and research block, the bottom billion or the poorest of the poorest.

With this clear demarcation of the global academic and research ecosystem the much demanded academic and research integrity and credibility will follow categories as shown below:

- Global North;
- Global South;
- Global South-South.

Only after the implementation of a fair and closer to reality global academic and research model will the global academic and research rankings, of all forms, be acceptable as credible. **Table 1.0** presents the examples of this classification system with sample country names listed whilst Table 1.1 struggles to present the overarching view of the global north, global south and global south-south academic and research systems, with their corresponding stakeholders.

**Table 1:** Examples of possible world global academic and research group ranking system

| **Global North Group** | **Global South Group** | **Global South-South Group** |
|---|---|---|
| France | Brazil | Angola |
| Germany | China | Benin |
| Japan | India | Jamaica |
| United Kingdom | Indonesia | Somali |
| United States of America | South Africa | Zimbabwe |
| etc, etc | etc, etc | etc, etc |

**Table 2:** Proposed world global academic and research groupings

| **Global North** | **Global South** | **Global South-South The Bottom Billion** |
|---|---|---|
| **Stakeholders**<br>Global North Government<br>Global North Corporates<br>Global South Representatives<br>Global South Corporates<br>Global South-South Government<br>Global South-South Corporates | **Stakeholders**<br>Global South Government<br>Global South Corporates<br>Global North Representatives<br>Global North Corporates<br>Global South-South Government<br>Global South-South Corporates | **Stakeholders**<br>Global South-South Government<br>Global South-South Corporates<br>Global South Representatives<br>Global South-South Reps<br>Global North Government<br>Global North Corporates |
| **Global North Ranking Frameworks:** | **Global South Ranking Frameworks:** | **Global South-South Ranking Frameworks:** |

| | | |
|---|---|---|
| Quality<br>Accreditation<br>Rankings | Quality<br>Accreditation<br>Rankings | Quality<br>Accreditation<br>Rankings |
| **Ranking Frameworks Comparisons:**<br>Global North Ranking versus<br>Global South Ranking versus<br>Global South-South Ranking | **Ranking Frameworks Comparisons:**<br>Global North Government<br>Global North Corporates<br>Global South-South Government<br>Global South-South Corporates | **Ranking Frameworks Comparisons:**<br>Global North Government<br>Global North Corporates<br>Global South Government<br>Global South Corporates |
| **Academic & Research Benchmarking** | **Academic & Research Benchmarking**<br>Global North Government<br>Global North Corporates | **Academic & Research Benchmarking**<br>Global North Government<br>Global North Corporates<br>Global South Government<br>Global South Corporates |
| **Gap Bridge Funding Programs:**<br>Teaching & Learning Equipment<br>Research Labs & Workshops<br>Research Equipment<br>Capacity Building | **Capacity Building Loans & Grants**<br>Teaching & Learning Resources<br>Research Resources<br>Staff Development Opportunities | **Capacity Building Loans & Grants**<br>Teaching & Learning Resources<br>Research Resources<br>Staff Development Opportunities |

The world has been partly designed to define civilisation from the eyes of the universities. In other words the success and advancement of a nation state is partially defined by its ability to generate, acquire, retain, improve and translate the existing academic knowledge body into products, goods and services thus driving the university's knowledge body to globally competent alignment and competitive edge on various globally set and marked rules and benchmarks. However, in place of the existing one-size fits all global ranking system we foresee the dire need for a more progressive three tier model which separates nation states with respect to their levels of development, Table 1.2 endeavours to outline this narrative in a more stratified and simple manner highlighting the rankings of the future models which are:

- Global North, First World
- Global South, Second World; and
- Global South-South, aka The Bottom Billion, or Poorest of the Poorest

**Table 3:** Examples of future Universities global quality, accreditation and rankings framework

| | Actors (Universities) | | | | |
|---|---|---|---|---|---|
| | **Government** | **Publi c** | **Corpora te** | **Privat e** | **Religio us** |
| Global North | **Policy:** Enabling Ecosystem Implementation Models Monitoring Models Evaluation Models | Highest Order Global Rankings | | | |
| Global South | | Medium Order Global Rankings | | | |
| Global South-South The Bottom Billion | | Least Order Global Rankings | | | |

The truth be said, the global north universities enjoy unparalled power, influence and autonomy against the global south universities and global south-south universities from all forms of funding, recipients of advanced and modern research equipment, journals of choice, to being used as academic and research benchmarks for global south and global south-south universities to also being far better ranked amongst a whole bunch of poorly funded global south and global south-south universities with little to no endowment funds to their names.

It is far more important to accept that it will only be when the global academic and research terrain for the global north-south universities academic and research ecosystem has been equally levelled as has been done economically or otherwise by calibrating countries into groups as highlighted with examples below:

- Group of 5, G5 emerging economies;
- Group of 8, G8 advanced economies plus European Union; and
- Group of 20, G20 major economies plus African Union;

If the Global economies could be appropriately split into G5, G8 and G20, it boggles the mind why the global north, global south and global south-south academic and research universities ecosystem has not been treated with such wisdom and dexterity, since universities are somehow linked to the ultimate industrial, social, public and private performance of any country, as well as the scope and dynamics governing their country’s economy. Why rank a University in Zimbabwe, Somali, Laos or Jamaica against a University in London, Washington, Berlin, Paris or Moscow under the same Science, Technology, Engineering, Mathematics and Medicine category?

It has to be borne in mind, understood, appreciated and made an avenue for serious consideration when critical decisions are being cast in stone with regards to global south and global south-south academic and research universities, that there are, for a fact, global south and south-south academic and research universities that operate only on a salary budget life line, simply meaning no national budget for meaningful academia research and development. The fees charged to students are commensurate with the state of the national economic performance, in some case USD750 – USD1 000 per year per student, for STEM degree programmes. The biggest delusion to world to this phenomenon is that most global south and global south-south countries end up overdressing very hollow catchy academic research titles in an effort to win fair ranking chances and inturn attract a 'meaningful' slice of the meagre academic research funding available to poor countries.

It is of paramount importance and relevance that the global north develop an urgent acceptance and tolerance to the notion that it's no longer business as usual at the global south and global south-south academic and research levels. The global south and global south-south are sick and tired of demanding answers to a lot of sensitive advanced academic and research questions and are now beginning to create parallel structures at national and or regional levels, under the academic and technology diplomacy banners through various vehicles as listed below:

- South-South Memorandum of Understanding;
- South-South Memorandum of Minutes;
- South-South Joint Research Initiatives;
- South-South Research Initiatives; and
- South-South Technology Diplomacy;

On the other hand the visibility of corporate private funding and silent direct involvement of global north corporates, in particular, into the academic and research arena is now beginning to emerge. This alone is a sign that all is not well within the global academic and research university ecosystem.

An understanding of the above makes it plain and certain that the so-called gospel of academic equality and democracy according to the academic north to the emancipation of global south and global south-south universities academic and research autonomy will remain a mirage for another lifetime until and unless the key issues surrounding academic injustice, academic diplomacy, technology diplomacy and transparent and accountable global north-south, global south-south cooperation initiatives are not only promoted but equally implemented to the letter.

The global academic and research universities have never treaded fairly from the onset. The global north academic and research universities have had most, if not all, of the advantages in that most of the critical global components of the academic and research ecosystem reside within the jurisdiction of their national and regional economic boundaries:

- Academic regulatory bodies
- Research regulatory bodies
- Academic funding agencies
- Research funding agencies
- Academic Journal publishing agencies
- Research Patenting, Licensing, Utility models and copyright systems
- Academic teaching and learning systems; and
- Research equipment Original Equipment Manufacturers

However, armed with these the global north academic and research ecosystem has all the powers be, to determine who does what kind of academic and research and to what extent, factoring in the most controversial issue of research ethics. Arguments may be thrown in and around the court but the truth be said, the global north is the heart beat as well as the epicenter of all global academic and research initiatives and determines the nature, shape and scope of other global south, global south-south participants, thus introducing academic dictatorship.

***Background***

The last 70 years of our history have not, in any way, been kind to the sustainable academic justice environment and or ecosystem desirable for both the global North universities and global South universities. Lessons to be drawn from our last 70 years completely point to where we stand today demonstrating a worrisome tilting balance of academic justice in favour of the global north university ecosystem, hence we have been witnesses to a lot of academic and research injustices and atrocities never ever seen before, by mankind.

Yes, it is very important to discuss and find a practical way or ways towards attainable and sustainable global north, global south and global south-south academic and research justice. But, first things first, we need to look back and check how we got into these academic and research doldrums where we find ourselves in today. History stands firm to inform us of our past wretched and greedy behavior and it takes courage from our part to accept where we went wrong and avoid repeating our past actions that shaped our today and stands to inform and influence the shape of our children's tomorrow.

It is not only highly debatable but also very controversial as to why Universities where ever setup in the first place. They came clothed in the gentle spirit of advancing human civilization thereby demanding autonomy, promising and guaranteeing academic justice for all through academic dialogue, integrity, transparency and ethical conduct in research, but alas whilst we were sleeping the Universities fooled us.

However, what history as a learned teacher, has taught us is different. Universities research and development outputs have not been ethical at all, they simply made it very possible easy, faster and cheaper to enforce and cause massive death and destruction at the press of a button. Large industrial death factories where setup churning out massive killing machines no human civilization had ever seen before. If anything academic and research university research outputs have caused more deaths, poverty, diseases, climate disasters and misery than we ever dreamt of. Human and microbe killing machines, chemicals and methods have never been this sophisticated until Universities academic research and development joined the bandwagon, today we have pole vaulted:

- from bows and arrows to gunpowder, atomic and nuclear bombs
- from machine guns to missiles and drones; and
- from natural agricultural crop rotation to industrial agriculture

***Industrial Agriculture, Ecocides***

Humanity has used its academic and research prowess to generate knowledge of science to develop technological tools for use in attacking the microbe kingdoms, all enshrined in the spirit of improving agricultural harvest yields through declaring scientific and technological 'suicidal' wars with microorganisms. Instead of using science and technology to unravel the mysteries shrouded within the microbe kingdom, so that we can peacefully coexist with them, instead we decided to use scientific and technological research to wedge war against microbes in all forms using:

- Herbicides
- Insecticides; and
- Pesticides

All these resulted in mass 'suicides' within the microbe kingdom's population.

***Genetically Modified Organisms***

These can be loosely defined as plants, animals or microbes in which one or more changes have been made to the genome, typically using high-tech genetic engineering, in an attempt to alter the characteristics of an organism. These have slowly found ways into our breakfast, lunch and dinner tables in the name of food for all.

***Gene Cloning***

Regardless of thousands of products being developed, including human growth hormones and hepatitis B vaccine, on the basis of the gene cloning work done by Stanley Cohen and Herbert Boyer. A lot of ethical fears with regards to human cloning have been raised from this global north academic and research university output, including but not limited to:

- Increases in abortions and miscarriages
- Deformed embryos and clones
- Parenting a clone
- Clones becoming self-sufficient
- Unknown Clone personality; and
- Rights for clones

***Global Media***

The global north media has, without any aorta of shame, reached a level where they are now celebrating global north academic and research science, technology and engineering success outputs designed clearly as machines, weapons, technologies and engineering marvels of mass human death and destruction. A very good and clear example of an extremely well marketed and publicly accepted 'Oppenheimer' movie with a USD100 million budget and grossing over USD939 million in global box office revenue.

Here a Jewish faculty for a global north academic and research university is recruited into a fully funded project to develop an atomic bomb clearly meant for mass human death and destruction. This, alone, begs the question where is humanity in all this, where is ethical research when we badly needed it, when a globally ranked and celebrated global north academic and research university's research outputs are about mass death and destruction technologies and engineering machinery, who then will safe humanity?

***Brain Drain***

The global North academic and research university model through their well-knit strong, sound corporate influence and funding coupled with their equally strong and powerful university ordinances and policies created a conduit for siphoning the best of the best global south and global south-south academics from the global south and global south-south academic and research universities. They make the offers irrestitatble and even go as far as granting citizenship based on distinguished candidate's level of academic and research excellence. This then means that the global south and global south-south academic and research universities are left with second grade or second tire calibre of graduates and researchers, an obvious recipe for inevitable failure.

***The New Age University***

It is important to pause, wonder and reach an understanding that the situation on the global academic and research ecosystem appears to inform us that the global north never intended the academic and research university model, as we know it in global south and global south-south, to be the perfect and ultimate driving vehicle for universal human civilisation. It now appears that it was rather designed, developed and imposed as an academic and research diplomacy tool, so as to control the sovereignty of nations as to how far, how deep and how wide they should delve into unknown scientific territories yielding to unknown technological advances in machine design and instrumentation technologies crafted through radical transformative engineering prowess.

The global north academic and research universities have never tasted their own medicines, they simply concocted them for the global south and global south-south. We have learnt too late that there is a parallel path and structure to global academic and research universities where research is privately funded by giant corporates and run outside the restrictive academic and research university ordinances and frameworks, but using the very same faculty for the same. These are run by academic and research mercenaries funded either by very powerful and rich family trusts, global giant corporate and or conglomerates, who are created and assigned tasks by global north or any other organizational setup as scientific demand deems fit.

**The Collapse/Unbundling of the USSR**

The collapse or unbundling of the Union of Soviet Socialist Republics in 1991 opened flood gates of previously well-guarded military, space, pharmaceutical and other highly classified academic and research disciplines:

- Patents; (Both Patented and Unpatented)
- Utility Models; (Both Registered and Unregistered)
- Industrial designs; (Both filed and unfiled) and Copyrights. (Both Copyrighted and not)

On how most of the USSR

- Military equipment
- Space technologies
- Aviation technologies; and
- Heavy duty industrial complex master plans

were designed, constructed, commissioned, operated, repaired and maintained etc. apart from these documents finding their way into the global north academic and research hands, they also found their way into the immediate local regions. The collapse or unbundling of the Union of Soviet Socialist Republics created a rapid and serious exchange of hands for academic and research materials global north quality straight into the hands of the global south overnight. Never have such academic and research materials of such quality, nature and confidentiality moved faster than this period.

Most of the global south academic and research universities were capacitated to global north academic and research quality level overnight through this period hence most global south today have global north quality:

- Advanced Military manufacturing capabilities
- Space exploration capabilities
- Advanced Aviation capabilities; and
- Have Heavy duty industrial complexes

***The Global-South Advanced Academic and Research Pioneers***

Globally, by the mid-1940s a few global south countries after attaining their independence made it a policy to make Science, Technology, Engineering, Mathematics and Medicine academic and research the bedrock driving vehicle for their newly liberated economies. Table 1.3 shows examples of nine global south academic and research driven nations and their Science, Technology, Engineering, Mathematics and Medicine, STEMM related summary of their initiatives.

On special note is the remarkable effect that the unique combination of the global north and global south qualities of academic and research transformed these countries economically by harnessing the might of science and the power of technology.

**Table 4:** Examples of STEM related global south academic and research systems

| No. | Country | Leader | Period | Narration |
|---|---|---|---|---|
| 01 | China | Chairman Xiaoping Deng | 1978 - | Established designated Special Economic Zones e.g. Shenzhen<br>Instituted the State High Tech Development Plan for STEM, 863 Program<br>Adopted, leant from and implemented the Four Modernisations Philosophy |
| 02 | Libya | Muammar Gaddafi | 1979 - | Joined the International Atomic Energy Agency as a member in 1963<br>Built first nuclear research reactor in 1981 |
| 03 | Iran | Ayatollah Khomeini | 1979 - | Started its nuclear program in the 1950s under the Atoms for Peace<br>Bulshehr 1 nuclear reactor<br>Darkhoin Nuclear Power Plant |
| 04 | Iraq | Saddam Hussein | 1979 - | Al Tuwaitha Nuclear Centre<br>Nuclear reactors Tamuz 1 and Tamuz 2 |
| 05 | India | Pandit Jawaharlal Nehru | 1947 - | Atomic Energy Commission of India<br>Bhabha Atomic Research Centre<br>All India Institutes of Medical Science, AIIMS<br>Indian Institutes of Technologies |
| 06 | Malaysia | Mohamad Mahathir | 1981 - | Established Proton car manufacturing company<br>Established the Multimedia Super Corridor<br>Brought Formula One Grand Prix to Sepang |
| 09 | Singapore | Lee Kuan Yew | 1959 - | Construction of Public Housing through housing & development board<br>Industrial estate housing, steel mills, shipyards and oil refineries<br>Established and enforced first world infrastructure and standards |

In Table 4 there are fifty-eight, 58, handpicked Indian examples of national initiatives both public and private that contributed to the shaping and transformation of India into a global powerhouse through combining the global north and global south qualities of academic and research philosophies. Tables 4 and 5 therefore demonstrate the urgent need for global technology diplomacy that is if all stakeholders are sincere in their commitments i.e. the global north, global south and the global south-south.

The global north stakeholders have to make deliberate efforts to bridge the scientific, technology, engineering knowledge gap between the global north, south and south-south academic and research capabilities inorder to end the global south and south-south science, technology, engineering, mathematics and medicine academic poverty cycle, which has led to a failed global south, and global south-south scientific, technological, engineering and industrial growth revolution which would have led to the age of minerals beneficiation in the global south and south south and stopped commodity trading long ago.

**Table 5:** Examples of National initiatives that shape and transform the Academic and Research Universities landscape

| No. | Period | Narration |
|---|---|---|
| 01 | 1868 - | Tata Group established |
| 02 | 1900 - | Murugappa Group |
| 03 | 1916 - | Central Universities, Banaras Hindu University fore runner |
| 04 | 1925 - | Association of India Universities established |
| 05 | 1926 - | Bajaj Group |
| 06 | 1935 - | Cipla Limited |
| 07 | 1945 - 1956 | University Grants Commission enacted by an Act of Parliament |
| 08 | 1945 - | Tata Motors Limited established |
| 09 | | Mahindra & Mahindra Limited established |
| 10 | | Tata Institute of Fundamental Sciences established |
| 11 | | Wipro |
| 12 | 1948 - | Atomic Energy Commission of India |
| 13 | 1951 - | Cadila Pharmaceuticals Limited |
| 14 | 1953 - | Hindustan Machine Tools Limited, HMT |
| 15 | 1954 - | Bhabha Atomic Research Centre |
| 16 | 1955 - | Integral Coach Factory, ICF, Indian Railways |
| 17 | 1956 - | All India Institutes of Medical Science, AIIMS |
| 18 | 1958 - | Reliance Industries Limited established |
| 19 | | Indian Institute of Science |
| 20 | 1959 - | Torrent Group |
| 21 | 1961 - | Indian Institutes of Management |
| 22 | 1962 - | Indian Institutes of Technologies enacted by an Act of Parliament |
| 23 | 1968 - | Tata Consultancy Services established |
| 24 | 1969 - | Sriharikota island was chosen as an Indian satellite launching station Sir Satish Dhawan Space Centre |
| 25 | | Indian Space Research Organisation, ISRO |
| 26 | 1970 - | Yash Raj Films, YRF |
| 27 | | Parle Group aka Bisleri International |
| 28 | 1971 - | The Central Council of Indian Medicine |
| 29 | 1975 - | India joins space race in partnership with USSR |
| 30 | 1976 - | HCLTech |
| 31 | 1977 - | Eros International |
| 32 | 1978 - | Sahara India Pariwar |
| 33 | 1981 - | India Maruti Udyog in partnership with Suzuki |

| | | |
|---|---|---|
| 34 | | Infosys |
| 35 | 1982 - | OP Jindal Group, aka JSW |
| 36 | 1984 - | Rapid Transit Rail Metro |
| 37 | 1988 - | Adani Group |
| 38 | | Technology Information Forecasting & Assessment Council, TIFAC |
| 39 | | Centre for Development of Advanced Computing, CDAC |
| 40 | 1990 - | Direct to Desk Courier & Cargo, DTDC |
| 41 | 1995 - | Department of Indian Systems of Medicine & Homeopathy |
| 42 | | Sikkim Manipal University, Private |
| 43 | | Bharti Airtel, Telecomms |
| 44 | 1997 - | Indian Institutes of Information Technology |
| 45 | | Indian Institutes of Law introduced by Act of Parliament |
| 46 | 2002 - | National Institutes of Technology, NITS |
| 47 | | SRM Institute of Science & Technology, Private University |
| 48 | 2004 - | India Science Award |
| 49 | 2005 - | Amity Education Group, Private University |
| 50 | 2008 - | Tata Nano hits the Indian streets |
| 51 | 2014 - | Ministry of AYUSH<br>Ayurveda, Yoga & Naturopathy, Unani, Siddha, Sowa Rigpa, & Homeopathy |
| 52 | | Make in India Mission |
| 53 | 2015 - | National Institute Ranking Framework, NIRF |
| 54 | 2016 - | Atal Incubation Mission, AIM |
| 55 | 2021 - | Academic Bank of Credits |
| 56 | 2022 - | India welcomes Global North Universities on Indian soil |
| 57 | | India mandates Indian Institutes of Technology to open Foreign Campuses |
| 58 | 2023 - | India joins the Global Big 5 Economies |

## The Universities of the Future

### *Shape and Nature of the Future*

If the current trend and the shape and nature of the existing academic and research parasitic and or master and slave relationship persists between the global north universities, global south and global south-south universities then the global north universities will always succeed in academically annihilating the global south and global south-south universities as their modern day academic research and development colonies destined to pay tribute to their newly found modern day academic research and development colonial masters through Patents, Publications, Licenses, Utility models, copyrights, etc.

It is very important to observe that the global north has all the relevant prerequisites for defining, shaping, implementing, regulating, monitoring and evaluation of a sound academic and research ecosystem for all and sundry the global north, global south and global south-south. But history has taught us clearly that they have no intention to do just that as they are more interested in an equally opposite unbalanced ecosystem were the global north:

- Plays king maker
- Has all the global regulatory centres; e.g. academic, research
- Decides, defines and controls how global funding is to be understood and implemented
- Disburses all forms of funding at will, without consulting global south
- Defines and controls how what is ethical and unethical
- Defines and controls global academic degrees nomenclature
- Defines and controls minimum Journal benchmarks e.g. academic and research

The global south academic and research

- Plays recipient or beggar
- Accepts as minimum standard the list of global regulatory centres e.g. academic, research
- Accepts and competes for defined global funding announced opportunities
- Receives and accounts for all forms of funding received, without explanation
- Accepts and adheres to set definitions of what is ethical and or unethical
- Accepts and implements set and announced academic degrees nomenclature
- Benchmarks with global north academic and research on minimum journal benchmarks.

To this end the global north universities have been designed, shaped, equipped and empowered to dispatch academic mercenaries with one simple direct and clear mandate, to take over all promising academic and research outputs from global south and global south-south universities. If no immediate position is established and actioned the global south will continue to remain a source of cheap:

- Highly skilled academic and research human resource
- Patent, Utility models, harvesting centre

- Test centre for high risk unethical research projects; e.g. Medical, Nuclear, and Military Dumping ground for obsolete technologies in the name of reverse engineering.

The further drifting apart between the global north academic and global south and global south-south academic poles will continue unabated as the global political and economic capitals continue to shift and waiver on key global issues like:

- Peace and stability
- Global free and fair trade
- Human rights and justice for all;
- Respect of the sovereignty of global nation states;
- Non Interference of nation states in global decision making process; e.g. United Nations, African Union, and European Union.

The global north will continue to fund research in more controversial and unethical research areas under the blessings of both public, corporate and private funds. The following areas, amongst a more wider and broader controversial research thrusts, will be introduced, though controversial at first but since the global north controls both money (grants and funds) and all forms of meaningful international media outlets they will succeed to massively perform research in:

- Human cloning;
- Human organ 3D printing;
- Atomic bombs and associated death and destruction technologies;
- Nuclear bombs and associated death and destruction technologies;
- New military human killing machines;
- Research in aviation both commercial and military; and
- Declassifying dangerous drugs into recreational drugs.

Whilst the global north has set the tone and tenor for its academic and research autonomy, it inturn ties a millstone to the global south and global south-south by redefining ethical and unethical research from a capacity based viewpoint:

- Financial capacity;
- World class research equipment;
- Highly competitive global academic and research human capital; and
- National stability, how politically stable is the host global south country.

This, in essence, means the global south and global south-south will never be allowed to venture into certain research areas as they are reserved for the global north only. Whilst the global south and global south-south academic and research universities are hoodwinked into hunting for controversial global north funding which often hunts for potentially cheap:

- Patents;
- Utility and Industrial Models;
- Licensing; and
- Copyrights

The Universities of the future, just like the Universities of old, will remain centres of designing, developing and upgrading all kinds of military arsenal (human and microbes killing machines and instruments). Universities of the future will empower man to a level like never seen before, humanity will be endowed with the capacity to kill each other in mass numbers never thought possible before, all at the wink of an eye. Universities of the future will be nothing but the manifestation of death and destruction in all manner of levels and without mercy:

- Mass murders, humanity against humanity, wars and rumours of wars;
- Product Imperialism, technologies to control and manipulate supply and demand will be developed to support and defend the global north corporates and their industries;
- Technological Colonisation, only a few technologies will be allowed to be used, the rest will be considered illegal and labelled instruments of terrorism;
- Pharmaceutical Warfare, only a handful of Pharmaceutical suppliers will be accredited the rest will be condemned as their research findings will be considered substandard by the global north corporates funded government policy formulating bodies.

Universities of the future will never be 'academically sustainable', yes they can be sustainable in their operations but it's the nature and form of the operations that then brings to question the relevance of their sustainability in a world that falling apart and need more healing than differences, in a manner of speaking Universities of the future will be a serious liability to humanity, a heavy burden to sanctity and a nuisance to human civilization.

The global academic and research university model as we know it today has been on the decline over the last 70 years or more. After several radical disagreements some global south countries who had vehemently been in contradiction with the global north academic and research university model have been, over the decades, been crafting out new and alternate ways to redefine academic and research autonomy, conduct academic and research with the same academic and research pleasure and benefits as those enjoyed by the global north and have harnessed terms like:

- Technology Diplomacy;

    - Academic Justice;
    - Academic mercenaries
- South-South academic diplomacy;
- South-South technology Diplomacy;
- South-South academic cooperation; and
- South-south technology cooperation, etc, etc.

These global south academic and research universities have begun to sprout silently and attracting more favour to those in the global south and global south-south academic and research community who feel deprived of the academic and research privileges as promised within the global north academic and research university model. Most of the natural resource rich global south-south countries, without the scientific, technological and engineering academic and research prowess to 'beneficiate' their own natural resources and are victims of 'commodity trading' have found the 'global academic and research south-south' philosophy, pregnant with appropriate promises and fit for purpose. Arrayed on offer under the global academic and research south-south model are various instruments meant to redesign, sharpen and empower the global south and global south-south academic and research communities amongst themselves so that they rise to the global academic and research table as an equal partners, competitors and players coming from a more sound academically and research global south and south-south formidable competitive platform. Amongst the instruments, but not limited to, at play to the academic and research global south and south-south model are:

- Global South and Global South-South Technology transfer;
- Global South and Global South-South Technology Diplomacy;
- Global South and Global South-South Academic Justice;
- Global South and Global South-South academic diplomacy;
- Global South and Global South-South technology Diplomacy;
- Global South and Global South-South academic cooperation; and
- Global South and Global South-South technology cooperation.

**Enter Artificial Intelligence**

There is a going to be an introduction and adoption of machine based highly complex competence skills first demanded by the rise of new Technological and Engineering companies and corporates, where man-machine will be intricately integrated, purely based on the new age society whose demands will be shaped and informed by the new social order, lifestyle demands, digital government requirements, and incremental knowledge developed by learning machines.

At the global academic and research landscape focuses more and more towards maturity level aided by the rapid domination of artificial intelligence, there is more likely to be more radical and never thought of global academic and research changes as the global academic and research ecosystem tries to re-identify, redefine, reshape, refocus, re-implement and subsequently reevaluate itself by going back to basic aided by the use of artificial intelligence.

**Global North Corporates Invasion**

The public universities are designed to absorb, officiate and endorse the global north corporate academic and research agenda through benchmarking its academic programs and research agendas with those of the global north corporate academic universities and seal that under their national mandate as per their enabling national act.

However, government as we know it today will be too slow to catchup with relevant acts, statutory instruments, policies and ordinances governing the birth of new technologies. Private universities as we know them today will also not be able to live up to the hype as they will lack the stamina and endurance to impact fully persuade and convince the government to enact new policies in line with the coming world of man-machines. The only game changing force will come from the global technological, scientific and engineering corporates, think tanks as well global original equipment manufacturers, OEM, who will enter the global academic and research arena as wolves in sheep skins. They will reshape and turn the whole global academic and research arena upside down as they will introduce a new wave of academic qualifications and research thrusts that are machine compatible.

The rise and rise of more global north individuals and corporates far richer than most global south-south countries is slowly, but surely, creating very weak global south-south governments who will abandon their visions and aspirations as a people and simply go with global corporate north academic and research agenda. These rich global north corporates will:

- Establish new successful global north corporate private universities;
- They have the money, stamina and endurance to tactfully persuade and convince the global north decision making centres to introduce, enforce, implement, monitor, assess and evaluate the deployment of the global academic and research new world order.

These global north corporates will rise exponentially in number significantly invading the academic and research space and riding very high on the premise of global academic freedom and questionable ethical research. These will emerge from the science, technology, engineering, medicine decorated by the global banking and finance academic cartels. They will dominate various key fields of human endeavours and will shape, influence, fund and drive government agendas in:

- Pharmaceuticals;
- Space sciences;
- Telecomms;
- Energy;
- Nutrition and diet;
- Petroleum;
- Electronics;
- Agriculture; and
- Banking and Finance.

The financially struggling global south-south governments, having been already entangled and impoverished by either colonisation and or tribal wars and later to find themselves independent but tied to the commodity trading poverty mill and

- They cannot fund their own national visions and aspirations;
- They cannot create meaningful employment outside the global north corporates;
- They have no influence nor muscle capacity to attract Foreign Direct Investment;

Trapped between Commodity trading or scavenging for meagre licensing fees and directed research funds offered by global north in return for allegiance to global north new academic and research world order.

The corporate private academic and research south-south universities are left with no choice but to acknowledge the arrival of a much more stronger, influential and transformative corporate global north academic and research force riding on the approval and endorsement of responsible local governments. They are meant:

- To teach benchmarked and prescribed academic courses;
- They are to adhere to align with competence skills of the global north;
- In turn they then receive licensing fees and academic grants against each candidate.

**The rise of the radical global north corporate academic and research groups.**

The perpetuation of open and deliberate global academic injustices, funding of academic and research mercenaries, by the global north under the influence of the global north corporates will lead to the rise of an equally radical group of global south academic and research mercenary universities. These universities will be funded by their governments to conduct academic and research initiatives in areas where the global north corporates would have continued and successfully influenced the global south governments to condemn as unethical or as a disaster or threat to humanity in the name of defending the academic and research sanctity, purity and relevance.

On the contrary the global north corporates would continue to privately establish, fund, operate unethical research in those globally-condemned areas without engaging, deliberating, agreeing with the other global academic and research stakeholders e.g. global south and global south-south (The Bottom Billion). Table 1.5 shows one of the possible avenues the global north corporate driven academic and research new world order may find itself in shape, thereby impacting negatively on both global south and global south-south academic and research ecosystems.

**Table 6:** Possible Global North driven academic and research new world order, impact on global south

| Global North Corporates | Global South Governments | Global South Public Universities | Global South Private Universities |
|---|---|---|---|
| **Establish:** Corporate Academic and Research Universities | **Influenced:** To amend existing Academic Research Universities Acts | **Implement:** New world order academic degrees frameworks | **Replicate:** New world order academic degrees frameworks |
| **Introduce:** New Academic man machine driven Degrees | **Adopt:** New Academic man machine driven Degrees | **Implement :** New Academic man machine driven Degrees | **Replicate :** New Academic man machine driven Degrees |
| **Draft:** New Academic man machine based competencies | **Develop:** Frameworks for New Academic man machine based competencies | **Implement:** New Academic man machine based competencies | **Replicate:** New Academic man machine based competencies |
| **Fund :** New man-machine driven Research thrusts | **Develop:** New fundable man-machine driven Research thrusts | **Compete :** For New man-machine driven Research thrusts funding | **Solicit :** For New man-machine driven Research thrusts funding |

**The Future Global Academic and Research Order**

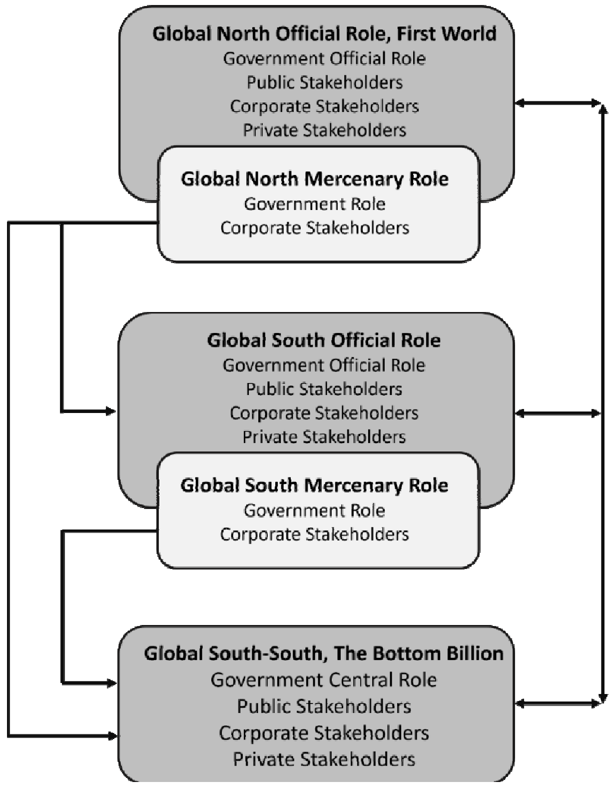


*Figure 1: The Future Global Academic and Research Order*

Figure 1.0 attempts to present a glimpse of what the future global academic research order will look like. In brief the future global academic research order will be influenced, driven, funded and monitored, by the rich and powerful global north corporates and it will be characterized by two distinct communication lines, one driven and underlined by virtues of peaceful, professional engagement and dialogue and another a one designed, defined and operated on the basis of academic dictatorship where fear, intimidation, control and command are the modus operandi.

In figure 1.0 the right side of the diagram represents the peaceful and professional academic and research engagement resulting in meaningful and collaborative dialogue. Academic diplomacy is only noted when either the global north or the global south or the global south-south calls for a meeting and the other parties respond appropriately. The global north, south and south-south are all clearly aware that they are not equal with regards to their scientific, technological advances, engineering prowess, mathematics and medicine, capacity, influence, nor infrastructure and financial resources. It is riding on the thread ultimate spirit of humanity translated into academic and research for empowerment of all by all concerned through harmonized collegial thinking engagement and collaboration that a new civilized human society may arise and the human experience may be enjoyed by all.

In figure 1.0 the left side of the diagram represents a one-way communication global academic and research injustice system driven by greed and ornamented with unfair, ruthless and unethical academic and research practices contributing and resulting into the rise of global north academic and research mercenaries, whose ulterior motives are fueled by greed, control, manipulation, oppression, death and destruction. This form of communication will originate from the global corporate north, in its desire to maintain dominance over global south and global south-south they will create a parallel system that goes against all the virtues and vices agreed on via engagement and dialogue through the right hand communication agreements. This form of academic and research injustice system will be imposed via global north academic and research corporate grants, loans, scholarships, decorated under the ambience of academic and research diplomacy as:

- Global North-South Cooperation, or
- Global North-South-South Cooperation.

As if by act of design, the Global south will also develop the controversial one-way communication academic and research mercenary style parallel system driven by fear of global north dominance thereby indulging in unfair, ruthless and unethical systems of academic and research practices leading to the rise of global south academic and research mercenaries, whose ulterior motives are fueled by fear of the powerful north and potential rise of a global north empowered global south-south. This form of parasitic academic and research oppression will be imposed via a vibrant brotherly global south academic and research corporate grants, loans, scholarships, decorated under the brotherhood of academic and research friendship as:

- Global South – south-south cooperation.

In light of the above, two very dangerous, well-funded global corporate academic and research mercenaries will arise parallel to the existing global academic and research ecosystem, one in the global north and another in the global south. However, the possibility of both north and south academic and research mercenary blocks establishing their academic and research results testing and implementation guinea pigs under the aegis of global north-south-south cooperation and global south south-south cooperation can never be ruled out resulting in the availability of very risky, unethical and substandard researches and their respective products flooding the global south-south, below are examples:

- Killing machines and other related technologies;
- Microbe kingdom destabilising technologies;
- Unethical experiments on humans as killing agents;
- Destruction of ‘natural’ agriculture as we know it today; and

- Dumping of not so easy to recycle ICT technology products etc, etc.

**The Global South, Global South-South the Bottom Billion Inclusion**

It is quite difficult to foresee the global south-south bottom billion, poorest of the poorest, benefitting meaningfully from any form of externally drafted academic and research university models, especially those in Africa. A whole mindset change triggered by an undiluted proactive spirit is demanded from the global south bottom billion, the simple ability to see above and beyond the majority is the calling of this time. Global south-south academic and research capitals need to be established as a matter of urgency.
If the global south countries are proactive and united to take the mantle upon themselves, they will present to themselves a far better global south academic and research ecosystem inline with and close to their own taste and desires than a global north imposed one. Dialogue between the global south corporates and the global south governments is key from the onset if the model is to yield any meaningful result. Once the global south corporates and the global south governments are in tandem then it's easy to incorporate the subsequent global south public universities in harmony with the global south private universities. Unity of purpose is vital here and it can be interpreted as the sincerity and integrity exuded by concerned parties, individuals or nations in peacefully engaging, agreeing and committing to an agreed course or courses of action and or dialogue upon reaching a conclusive state and holding fast and true to it, without any use of force, violence or external interference by any means necessary.

**Mind boggling global academia and research and the global south-south image.**

If no due respect for humanity is exercised Universities of the future will surely be designed as weapons against humanity to cause untold suffering in the global south-south also known as the bottom billion, the poorest of the poorest who unfortunately are endowed with the globally much needed natural resources, in all shapes, forms, quality and quantity. The smart and well executed model by the global north corporates, of not empowering the global south-south with an academic and research landscape with the much needed abilities and capabilities for beneficiation of their own natural resources has been a bone of contention for decades.

There has been, there is and there will remain to be greater need for the bottom billion to be empowered to beneficiate their natural resources and move away from the globally exploitative poverty train of commodity broking. In the absence of colonisation the academic and research global south-south universities have also done a better job in impoverishing their own. The bulk of the global south-south degrees are highly questionable with most of their researches being nothing but products of cheap academic and research replicas found in the old dustbins of the global north academic and research communities. The smaller percentage of the best minds in the global south and south-south in the so called science, technology, engineering, mathematics and medicine domains end up in the corporate laboratories, workshops and factories of the global corporate north and global corporate south. Table 1.6 shows the possible global south driven academic and research new world order, impact on global south-south (The bottom billion, the poorest of the poorest)

**Table 7:** Possible Global South driven academic and research new world order, impact on Global South-South (The bottom billion)

| Global South-South Corporates | Global South-South Governments | Global South-South Public Universities | Global South-South Private Universities |
|---|---|---|---|
| **Engage:** Corporates to establish Corporate academic and Research Universities | **Facilitate :** Amendment of existing Academic Research Universities Acts | **Implement:** New world order academic degrees frameworks | **Implement:** New world order academic degrees frameworks |
| **Converge :** To develop new academic man machine driven Degrees | **Facilitate :** The drafting of new academic man machine driven Degrees | **Implement :** New Academic man machine driven Degrees | **Implement:** New Academic man machine driven Degrees |
| **Dialogue:** On possible new academic man machine based competencies | **Facilitate :** Drafting of new frameworks academic man machine based competencies | **Implement:** New Academic man machine based competencies | **Implement:** New Academic man machine based competencies |
| **Pool Resources :** For new man-machine driven research thrusts | **Facilitate :** Establishing of new fundable man-machine driven Research thrusts | **Compete :** For New man-machine driven Research thrusts funding | **Compete :** For New man-machine driven Research thrusts funding |

**Silent Sounds of Ancient Modernity – The Rise of Global Ubuntu**

Selected by the intriguing and innovative, wind propelled, hand tossed, ancient centuries worn-out, weaved devices of modern day envy and wonder. Roasted by the ancient wild fires of mother Africa; borne out of the aromatic indigenous trees of mother Africa and finely grounded by the resounding silent sounds of mortars and pestles of the African Ubuntu royal order, producing an irresistible blend of Africa's nothing but only finest: a centuries old signature of perfection defined and enshrined in the sacred hills and caves of mother Africa.

Tailored? Meticulously bone stitched wild animal hides announced the arrival of mother Africa's ancient sense of beauty and a precipitate ancient African fashion culture of royalty unparalled to none. A hoarse and noisy call to the silent and patient sound of a serene meeting place where African tradition meets and confronts the virtues of modernity hammered by the paws of mother Africa's big five wild and giant cats decorated and dressed by nature at her best.

A perfect view of the daily savanna jewel is the adorning and refreshing sight of the rise of a new young, youthful and unfazed Serengeti dawn determined to birth a new, wiser and free generation full of untapped energy, hidden behind the granite boulders of the Matopos dotted, deep deep in the African wild and holding in its loins, seeds of a generation shrouded in the thunderous silent mysteries of the new and inevitable global Ubuntu, free from foreign civilization's expensive interior decorations: always hanging very colorful portraits of a tired and ignorant Africa.

The noisy chains of foreign modernity and civility seeking to erase the pleasant savour of ancient Ubuntu aroma footprints, will not prevail, as mother Africa's ancient drums continue churning out rhythmic harmonious sounds of unity, silence and peace, that will always remain louder than the indignant rhythms of foreign domination decorated in noise, trauma, death and destruction. Where the loud silence of the sounds of blowing winds is never summoned for questioning, therein lies the ancient beauty of modernity's true cardinals and virtues for the new age global Ubuntu.

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# 13
# ACTION LEARNING AS A TEACHING METHODOLOGY IN UNIVERSITY EDUCATION

**Dr. Alok Mishra**

*University education is undergoing a transformative shift, with traditional lecture-based pedagogy being supplemented or replaced by innovative teaching methodologies. One such approach that has gained considerable attention in recent years is action learning. Action learning is an experiential and collaborative method of learning that involves students tackling real-world problems and reflecting on their experiences. Action Learning is a robust educational strategy, especially relevant in the context of higher education. It centers on a problem-solving process where participants work in groups, using real-world problems as a medium to learn. The technique is more than just problem-solving, as it integrates reflection, learning, and action. Within a university setting, it holds immense potential to reshape how education is imparted and how students grasp concepts. This article explores the concept of action learning, its principles, implementation in university education, benefits, challenges, and its role in preparing students for the complex challenges of the 21$^{st}$ century.*

***Keywords:*** *Curriculum development, Teaching, Methodology, Higher Education, Integration,* Self-directed learning, *Critical Thinking*

## Introduction

University education is undergoing a transformative shift, with traditional lecture-based pedagogy being supplemented or replaced by innovative teaching methodologies. One such approach that has gained considerable attention in recent years is action learning. Action learning is an experiential and collaborative method of learning that involves students tackling real-world problems and reflecting on their experiences. Action Learning is a robust educational strategy, especially relevant in the context of higher education. It centers on a problem-solving process where participants work in groups, using real-world problems as a medium to learn. The technique is more than just problem-solving, as it integrates reflection, learning, and action. Within a university setting, it holds immense potential to reshape how education is imparted and how students grasp concepts.


Action learning is a pedagogical approach rooted in the belief that individuals learn best through experience, reflection, and collaborative problem-solving. Developed by Reg Revans in the 1940s, action learning has its origins in management and organizational development. It was initially designed to enhance problem-solving in professional settings and has since evolved to find applications in various educational contexts.

**Core Principles of Action Learning**

Action Learning, a dynamic approach to problem-solving and learning, has gained significant traction in various educational and organizational settings due to its emphasis on real-world challenges and reflective practice. At its heart, Action Learning is based on a set of core principles that guide its implementation and effectiveness.

(a) **Real-world Problem Solving**: At the foundation of Action Learning is the idea that learning is most effective when individuals or groups tackle real, pressing issues rather than hypothetical scenarios. This approach not only provides a genuine context but also ensures that the learning is relevant and immediately applicable.

(b) **Reflection**: Action Learning isn’t merely about jumping to solutions. The process places significant importance on reflecting upon the problem, the chosen solutions, the outcomes, and the learning journey itself. Reflection is as integral as the action, allowing participants to refine their understanding and strategies for future challenges.

(c) **Learning through Questions**: Rather than focusing solely on solutions, Action Learning encourages asking questions. The act of questioning stimulates critical thinking and often leads to deeper insights. As Reg Revans, the pioneer of Action Learning, emphasized, effective learning is a balance between the knowledge one possesses and the questions one asks.

(d) **Small Group Collaboration**: Action Learning typically occurs in small groups, often referred to as 'Action Learning Sets' or 'ALS'. These sets are usually diverse, allowing for a variety of perspectives and approaches. Working within such a group fosters teamwork, communication, and collaborative problem-solving.

(e) **Taking Action**: Action Learning isn't a theoretical exercise. Once a potential solution to a problem is identified, it is put into action. This real-world application is pivotal as it provides a concrete context for learning and reflection.

(f) **Commitment to Learning**: While solving the problem at hand is a goal, the primary objective of Action Learning is learning. Participants should be committed to their personal and group learning journeys, ensuring that insights are gleaned from each stage of the process.

(g) **Facilitator’s Role**: While the participants are at the center of the Action Learning process, a facilitator or coach often guides them. The facilitator's role isn't to provide answers but to steer the group, ensuring they remain focused on both problem- solving and learning.

These core principles, when effectively woven into the fabric of the Action Learning process, ensure that it isn’t just a problem-solving tool but a profound learning journey. Whether it's in educational settings or organizational contexts, Action Learning has proven to be a potent approach, fostering not just knowledge acquisition but also skills like critical thinking, collaboration, and adaptability. In today's ever-evolving landscape, where real-world challenges are complex and multifaceted, Action Learning stands out as a beacon, emphasizing that the best learning stems from doing, reflecting, and iterating.

**Historical Background**

Action Learning, a term now ingrained in the annals of educational theory, has its roots anchored in the early to mid-20th century. The credit for introducing and developing the concept goes largely to Reg Revans, a British academic, whose work was the foundation stone for the methodology that has become synonymous with real-world problem-solving and reflective learning.

Reg Revans embarked on the journey of conceptualizing Action Learning during his tenure at the University of Cambridge in the 1930s and 1940s. As a physicist, he was associated with some of the best minds of that era, including the Nobel Prize-winning scientists. Observing their approach to solving problems, Revans realized the value of questioning and reflective thinking. These scholars often learned not just from their structured experiments but also from their shared reflections, discussions, and mutual challenges. However, the first practical application of his ideas was not in the academic world but in the coal mines of Wales in the late 1940s. Revans observed the operations and the challenges the miners faced. By forming groups wherein miners collaboratively discussed and reflected upon their issues, Revans put forth that learning could be embedded in action – solving real problems. The results were striking. With no formal instructor and a process purely based on mutual questioning and problem-solving, productivity saw marked improvements.

To capture the essence of this methodology, Revans coined the formula:

$$L=P+Q.$$

Here, $L$ stands for Learning, $P$ for programmed knowledge (the knowledge already available), and $Q$ for questioning to provoke thought. It was this 'Q' element that Revans believed was the critical differentiator in learning.

The success in Wales was just the beginning. In the 1970s and 1980s, Revans took his ideas to Belgium, working with executives at the Belgian steel industry. The same principles, when applied, led to positive outcomes, reinforcing the belief in the power of Action Learning. While Europe was the birthplace of Action Learning, its appeal was universal. Over the subsequent decades, the method was embraced worldwide, from North America to Asia. Each region adapted Action Learning to its own cultural and educational context, but the core essence remained: real-world problem-solving coupled with reflection.

In the latter part of the 20th century, the academic world began to see the value in this approach. Business schools, particularly, found the idea of Action Learning appealing. Instead of teaching students through traditional lectures and hypothetical case studies, these institutions saw the benefit of real-world problem-solving. MBA students began consulting with actual businesses, providing solutions to genuine issues and, in the process, learning far more effectively. Today, Action Learning is not confined to any one discipline. It has found a place in sectors as diverse as healthcare, engineering, and public administration. It's a testament to the timelessness and universality of Revans' ideas. Action Learning's journey from the academic corridors of Cambridge to coal mines in Wales and then to the boardrooms of global businesses is a remarkable tale. It emphasizes the importance of challenging conventional wisdom, the power of reflective questioning, and the profound results that can come from learning rooted in real-world action. As Reg Revans himself put it, "For the things we have to learn before we can do them, we learn by doing them."

***Benefits of Action Learning in University Education***

In the realm of university education, traditional pedagogical methods, while valuable, often fall short in equipping students with real-world skills and adaptability. Action Learning, with its foundation in hands-on problem-solving and reflective practice, emerges as a potent tool to bridge this gap. The benefits of integrating Action Learning in university education are manifold:

(a) **Real-world Problem-solving**: Action Learning is rooted in tackling actual, pressing issues rather than theoretical scenarios. This equips students with practical skills and experience, ensuring they are prepared for real-world challenges post-university.

(b) **Enhanced Critical Thinking**: The emphasis on questioning in Action Learning stimulates critical thought. Students learn not just to accept information but to interrogate it, leading to deeper understanding and more innovative solutions.

(c) **Collaborative Learning**: Action Learning typically involves teamwork, fostering collaborative problem-solving. In a diverse university setting, this means students benefit from multiple perspectives, enhancing their interpersonal skills and appreciation for diverse viewpoints.

(d) **Development of Soft Skills**: Beyond academic knowledge, students hone essential soft skills like communication, leadership, adaptability, and conflict resolution. These skills are highly sought after in the professional world and are often what set individuals apart.

(e) **Emphasis on Reflection**: Reflective practice is integral to Action Learning. This nurtures the habit of self-assessment and continuous improvement in students, ensuring they remain lifelong learners.

(f) **Immediate Feedback**: The real-time application of solutions ensures immediate feedback. Students can assess the efficacy of their solutions and adapt accordingly, leading to more resilient problem-solving skills.
(g) **Bridging Theory and Practice**: Often, there's a chasm between academic theory and its practical application. Action Learning bridges this gap, allowing students to apply theoretical knowledge in real-world contexts, reinforcing their learning.
(h) **Enhanced Engagement**: Given the hands-on nature of Action Learning, students are often more engaged and invested. This increases retention and ensures a deeper understanding of the subject matter.

1. **Preparation for Professional Life**: By grappling with real-world problems and working in teams, students get a taste of professional life's challenges and dynamics. This makes their transition from university to the professional world smoother.
2. **Fostering a Growth Mindset**: Encountering and overcoming real challenges instils a growth mindset in students. They learn to view setbacks as learning opportunities, making them more resilient and open to growth.

Integrating Action Learning in university education ensures students aren't just passive recipients of knowledge but active participants in their learning journey. This methodology not only equips them with academic knowledge but also with the skills, mindset, and adaptability required in today's ever-evolving world.

**Action Learning Process**

Action Learning, a dynamic methodology rooted in solving real-world problems and reflective practice, has revolutionized the learning paradigm in both educational and organizational settings. Understanding the process is essential to harness its potential. The Action Learning process is usually delineated into several stages:

1. **Problem Identification**: Unlike conventional learning approaches that often begin with theory, Action Learning commences with a genuine, pressing issue or problem. This problem can arise from any domain, be it an organizational challenge, a community concern, or an academic question. The crucial element is that it should be a real problem whose resolution brings about meaningful change.
2. **Formation of Action Learning Set (ALS)**: An Action Learning Set is a small group, usually comprised of 4-8 individuals, tasked with addressing the problem. Diversity in these sets is encouraged, as different backgrounds, experiences, and perspectives lead to richer dialogue and more innovative solutions.
3. **Clarification and Definition**: Once the group convenes, it's essential to clarify

and define the problem. This involves understanding its nuances, underlying causes, and implications. Given Action Learning's emphasis on questioning, this stage often involves deep inquiry, with participants probing and challenging assumptions.

4. **Planning and Strategy Development**: With a clear grasp of the problem, the ALS begins brainstorming potential solutions. This isn't about jumping to the first or most obvious answer but rather exploring a range of strategies and analysing their potential outcomes. It's a collaborative effort, and the plan is shaped and reshaped through group discussions.
5. **Action Implementation**: As the name suggests, Action Learning isn't just theoretical. Once a strategy is chosen, it's put into practice. Participants take the necessary steps to implement the solution, observing its effects in the real world.
6. **Reflection and Learning**: After action is taken, a crucial step in the process is reflection. The group reconvenes to discuss the outcomes, whether the solution was effective, and what could have been done differently. This reflective phase is where significant learning occurs. By evaluating their actions, participants glean insights and refine their problem-solving skills.
7. **Revised Action**: Depending on the outcomes of the implemented solution, the group might decide to take revised actions. This iterative approach ensures that the problem is tackled from multiple angles and that solutions are continuously improved upon.
8. **Sharing and Application of Learning**: As the Action Learning process concludes, it's essential for participants to share their learnings, both within the ALS and with larger communities. This dissemination ensures that the insights gained aren't localized but benefit a broader audience.
9. **Closure and Celebration**: Once the problem is adequately addressed, it's vital to acknowledge the efforts of the ALS and celebrate their achievements. This fosters a sense of accomplishment and encourages future participation in Action Learning endeavours.

Action Learning's power lies not just in its results but in the journey itself. The process nurtures skills like critical thinking, collaboration, and adaptability. Moreover, by rooting learning in real-world challenges, it ensures relevance and immediate applicability.

**Implementing Action Learning**

Implementing Action Learning in university education requires a thoughtful approach to ensure its efficacy and to reap the maximum benefits. Here are the key considerations when adopting this methodology:

1. **Alignment with Learning Objectives**: Ensure that the Action Learning project aligns with the course's broader learning objectives. It should serve as a platform for students to apply theoretical knowledge and not just be an isolated activity.
2. **Selection of Real-World Problems**: Choose genuine, pressing issues that challenge students to apply their knowledge and skills. These problems should be relevant, meaningful, and allow for multiple solution approaches.
3. **Diverse Action Learning Sets (ALS)**: Form student groups with diverse backgrounds and perspectives to encourage rich dialogue, creativity, and comprehensive problem-solving.
4. **Role of the Facilitator**: The role of educators shifts from being mere instructors to facilitators. They should guide the learning process, stimulate critical thinking through questioning, and ensure that the group remains focused.
5. **Safe Learning Environment**: Create an environment where students feel comfortable sharing their thoughts, making mistakes, and learning from them. This is crucial for fostering open dialogue and reflective practice.
6. **Integration with Curriculum**: Action Learning shouldn't be an add-on but should be seamlessly integrated into the curriculum, enhancing traditional teaching methods.
7. **Assessment and Feedback**: Develop assessment criteria that evaluate both the process and the outcomes. Feedback should be constructive, focusing on how students can improve in future Action Learning projects.
8. **Duration and Timing**: Ensure that the duration of the Action Learning project allows for deep exploration, reflection, and revision of solutions. Timing should be such that students have adequate background knowledge to tackle the problem effectively.
9. **Resource Availability**: Ensure that students have access to necessary resources – be it literature, field experts, or materials – to address the problem at hand.
10. **Stakeholder Involvement**: If the problem is sourced from an external organization or community, involve relevant stakeholders in the process. They can provide valuable insights and ensure the applicability of the proposed solutions.
11. **Reflective Practice**: Emphasize the importance of reflection throughout the process. Encourage students to maintain reflective journals or conduct debriefing sessions to consolidate their learning.
12. **Ethical Considerations**: Given that Action Learning often deals with real-world problems, it's vital to address any ethical concerns, especially if the problem pertains to sensitive issues or vulnerable populations.
13. **Scalability and Flexibility**: While it's essential to have a structured approach, the Action Learning process should be flexible enough to accommodate varying problems, group dynamics, and unexpected challenges.
14. **Continuous Improvement**: Post-implementation, gather feedback from students and stakeholders to refine the process. Continuous evaluation ensures that the Action Learning methodology remains effective and relevant.

15. **Preparation and Orientation**: Before diving into the Action Learning project, conduct orientation sessions to familiarize students with the methodology, expectations, and potential challenges.

By giving due consideration to these aspects, universities can create a robust Action Learning framework that complements traditional teaching methodologies, offering students a holistic, applied, and reflective learning experience.

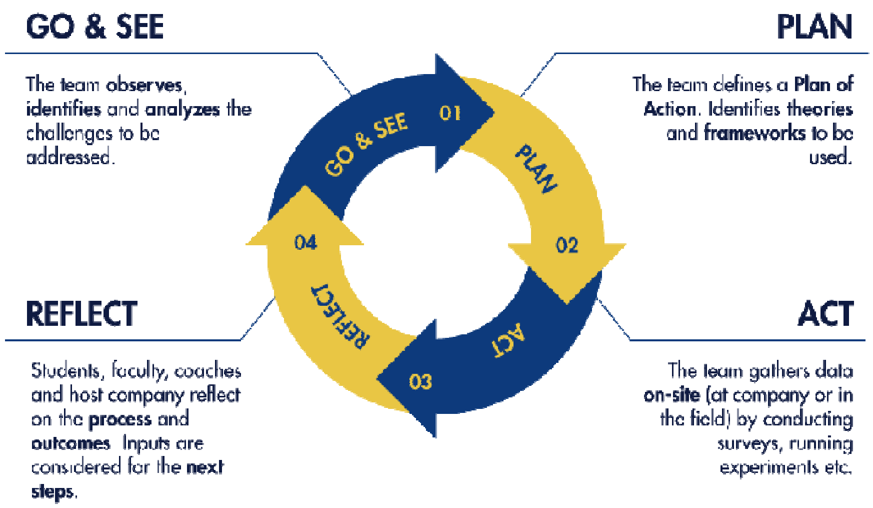
**Action Learning in Universities: A Glimpse into Case Studies Across Disciplines**

Action Learning has permeated academic spheres, with several universities adopting this hands-on, problem-solving methodology to enhance their curricula. Here's a glance into how Action Learning has been employed in various universities and disciplines:

1. **MIT Sloan School of Management**: The Leadership Lab, a program within MIT's MBA curriculum, utilizes Action Learning to tackle leadership challenges. Students work on team projects addressing real-world problems, complementing their classroom learning. The integration of Action Learning fosters skills like teamwork, leadership, and problem-solving, bridging the gap between theory and practical application.
2. **Stanford University's Design School**: In their Product Design program, students employ Action Learning principles in the 'Design Garage'. Here, students collaborate with industry professionals to prototype, design, and develop products, integrating their academic knowledge with industry insights.
3. **University of Gloucestershire, UK**: The Business School offers an 'Applied Business Projects' module. Students engage in Action Learning sets, exploring real business challenges presented by local companies. They are required to provide innovative solutions while reflecting on their learning experience.
4. **University of Queensland, Australia**: In the School of Civil Engineering, Action Learning is incorporated in the curriculum through community-based projects. Students collaborate with local communities to address infrastructural challenges, providing solutions that are both technically sound and community-centric.
5. **University of Maastricht, Netherlands**: Recognized for its Problem-Based Learning (PBL) system, the university incorporates Action Learning in various disciplines, including Medicine and Law. Students engage in case studies, simulating real-world challenges, fostering critical thinking, research skills, and practical application.
6. **University of Malaya, Malaysia**: The Faculty of Education implements Action Learning in its teacher training programs. Aspiring educators work on school-based projects, reflecting on classroom dynamics, teaching methodologies, and student

engagement. This hands-on approach prepares them for the nuances of real-world teaching.

These cases highlight the versatility of Action Learning, adaptable across disciplines, cultures, and academic levels. The underpinning principle remains consistent: to engage students in practical problem-solving, drawing from their academic insights, facilitating a holistic learning experience.




*Action Learning Process at Asia School of Business Malaysia in Collaboration with MIT Sloan*

**Challenges in Implementing an Action Learning Program at University Level**

Action Learning, though beneficial, can present a series of challenges when introduced at a university setting. The transformation from traditional pedagogical methods to an interactive, problem-solving approach may be daunting for both educators and students. Here are some of the prominent challenges:

1. **Resistance to Change**: Academia, often steeped in tradition, can sometimes be resistant to change. Faculty members accustomed to lecture-based teaching might find it challenging to shift to a facilitator role required in Action Learning.
2. **Lack of Real-world Problems**: A core component of Action Learning is addressing real-world problems. However, securing genuine, challenging problems from industries or communities for students to tackle can be difficult.
3. **Time Constraints**: Action Learning requires time for reflection, an essential part of

the process. The conventional semester system might not always allow for the extended time that Action Learning projects may need.

4. **Assessment Difficulties**: Traditional grading systems might not be suitable for Action Learning. Evaluating group dynamics, individual reflections, and problem-solving processes requires a more nuanced grading approach than conventional exams or assignments.
5. **Group Dynamics**: Diverse student groups can sometimes lead to conflicts or unequal participation. Ensuring every member contributes and benefits can be challenging.
6. **Facilitator Training**: Not every lecturer or professor is equipped to facilitate an Action Learning set. Training educators to guide without dominating, to provoke thought without providing solutions, is crucial and can be resource-intensive.
7. **Scalability**: While Action Learning might work well with small groups, scaling it to accommodate larger student cohorts without diluting the learning experience can be challenging.
8. **Resource Constraints**: Action Learning projects, especially those involving fieldwork, prototyping, or community engagement, can be resource-intensive. Universities might struggle with funding or providing logistical support for such endeavours.
9. **Stakeholder Engagement**: Engaging external stakeholders, like businesses or communities, is vital for genuine Action Learning projects. However, establishing and maintaining these relationships can be demanding.
10. **Differing Expectations**: Students might come into a course with the expectation of traditional lectures and exams. The shift to Action Learning can be disorienting, requiring a clear communication strategy to manage expectations.

While these challenges might seem significant, they are not insurmountable. With appropriate planning, stakeholder engagement, and resources, universities can harness the transformative power of Action Learning, offering students an enriching and holistic educational experience.

**The Future of Action Learning in Universities**

Action Learning, with its focus on real-world problem-solving and experiential learning, has been making waves in university education. Given the rapid pace of technological change and the dynamic needs of the 21$^{st}$ century job market, the relevance of Action Learning is expected to grow. Here's a look into the potential future of Action Learning in universities:

1. **Digital Transformation**: The integration of digital technologies will amplify the reach and impact of Action Learning. Virtual Action Learning sets, using platforms

like Zoom or Microsoft Teams, can facilitate collaboration between students across the globe, providing diverse perspectives on challenges.

2. **Interdisciplinary Collaboration**: The future will likely see more courses combining disciplines. For instance, a business management course could collaborate with an environmental science department to address sustainability challenges in businesses.
3. **Community Engagement**: Universities will increasingly engage with local communities. Students can work on projects that address local challenges, promoting community growth while offering invaluable real-world experience.
4. **Global Perspective**: With the world becoming increasingly interconnected, Action Learning projects will emphasize global challenges, like climate change or global health issues. Students might collaborate with peers from universities worldwide, fostering a global perspective.
5. **Integration with Industry**: Partnerships between universities and industries will strengthen. Real-world industry problems will become common coursework, bridging the gap between academia and industry.
6. **Focus on Soft Skills**: Apart from problem-solving, Action Learning will be used to develop soft skills crucial for modern workplaces, like communication, teamwork, and critical thinking.
7. **Personalized Learning Paths**: With the aid of technology, Action Learning can be tailored to suit individual student's learning styles and career goals, making education more student-centric.
8. **Assessment Evolution**: Traditional exams and assignments might give way to evaluations based on project outcomes, reflections, and peer reviews. This shift would provide a more holistic view of a student's skills and capabilities.
9. **Faculty Development**: As Action Learning becomes more mainstream, there will be a surge in programs dedicated to training faculty in facilitating Action Learning sets effectively.
10. **Institutional Support**: Universities will likely invest more in infrastructure supporting Action Learning, be it in the form of digital tools, dedicated project spaces, or community engagement offices.

While the future seems promising, it is contingent on universities recognizing the value of Action Learning and committing resources to its effective implementation. The dynamic nature of the global landscape necessitates an educational approach that equips students not just with knowledge but with the skills to apply it. Action Learning, with its emphasis on doing and reflecting, fits this requirement aptly.

## Concluding Remarks

Action Learning, as a pedagogical approach in university education, has undergone a transformative journey from its historical underpinnings to its envisioned future. Emphasizing real-world problem-solving, reflective practices, and collaboration, this methodology resonates deeply with the evolving educational landscape.Historically, the roots of Action Learning can be traced back to Reg Revans. Revans championed the idea that learning most effectively occurs when faced with real-world challenges. Over time, as traditional lecture-based learning methods have been scrutinized for their limited applicability in professional settings, Action Learning has garnered increasing attention. Its practical orientation bridges the gap between theoretical knowledge and its application in real-world scenarios.

The core principles of Action Learning are what set it apart. Focusing on a cyclical process of action and reflection, it emphasizes the importance of 'learning by doing.' It's not just about finding solutions to problems but understanding the learning that emerges from the process. With a facilitator's role being more of a guide than an instructor, Action Learning promotes self-directed learning and critical thinking, traits indispensable in today's rapidly changing world. The tangible benefits of Action Learning in university education are manifold. By embedding real-life problems into the curriculum, students are better prepared for professional life, armed with problem-solving capabilities and the ability to adapt to new situations. The methodology also fosters essential soft skills, from teamwork to communication, that are often cited as lacking in fresh graduates. However, as with any teaching methodology, there are challenges to consider. Implementing Action Learning requires a shift in both institutional mindset and infrastructure. The traditional lecture-based model is deeply entrenched in many institutions, and moving towards a more student-centric approach necessitates significant change. Faculty need training to adapt to their roles as facilitators, and curriculums must be overhauled to accommodate real-world projects. Yet, the potential future of Action Learning in universities is promising. Digital transformations, global perspectives, interdisciplinary collaborations, and increased community and industry engagement are trends likely to shape the next phase of Action Learning. As universities strive to stay relevant in a globalized world, the integration of Action Learning into mainstream education will be a game-changer.

Case studies across various universities and disciplines already underscore the versatility and effectiveness of this approach. Whether it's business students working on sustainability challenges or computer science students partnering with local businesses to develop software solutions, the real-world impact of these projects is palpable.

Despite potential roadblocks, the trajectory of Action Learning seems clear. As we stand on the cusp of an educational revolution, driven by technology and the need for skills that transcend textbooks, Action Learning will play a pivotal role. It promises an education that is not just about absorbing knowledge but using it, adapting it, and learning from it.

In essence, Action Learning doesn't just prepare students for the world; it brings the world to the students. As universities strive to produce not just graduates but lifelong learners, innovators, and problem-solvers, the embrace of Action Learning is not just an option – it's an imperative. The future of education beckons a more integrated, practical, and reflective approach, and Action Learning, with its rich legacy and brighter horizon, is poised to lead the way.

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# 14
# UNIVERSITIES TOMORROW: INDIA AND BEYOND

**Udaya Narayana Singh and Rana Bedi**

*This article tries to explore what tomorrow's universities could look like. The world is riding on the AI wave and its integration with Education is already being touted as the next revolution in the Ed-Tech Industry. India, however, still has many fundamental hurdles to cross. This article offers perspectives, evaluations by global media, experts, educators, researchers, seamlessly weaved into the authors' own interpretations and ideas of what Universities of Tomorrow will look like. The aim has been to provide a single point of reference for anyone seeking to review the latest possibilities and trends in education, with a special focus on what Indian Universities can learn from its own history as well as practices of world-leading institutions. Escalating development in Higher Education on this side of the growth spectrum becomes evident.*

***Keywords:*** *academic research, AI, education, educational, Education Policy, Higher Education, Indian education, industry-academia, online learning, research, students, Universities.*

## Introduction

### Survival of the fittest: nation, economy & education

#### *The Issue of Sustainability*

On Sept 19, 1999, Roger Segelken described in *Cornell Chronicle* based on a David Pimentel and his team's[3] report that "It will be much more difficult to survive in a world without voluntary controls on population growth and ever diminishing supplies of the Earth's resources." With per capita decrease in food production, and with 3 billion people suffering from malnutrition already, the resultant situation will curtail many freedoms: "freedom to travel and commute to work quickly and efficiently, freedom to visit and enjoy natural areas, freedom to select desired foods and freedom to be effectively represented by government." Our Biotechnology may not be fast paced enough to arrest this decline. Another report, coming out of Universal Business School in Australia says that as we passed on from one economic era to another, our population rose 25 times faster than our economy (Hooke & Alati 2021.) Of course, Science and Technology have been the major source of growth in the recent times. Our "economic eras have generally been getting shorter – the hunting era lasted 1.5 million years, the farming era 12,000 years, and the industrial era 200 years," and the ongoing digital era. Based on the descriptions of the UN's Population Division, CIA's The World Factbook, and the above authors' World Income Model for 168 counties, we see the following picture emerging:

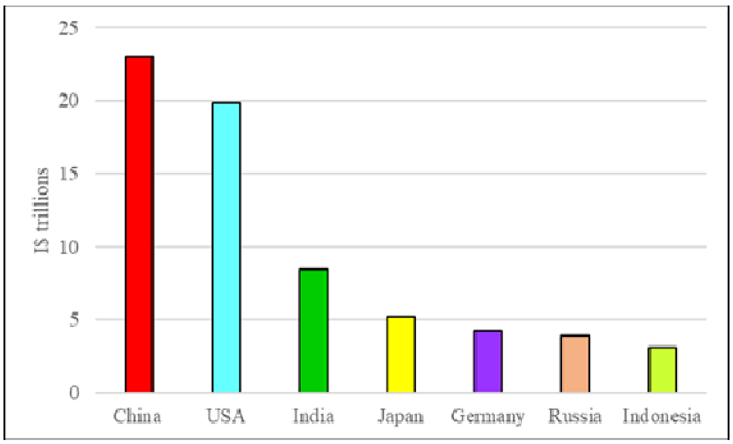


***Figure 1: GDP in the World's Seven Largest Economies, 2020***

This model assumes that the trajectory of a country's labour productivity depends on (1) the country's position relative to the global technology frontier, (2) the potential of the country to reach the frontier, and (3) the date on which it will realise this potential, and by that count – India will reach the mark in 2100 which the USA would have achieved in 2040. This is because this convergence model divides economic eras into three distinct phases: the breakaway, the catch-up, and the fine-tuning phase, and the economic agents into two categories: the technology leaders and the technology followers. My question is: What can our institutions of higher learning do to place India in the Technology Leader module? That should be our aim, and that will also define and shape our future. But one may ask, why did we slide down in the knowledge generation scenario, and what could have been the cause. First, lack of investment in high quality knowledge generation (that can be done only by innovative teacher-researchers) has pulled us down to a great extent. Second, our leaders of institutions have not been visionary, and could not see the trend in higher studies. Therefore the 2.5 million graduates we are churning out every year are of so uneven quality that the crème migrates to world ranking institutions abroad, leaving not many capable thought-leaders behind in our indigenous institutions. This flight of ideas and brains to elsewhere has been and will be a major concern unless our political leadership learns to make the condition easier for the new age researchers. Many have the habit of blaming our multicultural and plurilingual existence. Their theory, which I think is very much ill-conceived, is that we lag behind also because we do not know how to speak in the languages of power as we pen down our ideas. But to my mind, rather than blaming the medium, we need to see why our ideas and inventions are not game-changers. Our linguistic plurality rather enriches our every-day existence and prompts us to think differently, think innovatively. It is easy to use, as The Hindu has done in its report while outlining this problem by quoting from Shakespeare's *Hamlet*, where Marcellus says that "Something is rotten in the state of Denmark," and stop there – while evaluating our crises (Walia, 2023.) Bringing in foreign university campuses would not improve this situation, it is guessed there. The Outlook, on the other hand, reports that "Universities are in a fix because of the gap between high aspirations and low quality arising out of poor schooling" (Bhattacharya, 2023.) If we are merely doing derivative research, and not innovative work, we are and will remain technology followers, and not world leaders in S&T.

**Trends & possibilities in world-class education**

Predicting the exact future of universities is challenging, but several trends and possibilities provide insights into what the world universities of the future might look like:

- **(a)** We are moving towards Digital Transformation and Online Learning, as the integration of technology and online learning platforms continue to grow. Virtual classrooms, AI-driven personalized learning, and flexible learning schedules may become more prevalent.
- **(b)** Global Collaboration among universities are likely to result in more international collaboration, with students and faculty participating in joint research projects, exchange programs, and online courses with institutions from around the world.
- **(c)** Interdisciplinary Programs: The boundaries between traditional disciplines may blur, and universities could offer more interdisciplinary programs that address complex real-world problems. This approach fosters creativity and innovation.
- **(d)** Focus on Lifelong Learning will gain prominence. Universities may play a more active role in providing continuous education and upskilling opportunities throughout individuals' careers.
- **(e)** Experiential Learning and Real-World Applications would ensure that there is greater emphasis on hands-on, experiential learning and real-world applications of knowledge will likely increase. Universities of the future may strengthen ties with

industries to provide students with practical experiences and ensure graduates are job-ready.

**(f)** Personalized Education: Students' personalized learning paths will be tailored to individual needs and preferences. Adaptive learning technologies and AI-driven educational platforms could help customize education experiences.

**(g)** There will be focus on 'Soft Skills' such as thinking, creativity, communication, and problem-solving, recognizing their importance in a rapidly changing and interconnected world.

**(h)** We will have to develop Diverse Assessment Methods of measuring student achievement, moving away from traditional exams to incorporate project-based assessments, portfolios, and other forms of evaluation.

**(i)** Global Challenges and Sustainability such as climate change, public health, and social inequality, or Sustainability and social responsibility could become integral components of education in future.

**(j)** Decentralized Credentials: The concept of traditional degrees might evolve, with a greater emphasis on micro-credentials, digital badges, and other decentralized forms of certification that reflect specific skills and competencies.

**(k)** We need to see how we are integrating Artificial Intelligence and Automation into various aspects of education, from personalized tutoring to administrative tasks. This technology may enhance efficiency, allowing educators to focus on more complex aspects of teaching.

**(l)** Virtual and Augmented Reality may enhance the learning experience, providing immersive simulations and virtual laboratories, particularly in fields like science, medicine, and engineering.

**(m)** Flexible and Agile Institutions: Universities may become more flexible and agile, adapting quickly to changes in technology, industry demands, and global trends. This flexibility could extend to curriculum development, teaching methodologies, and institutional structures.

**(n)** Ethical Considerations and Data Privacy: With increased reliance on data and technology, universities will need to prioritize ethical considerations and ensure robust data privacy measures to protect student information.

While these trends provide a glimpse into potential developments, the future of universities will likely be shaped by a complex interplay of societal, technological, economic, and educational factors. Adaptability and a willingness to embrace change will be essential for our universities tomorrow which must be redesigned.

### *Life-Long Learning*

Life-long learning is the key phrase that marks the future of Higher Education. With fast evolving technologies, innovations in media and the way we access and utilize data, one needs to constantly be on their toes. The complacency that once came from becoming a simple graduate, even completing one's PhD in a specialized area will not suffice. As subject areas themselves are quickly evolving to incorporate new changes and trends, the need for knowledge and skill upgradation will become indispensable.

> *"The idea that one can earn a degree at the age of 22 and be set for a career has become as antiquated as the pocket watch."*

Well, that is how Jeffrey, R. Brown (2022), Dean at the Gies College of Business, University of Illinois perceives it all. The Universities of the Future will be those that are preparing students with skills and knowledge capacities which will be relevant in the foreseeable future.

Students joining universities as undergraduates are still very young to fully grasp the revolution that all industries are going through. This revolution though differently paced by factors like time and the extent of revolution, is still coming for all industries across all nations. Preparing these students for what's coming does not in any way mean neglecting the core and fundamentals of their subject areas. The fundamentals are the basic concepts, theories, definitions that we teach in our classrooms. It is to do with teaching them first to the students, the only difference that now we have better teaching-learning aids provided through a digital infrastructure. The fundamentals don't change and are thus learnt same as the earlier generations learnt them, the only difference lies in teaching methodologies. Gradually and incrementally building on these concepts, reviewing the whole journey of technological innovations, ways of doing things and then swiftly opening them up to new-age innovations that they must understand first before finding their applications.

### *Three-Step Flow of Learning*

Students pursuing higher education in the world-class universities where we wish to incubate and nurture them must passionately work towards a three-step flow of learning:

- **(a)** Understanding
- **(b)** Critical thinking applied to what they have understood. Dashing and sifting through its relevance, how reasonable it is for application in different economies, societies and ideological communities.

**(c)** Striving to build better ideas, more evolved concepts and models with applications more suitable. These revised ideas will then be learnt by the next set of learners starting from the ground up and these might yet again be revised, turned on its head to provide more suitable solutions.

The time elapsing between one set of learners and the others, who both apply their minds to understanding the same concepts is defined by a shift in technological, social and economic trends, even climactic and environmental necessities. Universities of Tomorrow would need to provide adequate resources for the new set of learners to adapt existing models and shape them into future-friendly paradigms.

Since India's independence from British rule, pivotal institutions structuring and re-structuring the country's education system have thrived. Till date, the University Grants Commission (established in 1953), NCERT (1961), All India Council for Technical Education (1945) have taken important strides in transforming the educational landscape, inching towards a more skilled, self-reliant nation, rising above India's acute challenge of unemployment and poverty.

After 76 years of Independence, we have around 1057 universities, (including 55 Central universities,) 23 IITs, 26 IIITs, and 20 IIMs. The FICCI & EY Parthenon (2022) knowledge report discusses the promise of the National Education Policy (NEP) 2020 and the reformative strategies and guidelines it provides that ensure an interdisciplinary skill development and a learning that supports India's linguistically and culturally diverse ethos.

India faces the acute challenge of sweeping migrations of some of the country's brightest minds to pursue Higher Education on foreign lands. It should be our endeavour to create a world class education hub on the Indian soil, to ease accessibility and affordability of resources and create a hospitable environment for international students.

India's Higher Education ecosystem is majorly fuelled by the private sector. Universities run by private players are today performing as some of the leading institutions of the world, competing to provide excellent standards of education, research and innovation. Well-performing, existing education standards and futuristic transformations must go hand-in-hand to be able to achieve NEP 2020's target GER of 50% by 2035.

The report also discusses the increasing demand of digital skills, non-conventional courses and a much wider range of subject offerings from the Universities and Educational institutions of tomorrow.

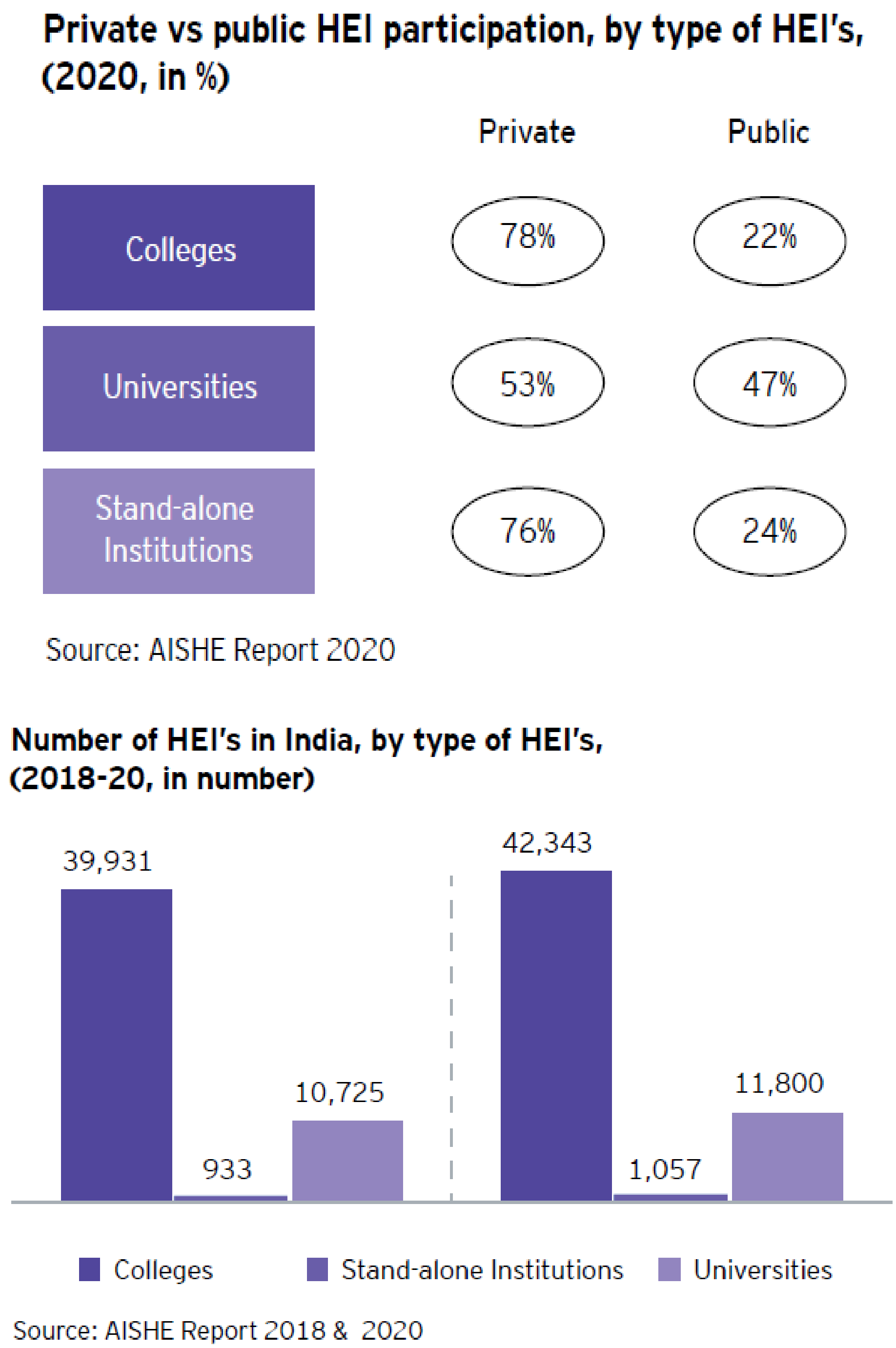


Figure 2: *State of Higher Education in India*


*Figure 3: Demand-Supply Gap of Digital Skilled Labour in India (Source: FICCI-EY Parthenon (2022)Knowledge Report)*

**Bridging University and Industry**

India is clearly on road to achieving the highest standards in Knowledge Transfer, supported by highest standards in infrastructure, quality of faculty and the curriculum taught. However, a fundamental quality of the excellent Universities of Tomorrow will be the culture of research, innovation, faculty and student participation in creating new ideas and building new models that are capable of solving the world's biggest problems. As Demarinis Loiotile et al. (2022) informs, some of the torchbearers in this direction are:

**(a)** Harvard University and other top Universities of the world apply huge amount of impetus on their research endeavours and the infrastructure they provide for advancements in research. Harvard University hosts the Office of Technology Development (OTD) that bridges the gap between academic innovations and the commercial sphere. Through their Accelerator programs, the university provides a smooth channel of communication between representatives from the industry and the University researchers, overseeing the protection of IP, funding strategies and other licencing requirements. There is lot of emphasis on collaborations between University researchers and industry, giving true value and credit to academic innovations supported by vital resources and support from the industry. Moreover, OTD's Entrepreneurs in Residence (EIRs) work towards business strategies and turning viable innovations into startups.

**(b)** The coveted Massachusetts Institute of Technology's 'TLO' (Technology Licensing Office) plays a similar role in bridging the gap between the academic researchers and the commercialization of their innovations at the industry end. MIT's Industrial Liaison Program hosts a website which calls itself, the "industry's most comprehensive portal to MIT, enabling companies world-wide to harness MIT resources to address current challenges and to anticipate future needs". MIT Corporate Relations another unit which focuses on finding connections to MIT faculty, departments, labs, and centres.

**(c)** Stanford University also hosts a similar Office of Technology Licensing (OTL) which allows University faculty, staff and researchers to submit their work, innovations and then vets them for their commercial viability and societal benefits. All the steps on the journey to commercialization including licencing are taken care of by this in-house University Office. There is a strong and regular University-industry networking continuum which ensures faculty and student exposure to the best of opportunities. The "University Corporate and Foundation Relations" looks after building and strengthening of relationships between the University, companies and private professional foundations. The incentives for industry in this relationship and constant stream of collaboration with Stanford are opportunities to recruit the best talent and even secure Executive Education degrees for themselves.

There is tremendous thrust given to entrepreneurship with courses like "Stanford Idea-to-Market (I2M)" course that gives hands-on training about tools and techniques to employ in order to make a viable and strong business idea into a reality. Similar in-house University units like Office of Intellectual Property and Industry Research Alliances (IPIRA) have been functioning in University of California, Berkeley Campus that ensure the same promise of visibility and recognition of university-led innovations and exploring possibilities for startups. One significant aspect under such emphasis on research, new technologies and innovation is to understand the equal importance of new ideas and development not just in the Science and Technology sector but also Social Sciences. Often, research and innovation becomes synonymous with developments in the field of Science, often neglecting the importance of probing social problems and their solutions. Universities of Tomorrow will need to invest in multidisciplinary research and attract robust funding opportunities for both Sciences and Social Sciences.

***AI & The tapovan tradition of education***

One major point of deliberation is how far AI should be encouraged in the working practices of educationists, especially learners. Does the advantages that AI brings breed more complacency in how we work, or is it a necessary integration to ease some basic functions in how we learn and conduct research?

In November 2022, OpenAI, a lab that studies Artificial Intelligence came out with a chatbot called ChatGPT (Generative Pre-trained Transformer) that uses natural language processing (NLP), which interacts in a realistic way and even "answers follow-up questions, admits its mistakes, challenges incorrect premises, and rejects inappropriate requests" (Tlili et al., 2023.)

Research shows that ChatGPT too, like every other technology, cannot be rejected or banned from schools and universities. It comes with its own pros and cons and must be embraced for the good it can do as well as curtailing the bad. Research shows that

ChatGPT can assist in content delivery for teachers and improve learning (Kasneci et al., 2023; King, M. R., & ChatGPT, 2023). We need to monitor how existing teaching-learning mechanisms are evolving in the current classroom space and come up with essential guidelines or teacher manuals that can help them to understand how to assess their students and ensure critical and argumentative thinking by them.

Karakas (2023), an associate professor of Business and leadership at the University of East Anglia, asked the AI for ideas of what universities of the future be like. Because Karakas is passionate about doodling, imagination, and creativity, his basic query was how different these institutions of higher learning would look. He began with an impression that many of us share that the universities require a major change and overhauling. His style of asking was unique as he focused on the following: "Name exciting, new mind-blowing, underrated, surprising, non-obvious ideas for the university of the future." He demanded a detailed and evidence-based response. And as a result, it created 165 new AI-generated ideas with a lot of freshness. Some of them will overlap with the University of Delhi's "Go brown Go-green and other initiatives" where the focus is on water, waste, air, land and energy – which would make the institution more environment-friendly (Agarwal, 2023). But this is one kind of demand of the time.

Our educational blueprint, which is our curriculum, also requires a changed set up. Frey (2009) refers to a popular Washington Post article that described the traditional university and going to college as- "packing up, getting a dorm room and listening to tenured professors." Frey guessed that iTunes would be used to access and distribute courses from anywhere in the world and could easily create a templated process, sent to a central distribution site, and easily distributed further to students around the world.

One creative model which India had invented and practised since ages was the Tapovan System of Learning. The Tapovan system was a unique educational and spiritual tradition that emphasized the integration of academic knowledge with practical and experiential learning in a natural, secluded environment (Desai et al., 2015.) The term "Tapovan" is derived from two Sanskrit words: *Tapah*, meaning austerity or "Penance", and *Van(a)*, meaning "Forest". Therefore, *Tapovan* can be translated as a forest or natural setting where individuals pursued knowledge through a combination of rigorous discipline, meditation, and academic study.

Some distinguishing features of the Tapovan system include:

- **Secluded Environment:** Tapovans were typically situated in serene and secluded forest areas, away from the hustle and bustle of urban life. The natural surroundings were considered conducive to contemplation and spiritual growth.

- **Guru-Disciple Relationship:** The heart of the Tapovan system was the relationship between the guru (teacher) and the shishya (disciple). The guru played a central role in imparting knowledge, not just through formal teaching but also through personal guidance and example.
- **Holistic Education:** Tapovan education was not limited to theoretical learning. It aimed at the holistic development of an individual, encompassing physical, mental, and spiritual dimensions. Disciples engaged in physical exercises, meditation, and the study of scriptures.
- **Austerity and Discipline:** Austerity and self-discipline were fundamental aspects of the Tapovan system. Disciples underwent rigorous practices, including fasting, meditation, and other forms of self-control, to enhance their spiritual and intellectual capabilities.
- **Study of Scriptures:** Tapovan education involved the study of sacred texts and scriptures, including Vedas, Upanishads, and other philosophical and spiritual literature. The emphasis was not only on memorization but also on understanding and internalizing the teachings.
- **Integration of Practical Skills:** In addition to theoretical knowledge, Tapovan education often included the acquisition of practical skills, such as agriculture, herbal medicine, and other crafts. This practical knowledge was seen as a means of self-sufficiency and a way to connect with nature.
- **Communal Living:** Many Tapovans operated as communities, where disciples lived together under the guidance of their guru. This communal living fostered a sense of shared responsibility and mutual support among the learners.
- **Spiritual Growth:** The ultimate goal of the Tapovan system was not just intellectual development but also spiritual growth and self-realization. The combination of academic study, meditation, and a disciplined lifestyle aimed to lead individuals on a path of spiritual enlightenment.

The Tapovan system of learning played a significant role in shaping the intellectual, cultural, and spiritual landscape of ancient India. It provided a framework for a well-rounded education that extended beyond the mere accumulation of knowledge, emphasizing the transformation of individuals into wise, disciplined, and spiritually aware beings. Recreating the *Tapovan* system in its exact historical form may be challenging due to the significant changes in societal structures, educational systems, and cultural contexts over the centuries. However, certain aspects of the Tapovan philosophy and principles can be adapted and incorporated into modern educational practices. Here are some possibilities:

**(a)** First, we could go for the Integration of Holistic Education that would address not only academic knowledge but also physical well-being, mental health, and character development. Encourage practices that contribute to overall personal growth.

**(b)** Secondly, Mentorship and Personal Guidance play a very important role even today. The emphasis should be towards fostering strong teacher-student relationships that go beyond the classroom, providing support and guidance in various aspects of life.

**(c)** Thirdly, Experiential and Integrated Learning opportunities should be created to allow students to apply theoretical knowledge in practical settings. This could include internships, community service projects, and hands-on experiences relevant to their field of study.

**(d)** Fourthly, abundance and opulence cannot give us what the students require. One might rather emphasise on Austerity and Discipline, and promote values of self-control and mindfulness in our schools and learning institutions.

**(e)** Fifthly, and ideally, we should encourage the students to adopt healthy habits, practice self-discipline, and engage in mindfulness activities to enhance their overall well-being.

**(f)** Sixthly, Environmental Education should be incorporated in our program and a connection with nature into the curriculum be created. This could involve outdoor learning experiences, ecological studies, and a focus on sustainable practices.

**(g)** Seventhly, Ethics plays a major role in shaping a new generation. While respecting diverse beliefs, consider incorporating elements of ethical and spiritual education that promote values such as compassion, empathy, and a sense of purpose beyond material success.

**(h)** Eighthly, Community Living and Collaboration are important. While it may not be feasible for everyone to live in a secluded forest, fostering a sense of community and shared responsibility among learners can enhance the overall educational experience.

**(i)** Ninthly, Flexible Learning Environments with different learning styles and preferences hold a key to success. Design flexible learning environments that accommodate various approaches to education, allowing students to explore and develop their unique strengths. We need to cultivate the Practical Skills and Survival Techniques in our curriculum that would help them survive through difficult times, and make them self-sufficient.

These ninefold principles could be used also to create or set up a "Virtual Tapovan," using the principles and philosophy of the traditional Tapovan system of learning to the modern context, leveraging digital technologies and online platforms. We could create an educational environment that embodies the core values of the Tapovan system while utilizing the capabilities of virtual and digital media. One could elaborate some of its features:

- **Digital Learning Platforms:** Create and use personalized online platforms and digital tools to deliver and receive educational contents suited to the requirement of a particular student. Virtual classrooms, webinars, and interactive e-learning modules can facilitate the dissemination of knowledge. These will still have a lot of human intervention as the teaching-learning happen. We need to leverage digital technologies to offer flexible and personalized learning experiences. Adaptive learning platforms, online resources, and customized learning paths can cater to individual needs and preferences.
- **Experiential Learning through Simulations:** Integrate virtual simulations and practical experiences into the curriculum. Virtual laboratories, simulations, and online projects can provide students with hands-on learning opportunities, even in subjects traditionally requiring physical presence.
- **Mentorship in the Digital Realm:** Foster mentorship and personal guidance through online communication channels. Virtual mentorship programs can connect students with experienced educators or professionals who provide guidance and support. As we mentioned ethics earlier, we could use online forums and virtual spaces to facilitate discussions on ethical and spiritual topics. Virtual seminars, webinars, or online discussion groups can provide a platform for exploring values and purpose in a digital context.
- **Well-being Apps:** Incorporate digital tools for promoting mindfulness and well-being. Apps and platforms that focus on mental health, meditation, and stress management can contribute to the holistic development of students.
- **Online Community Building:** Create virtual communities where students can collaborate, share experiences, and support each other. Discussion forums, social media groups, social clubs and collaborative online projects can foster a sense of community. One could also contemplate some healthy competition among these groups. Online modules, virtual field trips, and interactive content can help integrate even environmental education into the curriculum.
- **Digital Skills Training:** Integrate training in digital skills and technology literacy into the educational program. This aligns with the practical skills component of the Tapovan system, preparing students for the demands of the modern world. In designing such futuristic courses, we could encourage virtual collaboration on a global scale. Online platforms enable students to connect with peers, educators, and experts from around the world, fostering a broader perspective and understanding of diverse cultures and ideas.

The concept of a Virtual Tapovan would thus aim to preserve the essence of holistic education, discipline, mentorship, and spiritual growth while adapting to the opportunities and challenges presented by the digital age. It acknowledges the transformative potential of technology in enhancing educational experiences and creating a more interconnected and accessible learning environment but at the same time recreate a time-tested model.

## Concluding Remarks

While it’s important to acknowledge that Indian universities have made significant strides in various fields, there are some areas where they face challenges in taking leadership positions. Here are a few factors that contribute to this:

**(a)** First, Research Output and Innovation: Most Indian universities struggle to produce a substantial amount of high-quality research compared to leading global institutions, whatever be the reasons – like inadequate funding, outdated infrastructure, and no research-centric culture.

**(b)** Secondly, Global Rankings: Our universities often lag behind partly due to the criteria used in these rankings, which heavily emphasize research output, international collaboration, and faculty-student ratios, and partly because of the fact that we have not yet focused on improving in these areas to compete globally.

**(c)** Thirdly, Industry-Academia Collaboration: We have been taught to wait for the industry to take note of what we are doing. But unless there is a tie-up between academia and industry in India, it would hinder research relevance and application. Closer collaboration can foster innovation and help universities take a leadership role in shaping our industries too.

**(d)** Fourthly, Infrastructure and Facilities need to become state-of-the-art whether money comes from the state or from the private sources to facilitate research and higher education.

**(e)** Fifthly, Faculty Quality and Development should also match with this development of infrastructure. We do have and we do produce many highly qualified and talented faculty but retaining them and providing ongoing professional development can be a challenge. Attracting and retaining top-notch faculty is crucial for maintaining high academic standards.

**(f)** Sixthly, Relevant Curriculum in our universities are need of the time. They may not always align with the rapidly changing demands of industries and global trends. A more dynamic and industry-relevant curriculum could better prepare students for leadership roles in various fields.

**(g)** Seventhly, Internationalization is Crucial: Limited international exposure and collaboration can hinder the global standing of Indian universities. Encouraging international exchange programs, joint research initiatives, and attracting foreign faculty can help bridge this gap.

**(h)** Eighthly, Administrative Bureaucracy must be simplified and made less cumbersome, because bureaucratic hurdles can slow down decision-making and hinder the agility of universities in adapting to changing educational landscapes.

**(i)** Ninthly, Inadequate Funding is something that plagues many Indian universities. It impacts their ability to invest in research, infrastructure, and faculty development. Increased investment in higher education is crucial for achieving leadership positions.

**(j)** Finally, Innovation Ecosystem is essential within and around universities, because otherwise it can impede their ability to incubate and commercialize cutting-edge technologies and ideas.

Addressing all these ten-fold challenges requires a concerted effort from policymakers, educational institutions, industries, and other stakeholders to bring about comprehensive reforms in the higher education system in India. Universities of Tomorrow will also have to tread at pace with upcoming technologies and adapt their processes to integrate them better into their working practices, rather than avoiding discussion or banning them. This means that new teaching methodologies will have to be designed such as group projects, hands-on activities, and oral presentations.

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# 15
# INTERNATIONALIZATION OF INDIAN HIGHER EDUCATION: THE IMPERATIVES

**Dr. Rajesh Pankaj**

*In an era characterized by profound global interconnectedness, the imperative of internationalization propels academic institutions to transcend geographical boundaries. This article delves deeper into the pivotal role of governmental mandates and elucidates on the key policies and initiatives along with highlighting the achievements of higher education institutions (HEIs) in steering internationalization.*
*The research extends its focus to the transformative impact of internationalization on the quality of education within the Indian academic landscape. It investigates the intricate interplay between internationalization and cultural diplomacy, unveiling the soft power dynamics that mold higher education on the global stage.*
*This article also scrutinizes the economic ramifications of internationalization, providing insights into its role as a driver of economic growth. This article aims to contribute nuanced perspectives on how internationalization acts as a transformative force, shaping both the present and future landscape of higher education in India.*

***Keywords:*** *Internationalization, Indian Academia, Indian Higher Education, National Education Policy, NEP 2020, Education Policy, Higher Education Reform, Cultural Diplomacy, Soft Power, Global Learning, Economic Impact, Trade in Services, Global Engagement, Student Mobility, Future Imperatives, Cross-Border Collaboration, Educational Diplomacy, Global Engagement, Academic Excellence, Future Perspectives*

## Introduction

### *Crossing Frontiers in Indian Higher Education*

In today's age of unprecedented global connectivity and interdependence, the landscape of higher education is undergoing a profound transformation, with nations recognizing the imperative of internationalization as a catalyst for academic growth, cultural enrichment, and economic development. The internationalization of higher education is identified as a key driver in creating knowledge-based economies, citizens, and countries, offering sustainable employment opportunities and world-class living standards. (Bhandari & Chakravaram, 2022)

Incorporating an international, intercultural, or global dimension into the goals, operations, and implementation of postsecondary education is recognized for its capacity to elevate the quality of teaching and research for both students and staff. This approach empowers them to contribute meaningfully to society (De Wit, 2020)[2].

India, with its rich history and diverse cultural heritage, has emerged as a formidable player in the global knowledge economy. The country's higher education system, characterized by a multitude of institutions spanning various disciplines, has been a cornerstone of its intellectual prowess. However, as the world becomes more interconnected, the insularity of traditional education models impedes the full realization of India's academic potential. This urgency within the Indian context is accentuated by the nation's ambitious vision to position itself as a global knowledge hub.

As the cornerstone for sustainable development and a fundamental catalyst for shaping a global knowledge society, internationalization of education also has a critical role of in a nation's ability to cultivate a dynamic and cosmopolitan learning environment. Internationalisation can help foster increased international cooperation and capacity building, improved exposure to diverse cultures, perspectives, and methodologies that enrich academic experiences. Such exposure not only equips students to navigate the complexities of a globalized world but also contributes to the transformative impact of internationalization on the educational landscape.

Higher education is identified as one of the most vital instruments for socioeconomic transformation and human capital development of a nation (Tripathi & Bajpai, 2017)[3]. In the context of India, a nation with a burgeoning youth population, internationalization becomes a critical tool for addressing the evolving needs of the job market. The globalized economy demands a workforce with a nuanced understanding of international dynamics, excellent cross-cultural communication skills, and adaptability. By integrating international elements into the curriculum and encouraging student and faculty exchanges, Indian higher education can bridge the gap between academic knowledge and real-world application, producing graduates who are not only academically proficient but also globally competent.

Moreover, internationalization is instrumental in elevating the quality of education imparted in Indian institutions, contributing to improved quality of research. Exposure to international best practices, collaborative research endeavors, and engagement with global academic communities contribute to a continuous process of improvement. The infusion of diverse perspectives also stimulates innovation in teaching methodologies, curriculum design, and pedagogical approaches, creating a vibrant and progressive academic ecosystem.

On the diplomatic front, internationalization of higher education acts as a soft power tool for India, fostering goodwill and facilitating cultural exchange through the establishment of academic partnerships and collaborations. This positions India as a global knowledge hub, attracting students and scholars from around the world and enhancing the nation's influence on the global stage.

The imperative of internationalization for Indian higher education is a multifaceted mandate encompassing academic, economic, and diplomatic dimensions. As India aspires to become a global knowledge powerhouse, the strategic integration of international elements is deemed a necessity (de Wit & Altbach, 2021)[4]. While the benefits of internationalization are evident, the journey is not without challenges, with infrastructure constraints and varying accreditation standards. The necessity of internationalization gains prominence against the backdrop of socio-economic shifts, technological advancements, and the demand for a globally competent workforce.

This article embarks on a journey to explore the intricacies of this imperative, providing a roadmap for stakeholders to navigate the challenges and embrace the opportunities that internationalization presents for the future of Indian higher education.

***Shaping Internationalization Policies***

The economic productivity landscape has experienced a noteworthy transformation, with knowledge emerging as the predominant factor, surpassing conventional elements like capital, labor, or energy availability (Moreira & Stallivieri, 2023)[5].

Recognizing the significant role of education in human capital development, the Indian government has proactively implemented measures to enhance both primary and higher education. Between 1952 and 2010, education claimed a larger share of GDP compared to other expenditures, signifying a strategic investment in the nation's intellectual capital (Yadav, 2023)[6]. In higher education, these measures are further augmented in the recent mandates outlined by the University Grants Commission (UGC) regulations and the transformative National Education Policy 2020 (NEP 2020)[7], reflecting a focused approach to cultivate a robust educational ecosystem to address the nation's evolving needs.

NEP 2020 stands at the forefront of this educational transformation, recognizing the need to align with global best practices and foster international collaborations for India to compete globally. The policy envisions India as a global education and research hub with institutions that are not only competitive but also inclusive. With ambitious targets, NEP 2020 aims to establish India as a global education and research hub with 10 Indian Higher Education Institutions (HEIs) in the top 200 globally by 2030 and 20 HEIs by 2047. (Ministry of Education, 2023)[8].

The commitment of NEP 2020 to internationalization extends to diverse course offerings, twinning/dual/joint degree programs, and interdisciplinary initiatives, emphasizing subjects such as Data Analytics, Computer Science, and Climate Change. The University Grants Commission (UGC) has aligned with this vision by issuing comprehensive guidelines for the Internationalization of Higher Education in 2022, emphasizing global partnerships.

Concurrently, India actively fosters cultural understanding through the Indian Council for Cultural Relations (ICCR), annually awarding approximately 3,940 scholarships to students from around 140 countries (Kumar & Rajani, 2022)[9]. These initiatives contribute not only to educational excellence but also solidify the nation's role in shaping the global educational landscape.

These strategic steps align with the understanding that a developed education system, seamlessly integrated into the international educational and scientific space, constitutes a major competitive advantage in the global competition for intellectual talent (Amirbeka & Ydyrysb, 2014)[10].

In 2023, the University Grants Commission (UGC) also issued regulations for the establishment and operation of foreign higher education institutions in India. The regulation in harmony with the National Education Policy (NEP) 2020, offers a unified process for prospective institutions aiming to establish campuses in the country. It specifically aims to attract globally top-ranked institutions with expertise in diverse fields, thereby enriching the international dimension of higher education in India. Through strategic policy reforms, the Indian government is actively embedding internationalization into the regulatory framework, creating an enabling ecosystem. These efforts not only promote academic excellence but also solidify India's commitment to playing a central role in shaping the global educational landscape.

***Cultural Diplomacy and Soft Power Dynamics***

In the intricate global arena, nations employ a diverse array of tools to fortify their standing and propel long-term socio-economic development. This strategic choreography involves a nuanced fusion of hard and soft power, as articulated by Joseph Nye's seminal work in 2009. Nye's conceptualization of soft power, introduced in 1990, underscores a nation's capacity to attract and engage through non-coercive means, utilizing economic, cultural, and political influence as persuasive instruments (Nye, 2009)[11].

Amirbeka and Ydyrysb (2014) emphasize the pivotal role of a robust education system as a major competitive advantage. Further examining historical precedents in the successes of nations like Singapore and Malaysia, it becomes evident that a well-established education system contributes significantly to a state's prosperity (Nye, 2005)[12].

In the contemporary landscape, the interconnected nature of the educational system with politics and geopolitics gains prominence (Nye, 2005). Soft power, particularly wielded through education, emerges as a critical tool for nations to extend their influence globally (Antonova, Sushchenko & Popova, 2020)[13].

For Indian Higher Education Institutions (HEIs), the process of internationalization unfolds as a sophisticated interplay of economic opportunities, cultural diplomacy, and strategic soft power projection. Cultural diplomacy within internationalized HEIs manifests through initiatives like educational exchanges and collaborative research projects. Inspired by successful international models, these exchanges serve not only to enrich academic experiences but also to positively shape global perceptions of India.

The global network of alumni from internationalized Indian HEIs emerges as a potent force in shaping soft power. Beyond being beneficiaries of India's academic and cultural richness, these alumni act as cultural ambassadors, actively contributing to the narrative of India's academic prowess and cultural vibrancy

While initiatives like scholarships from the Indian Council for Cultural Relations (ICCR) and the promotion of Indian arts position India as an attractive education destination, the NEP also accentuates the need to align with global best practices, fostering collaborations, and inviting foreign universities. In this regard, collaborations in fields like yoga and Ayurveda not only enhance India's soft power but also contribute to global wellness trends.

Beyond the core focus on education, the narrative extends into creating connections and fostering cultural exchanges. Programs such as "Study in India," "India Immersion Programs," and collaborative projects underscore India's commitment to global academic excellence. These endeavors not only engage international students but also spotlight India as a culturally vibrant and hospitable nation.

As the global stage continually evolves, the role of soft power in education becomes ever more pronounced and a nuanced approach of academic excellence and cultural diplomacy, will position India as a pivotal player in the global knowledge economy.

***Economic Growth Through Global Integration***

Over the last three and half decades, every facet of modern life has been impacted by the forces of globalization. This has consequently also played a role in the internationalization of higher education sector across the globe. In recent years, with the expanding scale of knowledge-based and innovation-driven economies, some countries are turning to international higher education to produce a pool of highly skilled workforce. The internationalization of Indian Higher Education Institutions (HEIs) is a transformative force with far-reaching implications for India's economic landscape. This dynamic process extends beyond academic realms, intertwining with economic growth, job creation, and elevating education to the status of a pivotal trade service.

The mobility of international students has become a linchpin in the global economy, as demonstrated by nations like the U.S. and Canada which have reaped substantial economic benefits. The US with more than one million international students at U.S. colleges and universities contributed nearly $41 billion to the U.S. economy and supported 458,290 jobs during the 2018-2019 academic year (NAFSA, 2019)[14]. Canada, too, experienced a significant contribution of $21.6 billion in 2018 from international students, sustaining nearly 170,000 jobs (Statistics Canada)[15]. These figures underscore the vast economic potential inherent in the international education sector.

Since the late 1990s, the global higher education market has seen consistent 7% annual growth, with global annual fee income estimated at a substantial $30 billion (Kaul, 2006)[16]. Presently, Indian students' direct spending on studying abroad is estimated at a substantial US$47 billion for 2022 (ICEF Monitor, 2023)[17].

Strategically positioning itself to harness the influx of foreign students, India can catalyze its economic growth. The revenue generated through tuition fees, accommodation, and related expenditures has the potential to initiate a positive ripple effect across ancillary industries, playing a pivotal role in India's comprehensive economic development.

While India has surpassed China as the largest source of international graduate students in the U.S. recently, the country's own enrollment rate for foreign students is just under 0.13%, falling below the permissible 15% range (Varghese, 2020)[18]. This disparity underscores the need for India to actively engage in strategies that attract international students and elevate its position.

To achieve this, India must focus on aligning its higher education standards with global benchmarks. This involves improving the teaching-learning process in HEIs, developing world-class infrastructure, engaging global faculty, investing in branding and promoting Indian knowledge systems abroad. Initiatives like Study in India, promoting effective exchange programs, and enhancing quality through joint research are some of the other critical elements that can contribute to realizing the NEP 2020's vision of having half a million foreign students in India by 2047.

The role of the General Agreement on Trade in Services (GATS) in internationalizing Indian higher education also becomes crucial. While GATS encourages cross-border collaborations and global mobility, India must tread carefully to balance the benefits of internationalization with safeguarding its educational values. Navigating the intricate interplay between internationalization and economic growth reveals potential benefits extending far beyond academia. The strategic establishment of education as a trade service and India's positioning as a global education hub hold the promise of shaping a more economically vibrant and diplomatically connected future.

### *Academic Excellence in Global Context*

The internationalization of Indian higher education unfolds not just transformative opportunities but a key to elevating the standards of education. This strategic pursuit, marked by global collaborations, partnerships, and the infusion of international best practices, holds the promise of propelling Indian institutions into global excellence, positioning the nation as a knowledge economy.

The benefits to internationalization are manifold, encompassing knowledge translation, talent mobilization for global research, and curriculum enrichment with international content (Jibeen & Khan, 2015)[19]. This pursuit of academic excellence becomes intertwined with global rankings and excellence initiatives, reflecting the competitive spirit of elite research universities (Eggins, Smolentseva & de Wit)[20].

In the dynamic landscape of Indian higher education, the strategic pursuit of internationalization takes center stage, serving as a catalyst for ushering in an era of academic excellence. India's recent prominence in global rankings, standing as the second most represented country in Asia in the QS World University Rankings, underlines the nation's dedicated commitment to global academic eminence. However, there is a call to unlock the latent potential of more Indian Higher Education Institutions (HEIs).

Crucial to the transformative journey of internationalizing Indian higher education are initiatives supporting language proficiency, cultural sensitivity, and government policies incentivizing internationalization efforts. These play a pivotal role in preparing students for global opportunities, contributing significantly to India's evolution into a knowledge-driven economy. The transformative power of internationalization extends to the curriculum, propelling a paradigm shift towards globally relevant curricula and interdisciplinary education. This not only addresses subject disparities but also provides students with a comprehensive and interconnected understanding of knowledge. Inherent in this transformative journey is capacity building, endowing both faculty and students with a versatile skill set crucial for navigating the complexities of our interconnected world. Joint workshops and training programs, often conducted in collaboration with international partners, serve as conduits for knowledge exchange and skill enhancement, fostering a culture of perpetual refinement (Chien, 2023)[21].

The potential of joint research initiatives, faculty exchange, and the exchange of best practices also holds tremendous promise for Indian academia. These initiatives not only broaden intellectual horizons and enhance the teaching-learning process in India but also make substantial contributions to the global corpus of knowledge.

By embracing a global perspective and strategically positioning itself on the international stage, India has a unique opportunity to shape a future in which its higher education ecosystem is not only globally competitive but also stands as an academic powerhouse, poised for significant growth.

**Concluding Remarks**

The imperative of internationalization for Indian Higher Education Institutions (HEIs) represents a multifaceted journey extending beyond mere global partnerships. Renowned universities like Harvard, Oxford, MIT, Stanford and others have thrived by embracing internationalization, enriching academic ecosystem with diverse perspectives, and fostering a global community of scholars.

Policy interventions, as evident in the National Education Policy 2020 (NEP 2020), underscores the Indian government's commitment to internationalization. Practical measures such as aligning with global standards, fostering collaborations with esteemed institutions worldwide, and integrating an international dimension into the curriculum demonstrate a clear understanding of internationalization's growing significance in the country's higher education sector. Internationalization also serves as a pathway for Indian HEIs to actively contribute to and benchmark themselves against global academic excellence. Through strategic alliances and collaborative research ventures with top-tier international institutions, HEIs can leverage shared resources, expertise, and innovative methodologies, positioning Indian academia at the forefront of global knowledge creation and dissemination.

Further, cultural exchange is a significant outcome of internationalization, creating a rich tapestry of diverse perspectives within academic institutions. This infusion enriches the learning experience and enhances India's soft power on the global stage. The intrinsic link between the internationalization of higher education and economic growth, particularly in the knowledge economy, is also very evident and critical. Nurturing a globally competitive education system enables India to produce a skilled workforce capable of driving innovation, research, attracting foreign investments, and stimulating economic growth.

To fully embrace internationalization, Indian Higher Education Institutions (HEIs) need comprehensive policies that go beyond basic collaborations. This includes integrating a global curriculum and teaching approach, engaging in collaborative projects, participating in joint teaching and research, promoting faculty and student mobility, and learning from international best practices. India has a huge opportunity in cross border outreach and supply of e-learning services. Recent surge in Online Courses (MOOCs) in India have also allowed wide-scale access to knowledge from Indian higher education institutions.

To elevate foreign student enrollment, the government should implement tailored policies and incentives. Simplifying visa procedures, offering scholarship programs, and providing ample research grants will enhance India's appeal as a study destination. Initiatives like granting full waivers to outstanding students from emerging economies and scholarships for those from low-income backgrounds ensure inclusivity and diversity. Moreover, improving the academic environment, utilizing digital platforms for outreach, and fostering global partnerships will also help attract more students while positioning the country as a leading destination for international education.

The India success story on higher education needs to be told and showcased to the world in a focused and strategic manner. And to do the same we need to become leaders and create our own benchmarks and global standards. It is extremely important that with leading industry associations, India participates in global education events like NAFSA, APAIE, EAIE, etc.to make a show of strength and provide a strong narrative of India at the global stage. By embracing these strategies, Indian Higher Education Institutions (HEIs) can lead globally, attracting top talent and fostering cross-cultural collaboration for a brighter future.

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# 16

# MANAGEMENT EDUCATION FOR THE NEW AGE

**Prof. M P Gupta**

*Post-independence, Management education in India has grown significantly but with primary goal of producing professional feeding the need of Indian corporates. They still remain teaching and training centres with hardly any focus on research, innovation and thought leadership. India, but, today is an aspiring nation marching towards next 25 years' journey of fast growth to attain a status of developed country. In this scenario, it is pertinent to revisit their current functioning and bring out dimensions of avenues that they can leverage in view of emerging opportunities and become a more impactful entity in the nation's high octane growth journey.*

***Keywords:*** *Management, Business, Education, India, Growth, B- Schools, Emerging Technology, Digitalization, Start-up India*

## Introduction

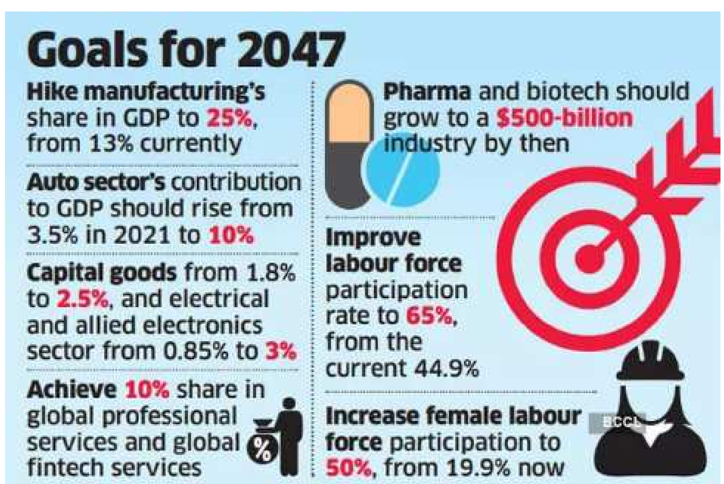
Today Business Schools or Management institutions in India are going through a challenging time, incomparable to anything in past. They teach the art of wealth creation, which remains the primary takeaway even now. However, today scenario has changed drastically. Post-internet society is characterised heavily by a technology layered living - fundamentally altering the way we live, work, and relate to one another. There is increasing dependency on each other globally- nations' dependency on the other nations; organizations collaborate more intimately and at large scale. Technology makes us capable of connecting everyone and everything, everywhere, all the time. Product and services are delivered instant and frictionless. This is unthinkable before!

Many in fortune 500 exist purely because of digital landscape. They bring a new belief and culture of business driven by continuous innovation. Innovation anyway results into wealth. Think of Amazon, Apple, Facebook, Google, Microsoft, Alibaba, Airbnb, Etsy, Lyft, Menlo Innovations, Saab, Samsung, Spotify, Tencent, Tesla and Uber …etc. In these firms, profits are the result, not the goal that defines 21st century thinking. Talent drives strategy; small teams may be enough in dealing with big issues; complex systems are descaled; and new age companies make money by innovating and not necessarily by focusing on money.

As per United Nations Conference on Trade and Development (UNCTAD) Digital Economy Report-2021, rise of digital economy size range from 4.5 to 15.5 per cent of world GDP. In this, share of United States and China together accounts for almost 40 per cent of the world total, about 90 per cent of the market capitalization of the world's largest digital platforms, 50% of the world's hyper-scale data centers, highest rates of 5G adoption and 94% of all funding of AI start-ups. It is expected to generate employment opportunity up 50 million. East Asia led by China will remain major center for value added Information & Communication Technology (ICT) manufacturing. Digitally deliverable service exports amounted to $2.9 trillion, or 50 per cent of global services exports. China and India together account for the biggest consumer market. Unfortunately, Business Schools have rarely given a thought to visualise grand direction to influence national and global economic growth in specific terms.

Climate concerns brought a new pledge by world corporations to clean up act. Also there are rising expectations from the national priority programs.

Do business schools rise to the new expectations? Change, though seen, often is small and change cycle is long. Research output remains a 'Library to library' journey. The fact is that most corporations go to consulting firms, and not to Business School for guidance. A massive opportunity is missed out by business schools, which consulting firms like Deloitte and McKinsey are taking advantage of.



**The Context**

*India@2047*

Is a new context. GoI has begun work on a blueprint for India@2047- a vision plan for a 'future ready India' with the aim to make the country one of the world's top three economies and bring it closer to developed nation status by the 100th year of its independence. The key areas identified so far include agriculture, commerce & industry, infrastructure and urban landscape, security & defence, technology and governance. Some the goals being considered are

- Defence: Freeing up India's defence acquisitions from foreign reliance
- Industry: restructuring and merger of public sector banks and creation of 3 or 4 big banks
- Developing 3 or 4 global champions in each sector, including oil and gas sector by merger or restructuring of companies,
- Developing semi-conductor complexes and making India a hub and leader in green technology Comprehensive skilling avenues
- Education: partner with foreign R&D organisations to build up top 10 labs in the country, develop India into a skill capital and bring at least 10 Indian institutions among the top 100 in the world.
- Technology identify focus areas 'to position India as a leader in such sectors within a decade
- Agriculture: A 'new age agriculture' plan proposes micro irrigation and organic farming, a flagship scheme for hilly regions, positioning India as a top exporter in identified streams.
- Urban: Development 'future ready' urban spaces

The above initiatives open up plethora of opportunities for every individual and institution in the country to play an ambitious role to realise the goals of 2047. Every management institution and Business School in the country should aspire to become an epicentre of India excelling in strategic thinking, professional prowess, become self-reliant and competitive nation by 2047. For that these entities need to align their goals with national priorities, create adequacy of resources and go far a high octane journey.

*Future of Jobs*

Technology trends are irreversible. These create a new economic environment called digital economy - an economy based on digital technologies. This is predicted to be much larger with 8% current share of the overall economy and more widely spread than previously thought. Its spill over effect is at an unimaginable scale. This casts a new light on how to make plans for the future corporations.

*Start-up Trends:* driven by ICT led innovation, start-ups are being encouraged by governments across the globe. On the occasion of 72th Independence Day, Prime Minister laid out plans to achieve a 5-trillion-dollar economy by 2024. A continued economic growth is feasible provided the intellectual economy is expanded through innovation and technology development. This is largely possible by growth of start-ups enterprises. As per GoI, there are 50,000 registered start-ups in India, and there will be 50,000 more by 2024 at this pace. In 2018, India had 18 tech unicorns valued at more than $1 Bn. The combined valuation of unicorns in India grew to $71 Bn in 2018 from $38 Bn in 2017. The country is likely to have 54 tech unicorns by 2024.

Emerging industry 4.0 organizations are about an ecosystem of real-time enterprises in its entirety. This depicts a scenario characterised by real time data flooded from multiple sources viz. banking, financial services, telecom, manufacturing and retail cutting across multiple functional areas. The nature of jobs will be dominantly around

- Technology Consulting
- Product Management
- Emerging Technology Sales and Business Development
- Strategy portfolios around Economics of Digital Platforms
- Data Science and Business Analytics
- Business Continuity

These jobs require professionals ready with skill to be able to leverage inputs from multiple cross-functional disciplines for implementation of advanced computational and mathematical models integrated with business rules from different functional areas of management. Technology leadership with emerging technologies (ICT Product, IoT, Big Data, Data science, Block chain, Cyber security & Real time Business continuity) will never be possible with a conventional Master of Business Administration (MBA). Developing professionals for these roles is one of the major premises that make Tech MBA highly relevant and yet different from conventional MBA. It is not only a novelty but also a need of the hour. It is going to be more pervasive than one can visualize, particularly in the aftermath of the pandemic triggered by Covid-19.

The rise of artificial intelligence (AI), fintech and robotics have changed everything. In the last few years, the demand for MBA graduates having a robust knowledge in these emerging technology has increased dramatically. Most jobs lie with tech companies as they still remain the biggest employers of MBA graduates. It is a fact that most of the top business schools graduating MBAs end up working in tech companies. Also future demand for a suited MBA will be bursting at its seams as statistics indicate 4.3 million digital workers will be missing in high-tech and telecommunications by 2030 and a further 10.7 million tech workers will be missing in Fintech and BFSI by the same year. In absence of such manpower, the opportunity cost would be equivalent to a loss of around one trillion dollars if we are unable to fulfil the tech job requirements.

The dominance of such tech ecosystems, led by Microsoft, Apple, Amazon, Google and Facebook sees the creation of many new job roles that are related to digital transformation – roles such as digital officers, data officers, and transformation officers. The use of tech services and products have also blown up within the last decade, and can be seen in the excessive use of mobile phones, and social media – especially where new markets such fuelled by start-ups are emerging. All of this inevitably drives tech talent demand, where the increased usage and adoption of technology is seeing the need for tech-related jobs and people.

The tech sector has its own culture, leadership style, even business models and so on. And so this is what many companies are trying to do – they are trying to copy the cultural and innovation approach and even the business models that tech companies have. They're trying to imitate, in a certain way, the success of companies like Apple, Google, Amazon and so on. That means the tech sector by itself has its own way of operating, which is why we feel the traditional MBA wouldn't work with the specializations in tech. Underlying economic, technological and cultural assumptions are also evolving with the changing technological paradigms.

The rise of tech ecosystems, tech talent demand, tech culture, and use of tech services were identified and given special treatment in the Tech-MBA ensuring that students will develop the knowledge and skillset needed to meet the demands of business and tech. Tech-MBA is a new wholesome program totally focussing on the tech sector. Business schools around the world are now developing technology-centered MBAs which offer several specialized tech tracks such as technology leadership, emerging technologies, and technology immersion. Tech MBAs have grown massively in popularity in recent years – especially among US business schools. European schools have taken longer to embrace them, however. The Tech MBA at IE Business School in Madrid is the first of its kind in Europe and is launching in September 2020.

## History

### *The Evolution of the MBA Program Worldwide*

The history of MBA programs is rooted in the times of industrialization which took place between 18th to 19th centuries when predominantly agrarian, rural societies in Europe and America became industrial and urban.

The early MBA courses were mostly training programs in accounting and bookkeeping. Those were regarded as sufficient for running a business. The Aula do Comércio in Lisbon, established in 1759, was the first institution to specialize in the teaching of accounting in those times. As corporations grew, there arose a need for skilled management professionals. This led to the start of Business Schools. ESCP Europe, established in Paris 1819, happened to be the first one that now has campuses in several other European cities viz. Berlin, London, Madrid, Paris, Torino, and Warsaw.

The Wharton School of Business in Pennsylvania established in 1881 was the first Business School in the United States of America (USA). The Haas School of Business at the University of California in Berkely was founded in 1898 within a few years of Wharton, followed by Tuck School of Business at Dartmouth College in 1900 and few others.

These B-schools used to offer many variants of degrees in management. Master of Business Administration (MBA) as a standard degree with a defined curriculum was started first time in 1908 by the Harvard University Graduate School of Administration, now known as Harvard Business School. Since then MBA is now adopted by most of Business Schools in the world as their flagship program.

The idea of similar programs for working executives was brought out at Massachusetts Institute of Technology (MIT), which established leadership education programs to train corporate executives. This was later adopted as executive MBA degree by the majority of business schools today.

MBA programs gradually evolved and spread across the world as the most popular choice of students aspiring to be part of the corporate world. The first business school in Europe to offer an MBA program was INSEAD in 1957. It is now considered to be one of the finest MBA programs worldwide. Overtime MBA programs gradually evolved and spread across the world as the most popular choice of students aspiring to be part of the corporate world.

**Tracking evolution of Management Education in India**

In India, the earliest history of MBA is traceable in three institutions: XLRI (Xavier Labor Relations Institute) in Jamshedpur was founded in 1949; Indian Institute of Social Welfare & Business Management (IISWBM), Kolkata established in 1953 and Faculty of Management Studies (also known as FMS Delhi) under Delhi University established in 1954. IISWBM was the first institute to offer MBA degree in 1953. The seeds of IISWBM were sown in 1942, when the British government, needing qualified labor officers for its facilities, especially its ordnance factories. After Independence, this evolved into the IISWBM, set up in April 1953, in collaboration with the Government of West Bengal, the University of Calcutta and the business community of West Bengal to promote management education. This institute once served as a mentoring institute for the much-reputed IIM C (Indian Institute of Management, Calcutta).

Later on, many other universities established their Business Schools in the 1950s and began offering the MBA program to a selected set of students. However, a fillip to management education came through the establishment of the Indian Institute of Management (IIM) at Calcutta and Ahmedabad under the aegis of the Planning Commission with support from the internationally renowned business schools of that time. IIM Calcutta was mentored by MIT Sloan School of Management, and IIM Ahmedabad was mentored by Harvard Business School. In 1972, a committee headed by Ravi J. Matthai took note of the success of these IIMs and recommended the setting up of two more IIMs.

Since then, management education has been in constant demand in the country particularly in the post-economic reforms era. This is reflected in the number of business schools currently established in India. Today there are about 2450 business schools in India, of which IIMs are 20 in numbers, and almost every university, technical institutions, IITs, NITs offering MBA programs in both the government and private universities. The growth of management education in the country, mostly, focused on the quantity reflected by a large number of B-Schools. However, quality of MBA education could not keep pace with the need of the time.

The Government of India has been actively promoting management education and has sought opinions from many committees to improve the standards of management education in India including the Prof. S. L. Rao committee of 2005 and the Bhargava Committee of 2008 among others. These committees identified specific concerns with state of the art and suggested reformative measures. Some pressing concerns include the relevance and coherence of the curriculum and quality and applicability of research among others. Several measures were suggested to improve on these counts. One significant one was to track progress by developing a national ranking of the business schools and participating in international accreditation programs.

The National Ranking Framework addressed the need for ranking of business schools in India. NIRF rankings reaffirmed the concerns of past committees.

**Issue of quality**

Quality for a Business School has to be seen in the context how it is viewed by its various stakeholder- students, faculty, Board, government, corporations and society etc. Each one carries definite expectations, which the schools should strive to exceed in meeting. In this pursuit, three level of care bring remarkable results:

- Adopt global standards of business processes, which comes from adhering to global accreditation processes
- Inculcate a vibrant research culture- this, in India, a big area of concern in Indian academic
- Nurture faculty in various areas or cognate areas of management

***Global Standards***

Another important driver of quality in business schools is their need to align curriculum and practices with the global standards. Global best practices are brought and promoted by accrediting bodies, such as the Association to Advance Collegiate Schools of Business (AACSB), the European Foundation for Management Development's (EFMD) Quality Improvement System (EQUIS), the Association for Master of Business Administration (AMBA) and the like. The influence of these accrediting bodies are significant in delivering necessary change for enhanced quality of delivery. In India, a National Board of Accreditation (NBA) was established in the year 1994 by the Indian government, in order to assess the qualitative competence of programs offered by Technical Institutions from Diploma to Post graduate level in Engineering & Technology, Management, Pharmacy & Architecture, etc. NBA accredits programs and not the institutions. In the year 2010, NBA became autonomous with the objective of assurance of quality and relevance of technical education through accreditation of programs. In the year 2013, Memorandum of Association (MOA) and Rules of NBA were amended to make it completely independent administratively as well as financially. During the calendar year 2022, 2192 programs were considered for accreditation, out of which 2016 programs were accredited and remaining 176 programs were not accredited.

While NBA is a good starting step and nationally relevant, globally there are more recognized accreditation systems in place that qualify Business Schools. The three most-coveted, international accreditations for Business Schools are those awarded by AACSB, AMBA, and EQUIS. These accreditation organizations evaluate the standards of a business school's teaching, faculty, services, and students, among other things.

There are several advantages of accreditation. It creates a gateway for students as their MBA degree gain recognition worldwide by industries and institutions, attending an accredited institution influences the competitiveness of MBA graduates in the job market as the best employers to prefer students from only those that carry such a tag. Students from accredited institutions can avail several avenues at the global level, ie. attend conferences, participate in exchange programs, become eligible for fellowships and higher education, etc. International collaborations by Business Schools and research grants obtained are also linked to accreditation.

Among the three, AACSB is the most popular and adopted by Business Schools of high repute viz. Harvard Business School. It has the broadest scope, as it accredits management and accounting programs and grants university-wide accreditation. AMBA go for a more focused approach as it accredits the B-school's programs such as MBA and MBM etc. EQUIS accredits the B-School but not the university. AACSB accreditation requires that schools teach everything that students need, from communication skills to financial reporting, have qualified and adequate faculty and staff to successfully deliver intended business programs successfully, produce research that advances business—which means students have access to innovative and relevant business ideas and methods. Participating in international accreditations is helpful for Indian business schools to grow and collaborate internationally and also helps students to be better recognized in the global skills market.

**Research Ambition**

A mind-set exists, where research is still seen as cost centre. It is not true in today's scenario. Research leads to innovations, patents and wealth. It brings reputation. Management institutions in India have been seriously lacking behind on research agenda as this is still seen as cost centre. In general, India is found wanting in scholarly publication (global statistics),. This is more to do with 'Library to Library' incremental research culture and less connected to lacking in facilities. PhD program across the board is abysmally low in quality due to inadequate supervision. 'Garbage in-Garbage out-Garbage in', thus, has cascading effect here — the same PhD graduate becomes faculty somewhere and culture of sub-optimal work continues.

Adopting global standards and best practices is only way to bring cultural changes. There are many ways to do — acting upon global ranking feedback, associating with global bodies, participating in global accreditation process, collaborating globally etc. Ignoring global norms on the pretext that India being unique require separate standards — will not take us anywhere. Then we should not have global aspirations at all.

University system plays a dominant role in science and technology research. Rise of China in recent time is attributed to the same pattern. 'Funding' research is big differentiator. US has the most vibrant R&D ecosystem and importance of institutions/universities was clearly articulated in a seminal report in the late 1940s by Vannevar Bush, which led to the creation of the National Science Foundation. Over the years, there has been a dramatic increase in federal funding to R&D in academia: of a total of $110 billion, academia gets the lion's share of more than 30%. In US, competition has been built in at all levels. There is competition to get good students, and equally strong competition to attract the best faculty - institutions/universities go out of their way to get good faculty and vigorously compete even with corporate research labs (incidentally, they often win this competition). And there is strong competition for research funding.

- R&D tied to economy; Management institutions should emerge as 'Idea Factory' - Knowledge into wealth
- Involve IIT & IIM for a Collective research visioning at national level
- Connect all research schemes / fellowships (Ministry of Education fellowships, UGC, DST, CSIR, ICSSR etc) to the issues of >40 national programs
- Funded Project: connect with user agencies (on line of IMPRINT scheme)
- Special efforts on mechanism for 'Indigenization' of tech
- Mechanism to attract investments in deep tech research
- Encourage more collaborative project
- Faculty evolve as 'Thought leader' and influence policies and guide corporations

In India, research & development is not really tied to the economy; an isolated industry didn't feel any need for it. Hence research remained library to library journey. Now, the integration of the Indian economy with the global economy has created a dependence on R&D for some segments. And in the future, its value will only increase as countries that have the ability to innovate will be better placed to compete in the global marketplace. NEP-2020 has very rightly emphasized on nurturing a number of research universities. In most of western countries the industry spends more on R & D than the government, while in India, it is reverse. It is essential that we build a large and vibrant R&D ecosystem in the country where industry participation is significant.

What kind of research a Business School should do? GoI has announced very ambitious national programs in the form of ‘Make in India’, ‘Digital India’, ‘Unnat Bharat’, ‘Swatchh Bharat’ ‘River Linking Project’ ‘Increasing FDI various sector for high growth’ and ‘100 smart cities project’…... These programs are > 40 in number. These if realized, will transform India and bring it in the league of advanced nations. Intellectual input is vital through a ‘think tank’ (on standards, tools and frameworks; regular assessment and release of white paper). At present ‘Think Tank’ doesn’t exist among institutions of higher learning. Management institutions should develop few think tank dedicated to national programs.

**Issue of Autonomy**

Developed nations are leaders in high quality education system, where research and innovations create corporations and wealth. In rest of the world, ‘Education’ system is developed to create skilled manpower to fulfil economic agenda. India falls into the group of nations where agenda of education is sub-optimal.

With >900 universities and 130 ‘Institutions of National Importance’ and >350 private universities and catering to around 4 crore students, India could not create a single institution worth of being rated anywhere near among the world’s top 50/100/150 universities. In 2017, attempt by Government of India (GoI) instituted panel of experts struggled to identify 20 institutions/ universities worthwhile and ready to be given ‘Institute of Eminence (IoE)’ tag that allows some autonomy to operate globally. Though the idea is good but too late and too little. There are still lot of restrictions in going global — in deciding fee to be charged, in admitting foreign students and faculty recruitment etc.

But why, at first place, we are looking for ‘only few’ institutions to be chosen and facilitated (by regulation and resources) to operate globally? This is unheard off elsewhere in other developed nations, where every university is free to operate globally they decided to do so. Restricting scale and scope of institute/university operation is very regressive idea. It paints a very poor state of affairs at a time when India’s New Education Policy (NEP-2020) is being unfolded. ‘Eminence’, however, a title, cannot be given overnight. World class institutions are about passionate journey of great minds coming from diverse places across the globe and form an assembly of intellectuals in university campuses whose confluence create knowledge and knowledgeable being — who build corporations, societies and nations! Story of attaining ‘Eminence’ is very fascinating. It takes several years to reach that pinnacle.

We, though, were never near creating a university setting to the standards of Oxford and Cambridge but NEP 2020 has potential to set a journey towards that. Diversity of talent makes a place powerhouse of innovation where quest for excellence is a very normal thing. MIT is an example, which is ranked top in the world not only in 'Technology' but also in 'Social Science' as well.

Sadly, search for talent pool among faculty is less proactive. It is seen finding more favour from within than the outlook of attracting talent from all over the country, forget outside of country. Criteria and processes are suitably used or tweaked if necessary to serve the self-purpose. It's all over my friends, my acquaintances, my students. We seem to dread merit and talent, which, unfortunately, lie in abundance outside & elsewhere. As a result, campuses have become more homogenous than diverse, resulting into setting-in a culture of complacency over quest for excellence.

This has not left unaffected even top rated IITs and IIMs.We need to do more. That is to render them 'Full autonomy' to operate globally instead of restrictive 'Institute of Eminence' title. Nobody understand what 'autonomy' means to an institution aspiring to come up on the world stage. Power of 'autonomy' and freedom to operate globally help create world class universities — this is amply clear from world top ranked universities — MIT, Harvard, Oxford, Cambridge etc. In the tone of famous saying 'It's the economy, stupid' — we can definitely say- it is 'autonomy' stupid- yes full 'autonomy'! The subject of 'Autonomy', however, couldn't receive exclusive heading in the NEP-2020 policy document as it deserved. NEP 2020 talks about graded autonomy, which would work well for evolving institutions. Panacea for established institutions like IITs/IIMs is not graded autonomy but full autonomy. Else, forget dreaming India having an Oxford or MIT anytime 100s of years in future. So far, the 130 'Institutions of National Importance' still operate in parent-child mode. It would be prudent for GoI to set them free to operate in a Grandfather-Father relationship mode. In other words, empower their Board of Governors (BoG) or Board of Trustees (BoT) comprising of accomplished experts of high reputation to set the goals and agenda, by-laws and governance structure to operate and compete globally.

**Ranking is eye opener**

Institutions should pro-actively participate in ranking process. Global ranking system offer a mirror – an eye opener to revisit, re-visualise and revitalise our programs to match global standards and compete in global market. It is important for Indian institutions to showcase on global stage. Message from global ranking is clear — asking serious introspection and some bold decisions. Questioning or cast aspersions on the rankings themselves is tantamount to avoiding global competition. National Institutional Ranking Framework (NIRF), an 'Indian' way to ranking universities was invented in response. Is it not a self-satisfying exercise, shielding Indian institutions away from nursing global aspirations? This will take us nowhere if we have sincere global dreams.

**Issue of financing**

World class institutions are run with financial adequacy and most of it comes from their own sources. Here fee component constitutes a very small part. To augment sources beyond fee, they maintain ambitious set up with seasoned professionals who work for expanding outreach activities, promote leadership programs, raise endowments and help in bidding large projects. On the contrary, In India, fee remains major source of revenue for institutions and in fact, they are fully dependent on fee to survive. Research income in Management institutions in India is abysmally low as there is no focus. Teaching- Training are their mainstay. This has to change. They should balance and skilfully re-orient themselves to ensure higher income from programs, research and endowments.

- **Research Income (25%)**
  Improved infrastructure, Research Parks, Equity in Start-up, Large collaborative projects – generate additional income
- **Global/ Leadership program (25%)**:
  All revenue generating 'outreach' activities should be undertaken under a **new society**/ Company.
- **Endowments (25%)**
  A section 8 company; use for infrastructure, Scholarships & Chairs for eminent experts
- **Competitive Fees (25%)**
  (defer fee – an option)

Innovative model guarantees every student is brought under fee paying club with deferred payment connected with future earnings. This will remove all overheads connected to fee and fellowship management. Deferred fee recovery will open up innovative ways to recoup more than liable fee to the students. For example, one becoming successful entrepreneur possess higher capacity to pay and pay more. What are innovative mechanism to deal with these high paying individuals. In lieu of the stipulated fee, a mix of return option can be conceived that includes stock options for the institute.

Charging competitive fee and brining all students to fee pay club will meet up to 20-25% of resources. This can be further augmented by developing innovative global programs with international partners for international audience. This will bring stature and revenue both. Other avenues are- special training modules for professional, tapping international students, raising endowments (naming Schools after high value donors) instituting chairs and fellowship schemes, adopting PPP model in developing infrastructure where some areas bring substantial rental or partnership revenue.

Upgrading research facilities opens up vast opportunities of revenue inflow- more from non-government sources.  A research Park is ideal option. A close relationship with industry will help generate more research funds, increase in overheads income as well as instate capacity to invest in and incubate research start-ups, and strengthen technology transfer and intellectual property licensing mechanisms. IIT Madras has shown a way through the creation of technology parks for boosting industry participation in research. Management institutions should establish a society under which all 'outreach' activities are undertaken (on the pattern of FITT of IIT Delhi or KBRC of Kyoto University-Japan).

***Reach-out for Endowments***

Why India does not have 'Rockefeller Foundation' or 'Gates Foundation' who generously fund research at global level? Private sector is flourishing with public facilitation. Private sector in India, however, does not have a tradition of 'Giving' to higher education. Harvard, Stanford and Massachusetts Institute of Technology (MIT) have pioneered the concept of endowments, now adopted by public institutions / universities across the world. Endowment investment returns can easily contribute up to a third of the university's income. Endowments are raised not only from the alumni but also from industry, philanthropists and governments. This has not been tapped by Indian institutions effectively. A successful endowment model will require the creation of fund-raising teams and investment policy changes to overcome bureaucratic hurdles. IITs have recently attempted to reach out to its large and successful alumni base all over the world to generate corpus. This remains an untapped area and has huge potential to fill the reservoir of Management institutions only if vigorous efforts are made.

***Financial Model for sub-units***

Schools/Centres within Management institutions should be sufficiently empowered entity - a micro model of the institute itself in complete administrative sense. Nurture them as a 'Father-Grandfather' relationship (self-sustaining model) rather than the existing 'Parents-Child' relationship (dependency model). Let finances of these academic units be run in a project mode (ie 80:20 model where academic unit retains 80% of revenue while 20% goes to central admiration). An annual 'Balance Sheet' may be prepared accounting all 'Cash inflows' and 'Cash outflows' to ascertain School's viability. In such a scenario, academic units will be more focused in offering demand-driven courses, run high quality training programs, make efforts to raise endowment and build a corpus for remaining self-sufficient.

**Nurturing Faculty as thought leader**

Faculty members are pillars of any institution. Searching and recruiting high quality faculty from across the best universities in world – remains the primary task of top leadership. There exists settled competition among B-Schools to reach out a promising faculty candidate by attractive propositions. Further challenge is to keep them motivated to contribute towards the national and institutional priorities over a period of time.

Office of Dean (Faculty) holds primary responsibility to facilitate academic units and the Director in faculty search, recruitment and **r**etaining the best and brightest talent. This is needed to keep B-School the beacons of innovation that the nation and the world need and will be willing to support. **A** closure look of this office would reveal, most of the tasks here are operational in nature. A faculty member joins the institute and is expected to contribute to the institute for 25-30 years typically. There is a need for envisioning how to ensure that he keeps contributing in the growth and rankings of the institute in the long run.

Strategizing faculty affairs would take us to understand 'faculty of future'. A 'life cycle approach' would be very helpful to articulate that. We visualise 'Faculty for a Future' an ambitious and sensitive academic who is guided by a sense of duty and channelizes all energy in dealing with problems and issues being faced around. All choices of their research, teaching, public engagement, and institutions are towards the pursuit of a better future. How become the first choice of such a faculty?

**Faculty Life Cycle Approach**

Faculty life cycle captures trajectory of a typical career in phases ie early phase-1 (Search-Attract-Recruit), mid phase-2 (Nurture-Engage) **B-School** to Mature phase-3 (Rise as thought leader) and Stay in Phase-4 (Global standing).

Faculty members after joining the institute serves in 4 different areas primarily, namely, teaching, research, administrative services and outreach. Teaching requirements are somewhat standardised across the institute. Administrative services and contributions are typically a combination of interests and nomination. However, a cursory look at Scopus indicates that while productive faculty members (say top 10%) produce double digit publications every year, there is a significant long tail that may not average a single publication also every year of their service. While the average number of publications per year is between 5-6, more than 60% faculty members produce less than this average. Similarly, when it comes to outreach excellence, the publicly available records in IRD showcase the lack of sustained initiatives to create impact from outreach and projects. This calls for an approach for building a faculty life-cycle management to sustain enthusiasm beyond career progression stages and have a long term organizational commitment towards the **B-School** through institutional practices.

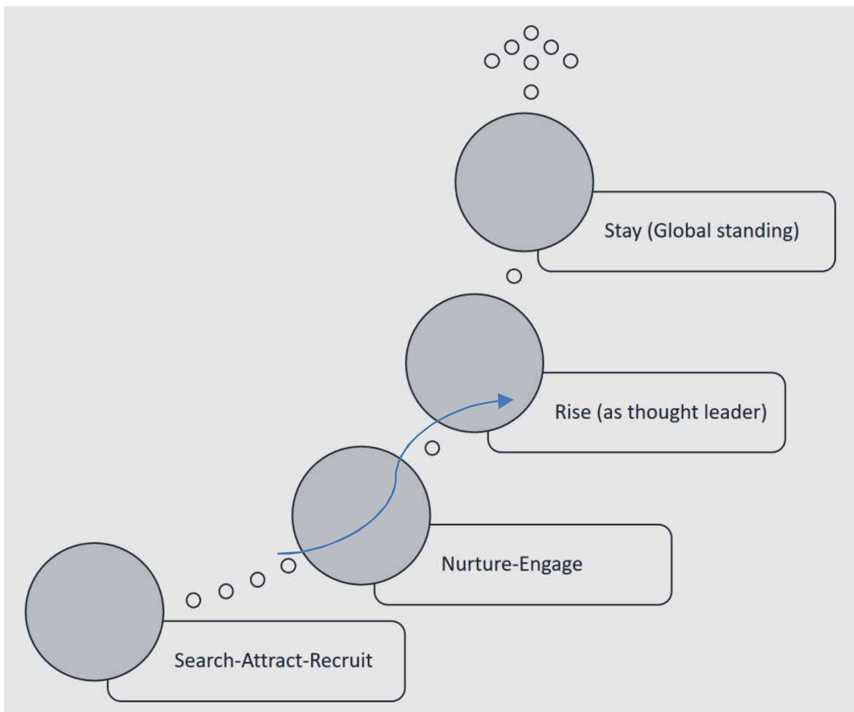



*Figure-2: Four(4)-phase FLC*

***Phase-1 (Search-Attract-Recruit)***

Search

- A team from every school/centre undertake visits and do roadshows to doctoral students of universities/ institutions of high ranking in India and abroad; These visits are also occasion to promote the program and explore collaborations & MoUs
    - Advertise in the leading academic Journals/ global media
    - Stalls at leading world conferences
    - Compile faculty success stories; video clips
    - Search Committee to facilitate the above and shortlisting process

Attract

- Identify and reach-out to high quality graduating doctoral students

- Identify and reach-out with personal letter to select few for lateral entry
- Prepare comprehensive 'Faculty Handbook' with FAQ

Recruit

- Encourage academic units to adopt latest global standards for shortlisting criteria; Revise them on regular basis
- Prefer 'Web of Science' listed outlets and standards therein; this will also enhance our global ranking
- Encourage academic units to suitably raise the bar over the minimum criteria communicated from the ministry
- Allow academic units to introduce intermediate steps in between Stage-I & II to filter and invite the select few from large number applications
- Today online meetings provide opportunity to take advantage of outside expert input. Hence, at least member from outside in each area must be made part of Committee of Professors (CoP) involved in the above processes - a fair system
- Develop mechanism to discourage those candidates seeking promotion by aiming bare minimum eligibility criteria
- Delegate recruitment of all non-regular positions ((viz PoP, VF, Adjunct & guest faculty etc.) to academic units; this will free the Director & others in the process from overheads of recruitment process
- Prepare a fresh recruitment guideline in view of the above
- Develop 'Single point help desk' for the new faculty

***Phase-2 (Nurture-Engage)***

Nurture

- Process orientation for new faculty; speed up process automation
- Develop mentorship scheme for all new faculty (i.e. attach to senior professor, preferably a Chair Professor, outside the Area to guide assimilation into the system advising on established practices, rules & regulations etc)
- Also encourage the new faculty to choose an 'Icon' mentor from anywhere in the world from whom he/she draws inspiration. A support system would be required to facilitate interaction with icon and host them in the B-School.
- Faculty seed grant for more collaborative work for cross area research
- Allocate doctoral candidates liberally; more in jointly supervision
- Encourage joint supervision of doctoral students for those faculty not active in supervising doctoral candidates
- Collaborative research with external experts (India & Abroad); Facilitate with staff & resources
- Allocate a support staff serving at least two faculty

Engage

- Encourage them to work on national priority programs or with strategic agencies (ISRO, DRDO, BARC etc)
- Constitute a 'Think Tank' expert group for each national priority program; this may have external experts as well; facilitate regular knowledge sharing workshop with other stakeholders; release white papers
- Encourage them work with industry associations on subject (CII, FICCI, NASSOM, DSCI etc); make them part working groups
- Arrange industry sabbaticals at attractive packages
- Encourage active participation in reviewing for established journals and building presence in Web of Science as a reviewer. This contribution over time leads to presence in editorial boards of the journals.
- Encourage guest editorship in reputed journals on topical areas of research to signal competency and interest to the academic community.

***Phase-3 (Rise as thought leader)***

- More funded Chair Professorship; which takes into account objective parameters surrounding faculty productivity and impact both
- Special drive to Invite eminent researchers (Padmshree, SS Bhatnagar & other Awardees, Fellows etc) to the Chair (lateral entry)
- Nominate Chair Professors to policy making bodies of government agencies
- Encourage them produce 'Strategy Papers' influencing policies
- Mechanism to participate in corporate Boards (non-executive, independent directors)
- Encourage them to actively join editorial boards of established journals so that they can contribute to the research ecosystem and also demonstrate impacts over time
- Encourage them to join review and expert boards for sponsored research and funding opportunities for startups and entrepreneurship
- Participate/ represent India in global forums (ITU, World Economic Forums etc)
- Encourage them to target global reputation benchmarks like Highly Cited Researcher by Web of Science, awarded to Top 1% researchers including Noble Laureates.
- Allow them life-long association with the B-School if there are demonstration of sustained excellence and high objective benchmarks as intellectual equity builds over time and helps institutional rankings.

***Phase-4 (Stay in Global standing)***

- Facilitate our highly cited professors further
- Create more honourable faculty ladders viz ‘Professor of Eminence’ ‘Distinguished Professor of Research’, ‘Distinguished Scientist’, Presidential Professor etc
- These are to be used to invite eminent researcher professors at very attractive sponsored package
- For example, Highly Cited Researchers (HCRs) who rank in the top 1% by citations for field and year in the Web of Science™. of the world’s scientists and social scientists
- HCRs (Highly Cited Researchers) truly are one in 1,000; so far there is only two HCR professor in Indian (one each in IIT Roorkee and IISc Bangalore)
- Invite HCR Researchers from global places: start with affiliate/adjunct position; position should be allowed liberally for HCR professors and host them under Distinguished Chair Professor Schemes.
- Invite and host a ‘Nobel Laureate’ in this scheme; Special endowment can be created for this
- Invite eminent professionals from practice world as ‘Professor of Practice’ in place of seeking applications (with select few)
- Allow them life-long association with the institution

**Impact of National Education Policy 2020**

Traditionally Technical and Management education in India have evolved separately and have maintained exclusivity to a large extend. However, provisions of National Education Policy 2020 (NEP 2020) are going to demand drastic change in character these institutions. As we know India’ NEP-2020 is announced after a gap of almost 35 years, replacing the previous policy in vogues since 1986. The Draft New Education Policy (DNEP) containing 484 pages, was released in 2019 that followed a number of public consultations, receiving over two lakh suggestions from across all parts of the country. The massive efforts enlisted above, have definitely resulted into new directions and new milestones that it sets for the nation. Such document, however, would normally be subjected to close scrutiny for its foresights and few possible omissions. It envisions a complete overhaul of the higher education system to deliver high-quality higher education, with equity and inclusion. The policy’s vision includes the following key changes
Problems with HEI

| NEP Recommendations | The recommendations include developing |
|---|---|
| ▪ Fragmented higher education ecosystem | ▪ Research universities (about 100 research universities from among >800 existing ones) |

- Limited autonomy
- Low emphasis on research
- Poor Governance
- Ineffective regulatory system
- Towards multi-disciplinary higher education system
- Faculty & institutional autonomy
- National research Foundation
- Governance by independent boards
- Light but tight regulation

- Large campuses with enhanced enrolment (a community of 25000 students and 2500 faculty)
- Multi-disciplinary universities, which are necessary for high quality innovation and research. India so far has been has taken the path of creating small and specialized institutions, which exhibit limited impact ie fulfilling the need of specialized professionals. IT industry has been greatly benefited by this strategy. However research outcome, so far, is found hardly any significance.
- A chosen few should be given special attention and allow them graduate into top league in the world

Research universities, stand out from teaching universities, as their entire energy is focused on nurturing a high quality research ecosystem with a strong Post Graduate and PhD programs. They remain engaged with government agencies and industry on strategic research projects. Old IITs, fall in this league. There is still long way to go for them to be impactful research university. Some clear actions are needed to scale up their operations and also expand the horizon beyond technology- to liberal arts, Business and Medical subjects to become full-fledged multi-disciplinary campuses as stipulated in NEP-2020.
This, however, would not be enough. The major hurdle in the emergence of Indian institutions in the world ranking is their lacking in 'global focus', which, is seen a very important feature of world class institutions. Global focus has never been an agenda of Indian higher education system and they have remained inward looking for a long time. Unfortunately, they are not yet ready for the same. Further, overall impact of Indian institutions/ universities is also abysmally low. The reasons are — low budget and severe restrictions under which they operate. High dependency on government grants is limiting them to grow as an impactful entity. Government grant is shrinking anyway.Business schools can draw upon lines from NEP 2020 that would enable them transform into a more holistic, flexible, and relevant to the needs of the 21$^{st}$ century society. This Policy adequately aligns with the Sustainable Development Goal (SDG)-4, is about quality of education and "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all". It is committed to achieving inclusive and quality education for all reaffirms the belief that education is one of the most powerful and proven vehicles for sustainable development. In this context, Business Schools are required to remodel to focus on imparting 'Responsible Management Education (RME)', which suggests that a key challenge for business schools engaging in RME is to prepare students to engage with and drive in a changing context. Responsible Management Education (UNPRME) outlines certain principles promoted by United Nations (UN),

whose aim is "to transform management education, research and thought leadership globally by providing the principles for responsible management education framework, developing learning communities and promoting awareness about the United Nations' SDGs" (UNPRME 2016). UN network and UNPRME resources should be leveraged by the Business schools in India to realise the promise of NEP 2020.

Pedagogy adopted in the Indian management schools is largely case study method of teaching. Top Business schools in India often go beyond case studies and add this with innovative approach (business simulation, live projects, self-study, diverse internships etc) that are keeping their curricula and pedagogy up to stakeholder needs with the changing demands of the time. The NEP 2020 promotes an interdisciplinary approach to education and encourages institutions to offer diverse management programs and specializations, and enhance technical skills, problem-solving abilities, and critical thinking. It emphasizes the importance of promoting entrepreneurship and innovation in the country, by providing them with the necessary support, mentoring, and exposure to entrepreneurship-related activities.

It encourages the use of technology in teaching and learning processes, which can enhance the overall learning experience, facilitate research, and prepare students for the digital economy. The policy encourages management institutions to focus on research activities, contribute to the development of management knowledge, and address real-world business challenges through research. It also promotes avenues for professional development of faculty members (enhance their teaching skills, research capabilities, and industry exposure, ensuring that they provide high-quality education to students). The policy encourages management institutions to maintain high standards of education and provides support for accreditation and quality assurance mechanisms. NEP 2020 advocates to draw upon Indian knowledge systems and complement class room teaching. Business Schools should strive to develop repository of resources on this.

Key question is about 'Autonomy'. NEP-2020 has outlined an idea of 'graded autonomy'. Does it apply to institutes like IITs/IIMs? Is it sufficient to unleash potential mature institute, at least those 130 'Institutions of National Importance'? Idea of 'Graded autonomy' doesn't make any sense for an already established and mature institutions. IITs and IIMs fall into this category. They should be given full autonomy – to be able to operate and compete globally. Act guiding these institutions – still offer restricted autonomy.

**Shaking up Governance**

If India wants its institutions to be seen in the club of Harvard, Oxford and MIT, the higher education system has to be revamped first. Otherwise, we keep blissfully occupied in endless debates but we remain where we are. Few features, particularly noticeable among Board of typical management institutions, are:

- governance structure does not encourage competition hence fail to set ambitious target.
- majority of the senior administrative positions is less strategic and more operational in content and nature.
- all appointees to these positions are made by the head of institution from a pool of senior faculty within the system.
- These positions are not open for a competitive search with a comparable compensation.

A competitive spirit, therefore, is lacking among the Indian universities/institutions.
Why not follow the global best practices of governance in academic system?

Every organization exists in public sphere with a long term 'vision' that is realized by undertaking specific 'mission' mode activities under the guidance of certain 'core values' deeply ingrained as fundamental beliefs that ensures righteous path is followed in all acts.
Governance structure is more like organs that facilitate organizations realize vision and mission without compromising its core values. Organs here refers to organizational structures and processes that are designed to ensure organization choose an aspirational 'vision', has clear 'mission' and set of 'core values' that guarantee accountability, transparency, inclusiveness and empowerment.

Often Governance is seen having overlapping meaning with management. Management however, is more about mobilizing and transforming various resources (physical, human and financial) to achieve concrete outcomes. Governance is about how power is distributed and shared, how policies are formulated, priorities set and stakeholders made accountable. Governance systems set the parameters under which management and administrative systems operate (UNESCO). The core of governance lies in creating an aspirational environment and encourages healthy competition within the organization. Opportunity lies into going forward with a transformational strategy and not incremental, where few suggestions outlined below are worthy enough to be adopted.

*A forward looking Board of Governors (BoG) — is vital*

- BoG should set transformational agenda and actively get involved in defining strategic directions; guide operational changes; look for innovative schemes to achieve financial stability and resilience. For that government has to empower BoG.

- Board accountability may be made higher by forming several sub-committees to push forward specific strategic goals and build momentum
- Include faculty and students in these committee as invitees. This will give them time to present concerns to the board and engage in a deep discussion of issues
- Since most of the Board members are from diverse background, it is important to regularly apprise them about global trends in higher education
- Eminence of Board members should be impeccable

*Involve everyone in setting new Vision*

- Develop aspirational and shared vision in conversation with all stakeholder (bottom up)
- Think global and set ambitious mission & targets (collective leadership)
- Encourage all units to brainstorm and come up with innovative solutions that help achieve the shared vision, suggest ownership and accountability (horizontal and vertical)

*Prepare for a transformational journey*

- With National Education Policy (NEP 2020) expecting institution to expand into multi-disciplinary set up with high research focus, it is asking too much too soon. Given that India has mostly nurtured linear academics for a long time, it is going to be transformational journey for most of them. Many structural changes would be necessary including introduction of some radical dimensions. Leadership guiding the change will matter the most. It is important to identify a bold leadership who possess strategic sense to lay down new expressways, have the ability to scout talent (from within and beyond), build smart teams for various subjects and put them together to accomplish larger goals. So far current breed of leaders lacks this character as they are accustomed to be playing an incremental role within the constraints, rather than coming out of it.
- Radical dimension means to focus more on external-facing strategic activities-mostly outreach, while leave internal operations to the team working under.
- First task is to create robust system so that most of the operations run in auto-pilot mode leaving the leadership time for strategic activities. This will also help develop a data-driven decision making culture. Occasional and high level guidance should be enough to operations.
- Radical dimension would entail developing a strategic plan where focus is more on financial stability in view of shrinking state funding, upgrading infrastructure to global standards, enhancing global operation, attracting global talent pool and teaming for impactful research etc. Indian universities/ institutions are going through a demanding time anyway. Just see so much media attention and increasing public scrutiny due to poor show in global ranking. Running universities is now a much

more complex business than usual. They need to be run like a large and complex enterprise.

***Set global ambition***

Growth lies into global operation with internationalization of the program. Global layering efforts have to be more aggressive: joint programs with global partners, foreign faculty recruitment; campaign for international student's enrolment; invite global faculty for teaching, and enhance global immersion program. International accreditation will make it easy to achieve these goals. Open representative offices in major continents – Europe, North America, South America, Middle East, & ASEAN

***Experiment with bold leadership***

- Extraordinary situations call for extraordinary measures [see my write up 'What's ailing India's Higher education (IHE) system?']
- Current leadership model is failure in India. The prevailing process of leadership selection is anything but fair. It lacks aim and professional approach to choose a competent leader. We see 'favorites' and mediocrity around.
- Can we do something radically different — as an experiment?
- Bring outsider (non-traditional leaders) to lead universities/ institutions? There are plenty of examples where a proven leader from other domain, in fact, have been brought to lead universities to a success.
- In USA, this trend is increasing with every passing year. There have been 10 such appointments in 1986; 14 in 1995; 23 in 2012 and 62 in 2014
- Let me refer to three appointments in US universities, where bold leadership choices were made to execute transformational agenda: Janet Napolitano, former secretary of homeland security, was named president of the University of California system in 2013. Clayton Rose, a former vice chairman at JPMorgan Chase was appointed president of Bowdoin College in 2015. And in 2016, South Carolina State University appointed James Clark, a retired AT&T executive, as president [McKinsey & Company, February 2018]
- Lets us keep academicians away from administrative roles as they primarily enjoy teaching and research hence let them go back to class rooms and labs to do what they do best

***Differentiating 'Strategic' from 'operational' activities***

- First is to identify and prioritize activities that directly lead to fulfilment of organization’s vision and mission. A clear distinction between ‘Strategic’ and ‘operational’ activities has to be made. Strategic activities may demand fundamental design changes and need adequate authority while ‘operational’ activities merely require efficient execution where an intelligent automation would ensure an ‘auto-pilot’ mode of operations-that serves well.
- The second step involves roles descriptions for ‘Strategic’ activities (distinct from operations) and aligning them with the broader organization, for a smooth interaction with various academic and administrative divisions.
- The third step is to explicitly allocate decision-making authority to various roles, adjoining committees, and stakeholders of the organization. The resulting governance system must strive for excellence, adopt best practices in order to develop higher capabilities, encourage competition, and emerge as true global organization having influence far and wide. It must have sufficient scope for stakeholder’s voice to influence the scope of business.

A leadership role is assigned most often without bothering to draw a line of distinction between ‘Strategic’ vs ‘Operational’ content of the role. Thus role get diffused to routines. Let us understand with an example- handling sponsored research and consultancy projects is one of the many important activities in a university administrative set up. It is led by, typically, a Dean (R&D). The name itself is old fashioned and limiting in scope (general omission is commercialization aspect of research). In most of the places, the task of this Dean is limited to facilitate administrative support required to manage the fund as per terms and conditions of the funding agency. While main task of this unit should be to play a more proactive role in developing research strategy for the institution, setting research agenda based on collective consultation over national needs, encourage institutional collaboration on larger theme and mobilizing faculty resources to participate in the same and most importantly connecting doctoral program with national priority programs. These proactive settings will ensure higher research outcome and impact.

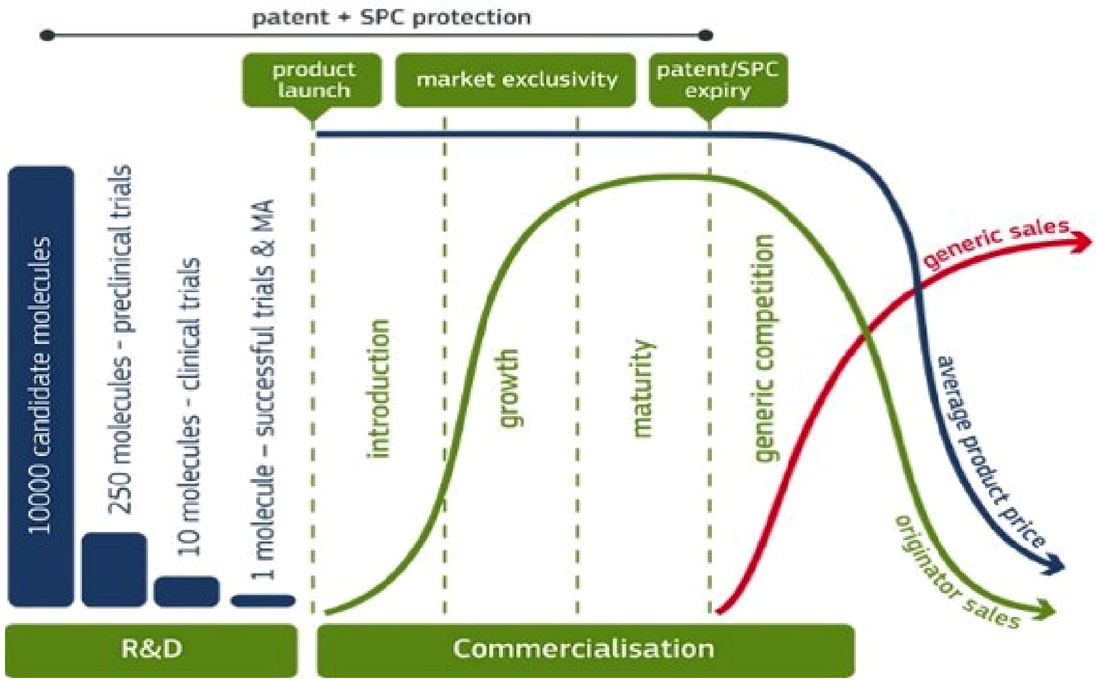


*Figure-3: R&D cycle promoted by European Union*

A new model is to have two separate but dependent positions- Dean (Research Strategy) having support of a Associate Dean (Research Operations). The team of Dean (Research Strategy) is supposed to devise and implement strategies and policies to maintain and increase the institute's research funding; shape the response to a changing research landscape and the requirements of our funding partners; and enhance institute's standing as a world-leading institution. European Union has prescribed Research Life Cycle (more for applicable for Pharma products) but generalizable enough to draw lesson and delineate entire 'Research Support Life cycle of a project' to be serviced by the office of both Dean and Associate Dean. The Associate Dean takes care execution and operational part.


***Figure 4:*** *Research Support Cycle*

***Diversity and scale of operation***

International diversity brings compounded impact. It creates multi-cultural environment most suited for academic pursuits. Management institutions should envision a future, responsive to the above trends and align with the 2047 goal of national development. Future wise, Management institution should aspire to:

- Aggressively diversify (vertically and horizontally both into cognate areas - Sustainability, Policy & Law, Diplomacy, Healthcare, Heritage and Technology Management etc.). These would augment high quality innovation and research.
- Expand undergraduate programs in areas that feed the management discipline.
- Research brings reputation. Impactful research is easily doable by touching national priority programs
- Area → School: The prevailing concept of 'Area' is a very adhoc faculty grouping primarily based on functional specialization but serving not more than a narrow purpose. This was fine in early days of start, but now, having established a reputation, should revisit and adopt a new umbrella set up. 'Area' should be given a more empowered structure viz. Schools or Centers. These entities also attract

donors and help build corpus for the school. They should operate with substantial size of 30-40 faculty.

To do so, management institutions should be allowed to remodel into an entity that has a character of a true International Management University. It will certainly have wider spread and help acquire multi-disciplinary character in due course. Singapore Management University (SMU) is a good example.

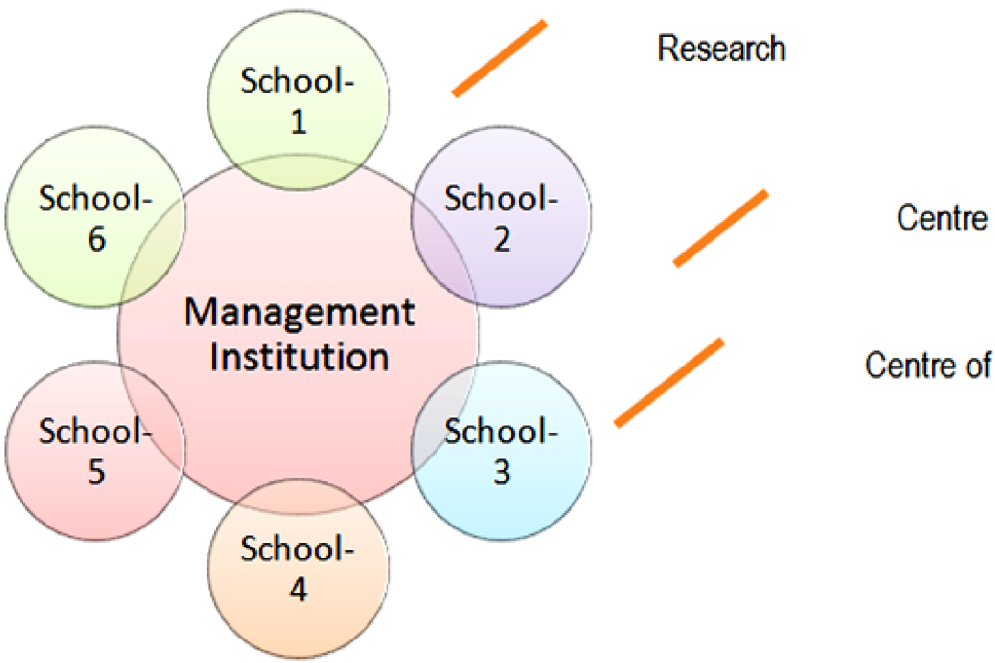



*Figure 5: Management Institutions with stable subunits*

Growth and expansion brings rich dividend. There are five options that can be explored:

- Choice-1 Smart Campus
- Choice-2 Academic Expansion
- Choice-3 Meta University or Unifying adjoining institutions based on synergy
- Choice-4 business ecosystem with campus neighbourhood
- Choice-5 Mentoring

Primary concern in many old institutions is limited available land area. Here seasoned urban planning experts and architects should be engaged to prepare a blue print of – designing vertical structures, land acquisition, satellite campuses, business ecosystem with campus neighbourhood and unifying two adjoining institutions.

(a) Make it 'Smart Campus'.
(b) Explore 'Meta University' concept with other leading institutions in the country (preferably with IIMs/IITs). This allows lot of flexibility in program offering – modular programs c-owned by multiple institutions, credit standardization, and maintain credit bank. Increasing enrolment is important in view of the fact that India's gross enrolment ratio (GER) in higher education is 28%. It lags behind the global average of 38% and behind China's 51%. If India wants to become a knowledge economy, our higher education institutions (HEIs) has to become very impactful in capacity and capability. Capacity means increasing GER to 50%, while capability refers to quality of content (valuable knowledge and influential graduates).
(c) Develop satellite campuses in the nearest vicinities.
(d) Nurture a 'Business ecosystem' in and around the campus. This refers to extended campus township creating partnership opportunities with the neighbourhood – most potent is meeting all residential requirements (student hostels and faculty housing) within neighbourhood. It should be done professionally designed as township where campus is extended to include neighbourhood on clear business understanding. Surrounded localities/adjoining villages have attained high real estate value now. With them, a semi-porous township consisting institute and adjoining area may be explored where multiple high rise towers may be developed by any established builder to operate them as hostels, residential complexes and hotels– all on commercial terms. The revenue model is sustainable based on partnership among the three entity – institute + Villages + The builder. A 'Knowledge Park' may also be worked as will attract large investment by corporations who would like to locate their HQ/Labs near the campus for a mutually beneficial arrangement.

*Under Graduate Programs*

World leading Business Schools have all round academic programs - undergraduate programs are a major part of it. Consider expanding Bachelor programs in areas that suitably aligns with flagship MBA viz. in Technology & Law, Digital Economics, Accountancy, Risk Management, Informatics, Urban Planning, Public Health and Diplomacy. These programs will command premium apart from first mover trend setter. The cutting edge curriculum, containing adequate corporate and global exposure, will be not only a differentiator but uniquely position them in professional world.

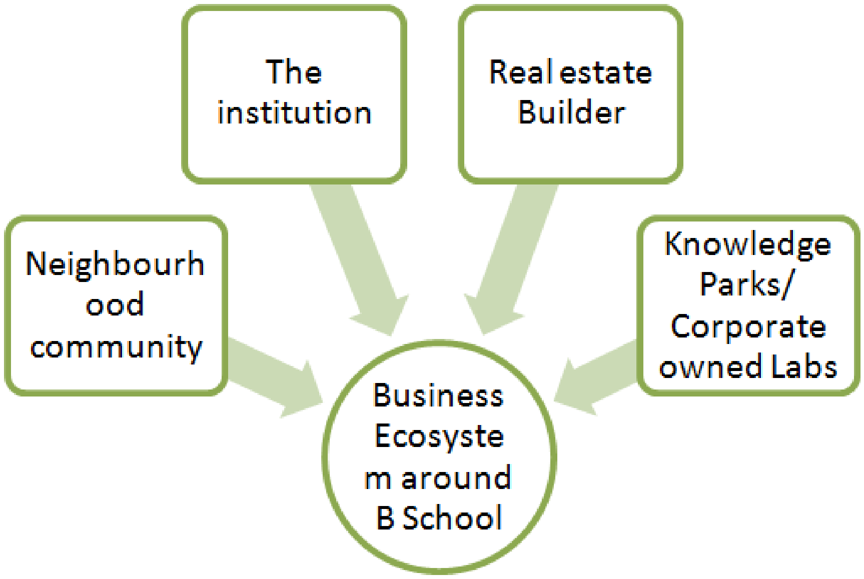



*Figure 6: Nurturing a Business Ecosystem around a Business School*

*Mentoring: a new experiment*

'Mentor' select few institutions in country of reputation, who are financially independent and self-governing, but align with own institution's long term agenda. Curriculum and quality control will be strictly implemented over the mentee institution. It will be easy to guide a teaching college/institute/ university infuse high quality teaching pedagogy or to move to become a research university.

**Aggressive Outreach**

*Leadership Program*

Training programs are important source of revenue and connect with the practice world. Management institutions should explore global market-place potent for such high quality programs. They should be offered for international audience via few strategic international partnerships for the same. Leadership level programs carry higher rewards.

*Deepen engagement with alumni*

The success of great institution is deeply connected to its graduates, who must first thrive within the confines of academia and then grow and develop in their organizations, thus giving back to their environment and their alma-mater. Alumni bring with them energy, respect for others, a thirst for discovery and the desire to contribute to their teams' well-being. The youth in them is positive that seeks to change the world and is guided by a real moral concern. Special programs should be designed to engage with alumni- Local articles, Clubs, Awards, Endowment funds and Fellowships etc. A dedicated and sizeable team following global traditions are obvious way forward.

*Harmony with Local Community*

Management institutions should host a range of interesting and engaging activities for all community surrounding the campus. It may include special programs kids, adult, housewives and animal kingdom. Swatchh Bharat Abhiyan program will boost the objective by a partnership with local community. Owning up an NGO may facilitate fruitful engagement on social issues.

*Development Society*

Becoming financially self-sufficient, will require adequate freedom to offer efficient governance to revenue generating operations. This may be delivered via owning a company or society under a suitable legal provisions. All 'outreach' activities would be undertaken and own sources of funds are managed within the society or establish a profit centre (on the pattern of KBRC of Kyoto University-Japan). This will provide adequate freedom to create by-laws and governance that guarantee its unbound growth. Quality of staff is very critical – develop capacity to hire qualified professionals for handling key outreach activities.

*Marketing and Branding*

It would be prudent to utilize the services of a professional firm to help with our Image, branding, and collaterals as these are going to be critical. It is essential to evaluate and decide upon: branding, Imaging & collateral creation, mentoring program for students and corporate customer survey (Corporate, NGO, PSU).

**What we can learn from IITs?**

Post internet, speed at which changes is being experienced, have not happened in past 200 years. Challenges we face today, therefore, are more intertwined with the technology assorts. Technology feeds Management, which in turn feeds Technology. Who is better equipped to deal with such a situation? IITs, obviously, are better positioned today to respond to changing needs than any other institution, as they have expertise of technology anyway. They are much closer and capable to play a bigger role in realizing ambitious national goal, making corporations ready for industry 4.0, leveraging digital economy, push start-up movement and feed into national programs. Stand-alone institutions, particularly B-Schools, have no future and will become irrelevant soon if they don't re-orient to the changing needs.

**How IITs could developed an edge?**

Since past 20 years, IITs have been continuously and very sensibly diversifying into several non-technical disciplines (viz. humanities, Social sciences, Management, Law, Bio & Medical, and Economics etc.). This ensured they remain most relevant. A non-technology discipline (eg.MBA) is rightly complimented by the existing academic unit viz. Computer Science, Communications & Smart Technologies, AI & Robotics, and Mathematics, Manufacturing and Industrial Engineering. These are not possible in stand-alone B-School settings. NiRF ranking in management also speaks the increasing value proposition Technology & Management as pair brings over the others. Undergraduate program has also been significantly reformed to offer students variety of choices - beyond technology.

In a way, they are more ready, to claim a multi-disciplinary campus than any other institution in the country – which is now mandated in NEP-2020. There should be no ambiguity that 'Technology' has to be central to a multi-disciplinary set up. Here, Massachusetts Institute of Technology (MIT) is the most apt example to illustrate this, which has a School of Architecture and Planning, a School of Humanities, Arts & Social Sciences, and a Sloan School of Management apart from School of Engineering. Interestingly MIT is ranked number-1 in the world in both 'Technology' and 'Social Science' both.

**Latest Trends in B Schools**

*We are into* a Fourth Industrial Revolution, which is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres'. It brings forth a scenario that is fundamentally altering the way we live, work, and relate to one another— organizations are connecting everyone and everything, everywhere, all the time. They are becoming capable of delivering instant, intimate, frictionless, incremental value on a large scale. This is unthinkable before! Do Business schools keep pace in their curriculum reflecting this trend?

Traditional thought of 'profit vs wealth maximization' that Business Schools teach is no more applicable. Today's firms are driven by continuous innovation for customers. Think of Amazon, Apple, Facebook, Google, Microsoft, Alibaba, Airbnb, Etsy, Lyft, Menlo Innovations, Saab, Samsung, Spotify, Tencent, Tesla, Uber and Warby Parker. In these firms, profits are the result, not the goal that defines 21$^{st}$ century thinking. Talent drives strategy; Dealing with big issues requires small teams, small tasks, small everything; Complex systems are inherently problematic, and must be descaled; and Companies make more money by not focusing on money.

Majority of senior executives want to master new practices created by these firms. Business Schools should be aware of new expectations. The accreditation process of business schools guarantees glacial change to core curricula. However, change often is small as the change cycle is long. **Paradoxically,** Business school research is also seen in an enclosed self-referential world—academics writing for other academics. The utility of the entire research is not convincingly established. The fact is that most businesses turn to other sources of knowledge, such as consulting firms, and not to Business School for guidance. This refers to a massive opportunity for business schools, which consulting firms like Deloitte and McKinsey are taking advantage by fulfilling the need. Further, to enhance quality in MBA education, a strong emphasis is now given on diversity, curriculum, Global Immersion Program (GIP), teaching pedagogy, amongst other factors.

***Diversity***

Referring to 2015 McKinsey study, companies now discover positive financial performance with more women leading alongside men - 15% better than the industry median. The most ethnically diverse companies did even better, outperforming the industry median by around 35%. Improving diversity in the MBA classroom is, therefore, crucial now. Additionally, gender diversity is vital for B-School rankings and could tip the outcome easily.

***Flipping the classroom***

The concept of "Flipping the classroom," a "pedagogy-first" approach to teaching is being found to be more impactful in course takeaway than traditional lecture mode pedagogy. Lectures can be watched and replayed hence Professor's time is more effective in engaging students into more case discussion, role-playing practical, project conceptualization and learning via business simulation. Thus the entire vision of delivering an MBA program has changed.

***Gamification***

Gamification is also playing a more prominent part in education. Students can engage with business simulations, where each student plays a role in running a company, thus, making learning outcome high.

***Soft skill***

Training in soft skills, such as negotiation, leadership, teamwork, and problem-solving, therefore, remains a top priority for business schools.

***The Global Immersion Program (GIP)***

It is a new trend designed to provide a high-level exposure of the economic, cultural and geopolitical drivers behind regions integral to the global economy. Students are sent to an overseas location in batches to get exposed to local culture and business environment. The overall objectives of the program are: to provide an understanding of the region's business, cultural, and political environments; achieve a working knowledge of local business practices through direct interaction with managers and government officials; explore the value of different economic models as benchmarks for global business practices; and promote intercultural awareness and communication.

***Technology trend***

MBA curriculum must reflect the emerging technology trends such as the Internet of Things (IoT), sensors, Blockchain, artificial intelligence (AI), cryptocurrency, Nano-technology, and neuro-technological brain enhancements, etc. However, in Business School setting, these would need to be suitably re-focussed.

*A tech-inspired curriculum*

The Tech MBA is a reflection of the growing demand for business leaders who can upskill and also be digital leaders where they apply their tech expertise within a business context. Tech MBA is still an MBA with a general management perspective, but a general management perspective for tech and tech-centric related companies. Tech-MBA focuses on digital finance, data analytics and AI, as well as digital transformation. It is a wholesome package created for students who are also going to study business strategy, in addition, they will be analysing the corporate strategy of top tech companies, like Amazon, Google, and other tech-centric companies, such as start-ups which are considered digital masters. They will study economics but there's going to be a strong emphasis on the digital economy. Operations are going to still focus on supply chain but with a focus on e-commerce companies. We're revolutionizing the way logistics and supply chain are managed and taught.

***Entrepreneurial Agenda***

- Leverage 'start-up' movement where GoI has an ambitious national program.
- Establish a School of Entrepreneurship & Innovation hubs
- Create innovation fellowships for students; Faculty innovation fellows
- Develop Innovation partners/ mentors to help with the complex process of taking ideas beyond invention.
- Scale up to have global operations (eg Babson College)

- Nurture corporate partnerships to support various activities (Start-up funding, Chairs, Fellowships etc)
- ‘Innovation hubs/ Knowledge Park’, within the campus, would complement this agenda.

Start-up India’ is an ambitious national program, which should be leveraged to further the national agenda. Having a School of Entrepreneurship would create opportunity of more organised and concerted efforts. This may include create innovation fellowships for graduate and undergraduate students; faculty innovation fellows-for distinguished faculty who focus a significant part of their research activities on translation and impact; and innovation partners/ mentors to help with the complex process of taking ideas beyond invention. Many corporate houses are infusing resources and working with reputed campuses to enhance the collaboration resulting from local proximity, develop a number of innovation-focused spaces (Incubation Centres), as well as small physical footprints in innovation hubs. These should be tapped. Accelerating efforts in three key areas may be helpful: one, conflicts of interest – to enable rapid impact while safeguarding academic integrity; two, faculty advancements – to give consideration to ideas-to-impact activities along with more traditional metrics of academic success; and three, corporate partnerships – to develop move streamlined approaches to industrial partnership. A ‘Knowledge Park’, around the campus, would complement this agenda. Alumni graduates must have noticeable presence in the start-up world. They should be involved in mentoring.

***Shorter Duration Management Education***

Compact 1-year Master program is becoming more popular. Some of the schools have already started winding up their 2-year full-time program. For instance, Tippie Business School launched 1-year master program in Business Analytics in 2014 and later decided to close the school's full-time MBA in August 2017. In Europe, many Business Schools have closed MBA program and started specialized programs of shorter duration such as MSc, MS, etc. of 1-year duration. These are a less costly option compared to MBA, and students get rightly placed after graduation and payback education loans easily. It is a fact that overhead costs of MBA are high for student and employer both. Of 661 institutions accredited by the AACSB, 79 Schools do not offer any form of MBA, instead opted for 1 year specialized programs in cutting edge topics. A handful of schools have either dropped full-time courses or opened without MBA programmes such as King's College London, Wake Forest University in North Carolina and the University of Iowa's Tippie College of Business. These decisions were made as the schools coped with shifting demands in the business education market. Due to the new format of shorter management education, a higher number of applications is received in European and Asian institutions as compared to the USA. Tippie Business School is now going to offer a range of specialist masters courses, building on the success of its existing degree in business analytics. Applications for that course have grown 517 percent since its inception in 2014. In Europe, many Business Schools have closed MBA program started specialized programs of shorter duration (MSc, MS, etc. of 1-year duration). These are a less costly option compared to MBA, and students get rightly placed after graduation and payback education loans easily. Of 661 institutions accredited by the Association to Advance Collegiate Schools of Business (AACSB), 79 Schools did not offer any form of MBA, instead opted for 1 year specialized programs in cutting edge topics.

## Concluding Remarks

A vibrant research culture provides an overall edge! Standalone Management institutions in India are severely lacking on any of these character, which can only be compensated by a strong push to diversify vertically and horizontally both. A clear and immediate opportunity is launch contemporary undergraduate programs in select area that feed the management discipline. It will certainly have wider spread and help acquire multi-disciplinary character in due course. Singapore Management University (SMU) is a good example.

## Nomenclature

| | |
|---|---|
| AACSB | Association to Advance Collegiate Schools of Business |
| AMBA | Association of MBAs |
| EQUIS | European Quality Improvement System |
| UNCTAD | United Nations Conference on Trade and Development |
| ICT | Information & Communication Technology |
| GDP | Gross Domestic Product |
| GoI | Government of India |
| MBA | Master of Business Administration |
| AI | Artificial Intelligence |
| BFSI | Banking, Financial Services, and Insurance |
| USA | United States of America |
| MIT | Massachusetts Institute of Technology (MIT) |
| XLRI | Xavier Labor Relations Institute |
| IISWBM | Indian Institute of Social Welfare & Business Management |
| IIM | Indian Institute of Management (IIM) |
| IIT | Indian Institute of Technology |
| NBA | National Board of Accreditation |
| MoA | Memorandum of Association |
| NiRF | National Institutional Ranking Framework |

| | |
|---|---|
| KBRC | Kyoto Business Research Centre |
| FITT | Foundation for Innovation and Technology Transfer |
| ISRO | Indian Space Research Organisation |
| DRDO | Defence Research and Development Organisation |
| BARC | Bhabha Atomic Research Centre i |
| CII | Confederation of Indian Industry |
| FICCI | Federation of Indian Chambers of Commerce & Industry |
| NASSOM | National Association of Software and Service Companies |
| DSCI | Data Security Council of India |
| ITU | International Telecommunication Union |
| HCR | Highly Cited Researchers |
| HEI | Higher Education Institutions |
| SDG | Sustainable Development Goal |
| RME | Responsible Management Education |
| RIEF | Research and Innovation Excellence Frameworks |

# 17

# THE UNIVERSITIES OF FUTURE: NEW CHALLENGES AND DIMENSIONS

**Prof. Priyaranjan Trivedi**

*Education stands as the largest global exertion, with over a billion scholars and millions of preceptors. Its significance lies not only in scale but also in its part as a conduit for knowledge. The 21st century marks not just an explosion in pupil figures but a knowledge explosion, rendering conventional educational models obsolete within a decade. The COVID-19 epidemic accelerated the shift towards distance and online education, heralding a rapid-fire metamorphosis in advanced education. As universities face an uncertain future, conforming to demographic shifts, geopolitical challenges, and changing demands is imperative. The emergence of indispensable delegation mechanisms and the supremacy of digital gests emphasize the need for nimble responses. This composition proposes training, literacy, and environmental doctrines for unborn universities, emphasizing rigidity, collaboration, and personalized literacy. In India, the National Education Policy- 2020 signals a structural and values- acquainted shift, with the establishment of institutions like the Higher Education Commission. The challenge lies in integrating being values with new paradigms to shape the future of Indian advanced education. As universities evolve, incorporating skill- grounded courses and embracing online literacy becomes essential to meet assiduity requirements and foster invention. Despite the rise of online education, the enduring applicability of physical premises underscores the mortal need for social commerce and cooperative literacy surroundings. The future of universities lies in creating dynamic spaces that prioritize pupil- centered literacy and acclimatize to technological advancements. Embracing change and invention, universities must evolve to meet the demands of the 21stcentury.*

***Keywords:*** *NEP-2020, Teaching, Training, Student-centred Learning, Massive Open Online Courses, Technology, Education*

## Introduction

Education is the largest single exertion in the world, involving over 1000 million scholars and 50 million preceptors at all situations, not counting millions of others in educational support conditioning. But its significance stems not simply from its size but also from its part as institutionalized knowledge, the top depository, patron, transmission belt and disseminator of all forms of knowledge.

The most significant point of global education in the 21st century isn't so much what the French call l'explosion scolaire( pupil explosion), but the knowledge explosion, which has expanded the catchment areas of learning so presto that it takes only a decade now for the state of the art in any field to come obsolete. The modes of communicating that knowledge are also changing and getting more sophisticated; knowledge now can be allocated technologically and electronically. preceptors and formal academy structures are getting less important, and the conventional age limits on the literacy process are getting blurred.

This Composition is regarding the shape of the Universities of the future as the future of Universities is in peril due to epidemic. Consequently, new reality has to be accepted. adding distance and online education conditioning due to the COVID- 19 epidemic is just the morning of a rapid-fire change in the field of advanced and tertiary education and indeed after the reopening of the premises of the Institutions, their officers will have to accept that the situation is back to normal. This has been assessed in a new report which explains that due to the epidemic, numerous subjects are coming before the Universities in advanced countries and in such a situation the future of the Universities is in peril.

The Universities must fleetly acclimatize to the new reality given the demographic shifts, geopolitical challenges, changing demands on workplaces and scholars' bournes for a quality digital experience. Universities each over the world are still battling the global epidemic. The rapid-fire move towards temporary distance and online education is just the morning of a rapid-fire metamorphosis in this sector.

A recent report on advanced and tertiary education has editorialized that the monopoly of Universities on granting delegation is coming to an end and mainstreaming of tutoring-training in a long- term manner and without degrees is taking place. It states that Institutions must prepare for a world where position or credentials aren't so important to those being trained.

The following types of training doctrines, training approach, learning approach and the new terrain among the scholars and the preceptors are being proposed by the author

**Training Philosophy**

The training philosophy for the students of the Universities of the future is to help the participants to:

- acquire, retain and be able to use knowledge
- understand, analyse, synthesize, and evaluate
- achieve skills
- establish habits
- develop attitudes

**Training Approach**

The training approach for the students of the Universities of the future is to help the participants to:

- talk to students
- talk with students
- have them talk together
- supervise them
- provide opportunities for practice

**Learning Approach**

The learning approach for the students of the Universities of the future is to help the participants be:

- primarily controlled by the learner
- unique and individual
- affected by the total state of the learner
- cooperative and collaborative
- a consequence of experience
- not directly observable
- both an emotional and intellectual process

**Environment among the Students and the Teachers**

A neo logical approach to creating a new environment among the students and teachers of the Universities of the future is to help the trainees to:

- encourage trainees to be active
- emphasize the personal nature of learning
- accept that difference is desirable
- recognise student's right to make mistakes
- tolerate imperfection

- encourage openness of mind and trust in self
- make feel respected and accepted
- facilitate discovery
- put emphasis of self-evaluation in cooperation
- permit confrontation of ideas

Let me now concentrate on the future of educational script in India in general and of advanced and tertiary education related future in particular.

The process of any change is slow in this COVID- 19 period, but indeed in this COVID-19 affected time, the work of perpetration of the country's new National Education Policy- 2020 is going on. colorful State Governments have started work for this by forming their ownCommittees.Many Universities have also started the work of making changes and making classes under this new education policy by forming panels,Sub-Committees for the perpetration of the New National Education Policy. The University subventions Commission( UGC) is constantly trying to speed up this process. It's certain that with this National Education Policy, a comprehensive change in the Indian Education System will be possible. It seems that this change won't only be a structural change but also a change of values. nonetheless, education is also a inflow of mortal and social values in a special sense. Under this New Education Policy, new Institutions are going to be formed. An apex body like Advanced Education Commission( HEC) will come into actuality rather of University subventions Commission( UGC). piecemeal from this, numerous other Institutions like National Research Foundation will also be formed. It's anticipated that the changes will revise the growth of Universities of the Future.

With the conformation of the Higher Education Commission, the apex body of the Indian Education System, a new value structure will also be created. By the way, this structure of values won't be fully new, but along with the durability of the being tutoring values, along with the association of some new values, the nature of these new institutions will be developed. It's also possible to integrate the values created by the University subventions Commission so far in the value creation of the Higher Education Commission. As we know that no new Institution developed out of a vacuum, it has to communicate with the value traditions formerly in place. The UGC, in its long history, has created and continuously developed a sense of value in Indian education.

It must be assured that the new Institution doesn't in any way allow it to come the history. Collaboration of being value comprehensions with new value comprehensions will form the base of the proposed Institutions. The old has to be the new, which in Indian traditional converse is also appertained to as the process of reanimation. This process of reinvention has to be in the construction of educational Institutions as well. The positive values that the UGC has been accumulating within itself, to be included in the Higher Education Commission, it'll be a big challenge for the unborn itineraries of the education system.

The understanding of Indian tradition with the being values of education, the sapience from the Indian soil, the values arising out of the deep dialogue of fustiness and tradition together with the educational value world will be suitable to give shape to Indian advanced education. Let stopgap that the Higher Education Commission will be suitable to come an Institution of formative integration of being values and new values in advanced education, this is a challenge as well as stopgap. It remains to be seen how the future of Indian education can face its challenges and produce a new terrain for working the burning problems of our countryviz. peace lessness, insurrection, severance, pollutionetc.

There's an critical need to incorporate changes in the Universities of the Future by introducing skill- grounded courses for feeding to the requirements of diligence to come up in India after COVID- 19 in the light of the fact that utmost of the Industrialists would like to invest in India rather than China.

Let me prognosticate the University Premises of the Future and what will it look like?

The rise of online and amalgamated literacy and how free online courses are set to transfigure the advanced education sector is to be seen. I'm looking at how online education will transfigure the University Lot. The unforeseen fashionability of Massive Open Online Courses( MOOCs) – where brand name Universities offer analogous courses to scholars for free, online – has led some experts to question the need for University Premises. While it may be a bit unseasonable to fully write off a lot demand, there's no mistrustfulness that online mobile education is set to unnaturally change the University armature.

There are two important reasons why University Premises will survive. First, humans are social and political creatures that need spaces to interact with each other. Just as Facebook and Twitter have not stopped people gathering in public places to fraternize, online education will not mean scholars stop going to University places to learn. The alternate is the UniversityVice-Chancellor's executive Lot the" my structure is bigger than yours" intelligence. Universities will continue to contend to attract scholars and academics by erecting ever more emotional installations. Let me also explain as to what's really demanded? But how should University Premises replace the new dynamic of online education? And can great premises – the desire for great spaces – be designed to produce a literacy terrain for the 21st century and the third renaissance?

Let me be the first to say that I drink the change the University is bringing to literacy and new ideas, technologies, and openings. Physical changes can help enhance this literacy experience and Universities will begin to contend to offer further and further specialized and pupil-friendly spaces. A step in the right direction has been the creation of cooperative literacy spaces, frequently appertained to as" Learning Commons". These venues are much more suited to the new dynamics of online and pupil- centred literacy than lecture theatres.

Lecture theatre favours a one- way style of tutoring, where the Learning Commons provides a space for dialogue. Learning Commons is also suitable to take advantage of mobile IT capability and wireless connectivity. These new literacy spaces demanded to incorporate a variety of audio-visual outfit and interactive displays, not by whiteboards, but by power outlets and USB anchorages to enable populations or groups to use laptops and iPads. With Learning Commons and smaller large lecture theatres, Universities also need broadcast workrooms. Actually, Broadcast Workrooms are essential for developing videotape content for virtual classrooms, in situ and on the move, by the defenses of laptops and desktops.

As the Universities are the future of education, rather than a relic of the history, they need not have a lot on every corner, but should insure our learner, social and cerebral requirements. Above all, the scholars should be at the centre of this new armature. We should drink the MOOCs challenge as an occasion to produce the virtual and physical literacy spaces of the future.

The Hon'ble Prime Minister Shri Narendra Modi is stressing the critical need for tutoring Blue Economy with a view to preparing a competent skeleton of youthful professionals for diving the judicious application of ocean coffers for icing employment generation. It'll be in fitness of effects that the University of the future starts designing class at different stages under the modular system. I've formerly prepared the class on this subject at Secondary, elderly Secondary, Bachelor's, Master's, and Doctoral situations and have invited all the Universities of our country to seek fullest cooperation from my side in particular and from the Confederation of Indian Universities in general.

**Summary**

The geography of advanced education is witnessing a profound metamorphosis, accelerated by the COVID- 19 epidemic. As universities grapple with unknown challenges, adaption and invention are imperative. The future of education lies in embracing digital technologies, fostering collaboration, and reimagining traditional

literacy spaces. The shift towards online and amalgamated literacy necessitates a abecedarian rethink of educational doctrines and approaches. In India, the perpetration of the National Education Policy- 2020 heralds a paradigm shift towards holistic and skill-grounded education. As universities navigate these changes, they must prioritize pupil requirements, foster creativity, and prepare learners for the demands of a fleetly evolving world. By embracing invention and using technology, universities can insure their applicability and adaptability in the face of query. The future of education is dynamic and promising, offering bottomless openings for growth and metamorphosis.

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# 18
# REDESIGNING SKILL UNIVERSITIES: TRANSFORMING HIGHER EDUCATION FOR THE FUTURE

**Prof. Sanjna Vij**

*The landscape of higher education is undergoing a profound shift, driven by the ever-evolving job market and the increasing demand for graduates who are adaptable and ready for employment. This article elves into the core concept of "Redesigning Skill Universities," presenting an innovative approach to reshaping conventional higher education paradigms. Skill Universities introduce a fresh learning perspective, highlighting the significance of practical skills, experiential learning, and the seamless integration of reskilling and upskilling opportunities. This article thoroughly explores vital facets of this transformation, including Skill Towers, experiential learning methods, course restructuring to cultivate advanced cognitive abilities, the development of skill-focused curricula, and the distinction between Skill Universities and traditional educational institutions. By examining these dimensions, the article underscores how Skill Universities are diligently preparing students to confront the dynamic demands of the job market, ultimately paving the way for the future of Higher Education.*

***Keywords:*** *Skills, Higher Education, Skill Model, Experiential Learning, Curriculum Redesign, Differentiation From Traditional Institutions.*

## Introduction

The concept of Skill Universities represents a ground-breaking approach to Higher Education, specifically tailored to meet the evolving demands of the modern job market. These universities are designed to equip students with a diverse skillset that goes beyond traditional academic knowledge, making them highly adaptable and job-ready graduates.

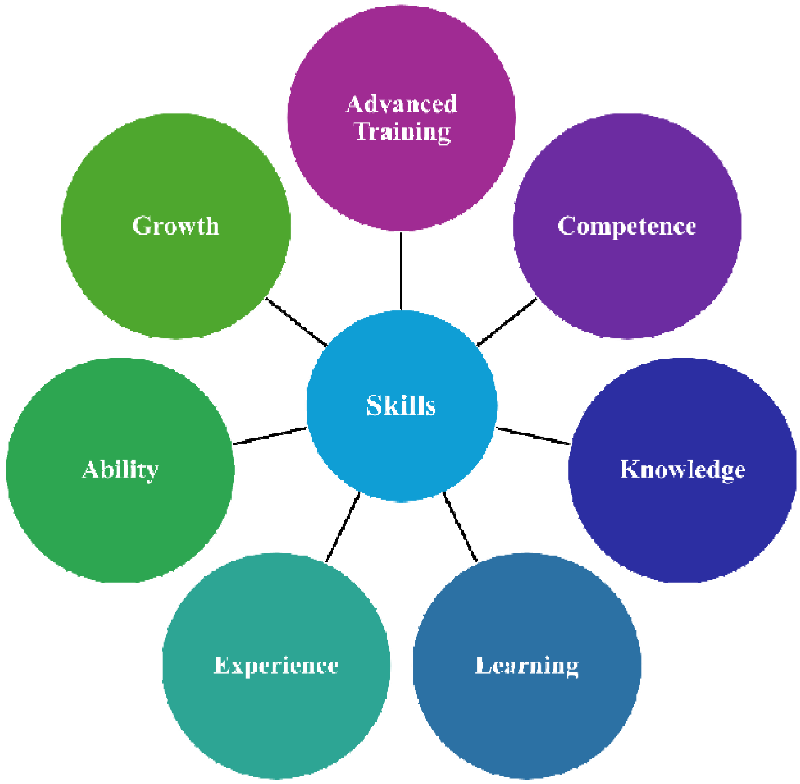


*Figure 1: Skill-based Curriculum (Source: Adams, 2021)*

Skill Universities prioritize the development of practical, hands-on skills that have direct applicability in real-world work environments (Adams, 2021). Within this context, the curriculum focuses on industry-specific technical proficiencies and essential soft skills such as communication, critical thinking, and problem-solving. Moreover, these universities actively integrate experiential learning opportunities into their academic framework. It includes facilitating internships, cooperative programs, and collaborations with various industries. Through these experiences, students gain practical insights and acquire the ability to apply their knowledge in authentic professional settings (Marginson, 2020). A hallmark of Skill Universities is their flexible and customizable learning pathways. Students are encouraged to tailor their educational journeys by selecting courses and modules that align with their career aspirations and personal interests. This adaptability ensures that graduates are well-prepared for a wide array of job roles and possess a profound understanding of their chosen field. In addition to being adaptable learners, graduates of Skill Universities are instilled with a culture of lifelong learning (Gao & Lee, 2018). Continuous skill development and upskilling are essential to remain competitive in the ever-evolving job market.

Collaboration with industries is a fundamental aspect of Skill Universities. This partnership ensures that the curricula remain aligned with the current demands of the job market. Graduates are thus equipped with skills and knowledge that are highly relevant and meet the precise expectations of employers. Furthermore, Skill Universities offer clarity in career pathways, providing robust guidance to assist students in making informed choices about their education and future professions. This clarity empowers students to pursue their desired careers actively and be confident in their choices (Bowen & Farlie, 2003). In today's rapidly changing job landscape, where technological advancements, automation, and globalization are reshaping industries, Skill Universities play a pivotal role in preparing individuals for success. They bridge the gap between academia and the job market by ensuring graduates possess the skills and attributes required to excel in their careers.

In an era where adaptability and practical skills are highly prized, Skill Universities are instrumental in empowering individuals to thrive in their chosen professions and contribute to the future workforce.

**Research Objectives**

- To evaluate the efficacy and results of Skill Educational Institutions about conventional colleges and universities for employment and skill acquisition;
- To record the past evolution and expansion of Skilled Universities, comprehending their inception, goals, and distinctive features;
- To investigate and assess the "Skill Towers" structure as a cutting-edge method of developing abilities inside Skill Universities, looking at how it affects student education and skill acquisition;
- To look into how experiential learning techniques are used in Skill Universities and comprehend how they improve employment and real-world abilities.

**Research Questions**

- What is the difference between the employability and educational results from Skill Universities and Regular Universities?
- What are the main trends in the creation and expansion of Skill Universities throughout history, and how have they changed over time?
- How does the "Skill Towers" framework affect the development of skills inside Skill Universities, and how does it enhance the learning process for the learners?
- What part does hands-on education play in improving employment and pragmatic skills? How is it incorporated into the academic programme of Skill Universities?

### A Comparative Analysis: Skill Universities versus Traditional Universities

In the ever-evolving landscape of higher education, the emergence of Skill Universities has brought a transformative approach that distinguishes them from traditional universities (European Centre for the Development of Vocational Training, 2016). This comparative analysis aims to shed light on the key differentiators and similarities between Skill Universities and their conventional counterparts, highlighting how these distinctions cater to the changing needs of the job market and students.

**Table 1:** Comparison of Skill Universities and Traditional Universities

| Factors | Skill Universities | Traditional Universities |
|---|---|---|
| **Educational Focus** | These institutions prioritize the development of practical skills, both technical and soft, to make graduates job-ready (World Economic Forum, 2020). The curriculum emphasizes experiential learning and hands-on experiences. | Conventional universities primarily focus on academic knowledge, theory, and research. Practical skills are often secondary to the academic curriculum. |
| **Learning Approach** | Embrace experiential learning methods such as internships, co-op programs, and industry partnerships to provide real-world exposure and application of knowledge. | More classroom-based learning with a significant emphasis on theoretical knowledge and research (OECD, 2019). |
| **Curricular Flexibility** | Offer highly flexible and customizable learning pathways, allowing students to choose courses aligned with their career goals and interests (Hart Research Associates, 2018). | Often follow a more structured curriculum with fewer choices for students to tailor their education. |
| **Lifelong Learning Culture** | Encourage a culture of lifelong learning and continuous skill development to keep up with evolving job market demands. | The focus is on the acquisition of a degree, with less emphasis on post-graduation skill development (Dello *et al.,* 2017). |
| **Industry Integration** | Collaborate closely with industries to align their curriculum with current market needs, ensuring graduates possess relevant skills. | May have partnerships with industries, but the level of integration varies (National Research Council, 2012). |
| **Career-Centric Approach** | Provide clear career pathways and guidance, helping students make informed decisions about their education and future careers. | Career guidance varies, and is often not as central to the academic experience (World Economic Forum, 2020). |
| **Interdisciplinary Education** | Often adopt an interdisciplinary approach, encouraging students to | Tend to follow a more discipline-specific approach with limited |

| | | |
|---|---|---|
| | explore a wide range of subjects, promoting versatility. | exposure to other fields (Ministry of Education, Government of India, 2020). |
| **Practical vs. Theoretical Emphasis** | Prioritize practical knowledge and skills that are directly applicable in professional settings. | Tend to focus more on theoretical and academic knowledge. |
| **Job Market Readiness** | Graduates are better prepared for the job market due to their practical skills and real-world experience (Kolb, 1984). | Graduates may require additional training or experience to become job-ready. |
| **Versatility** | Graduates are adaptable to various roles and industries. | Graduates may be more specialized in their field of study. |

Skill Universities represent a dynamic shift in higher education that aligns with the changing demands of the job market. While Traditional Universities continue to provide a strong foundation in academic knowledge and research, Skill Universities offer a more practical, adaptable, and career-focused approach, better preparing students for the challenges of the modern workforce.

**The Evolution of "Skill Universities":** The concept of "Skill Universities" represents a significant evolution in the Higher Education landscape. Several interconnected factors have driven this evolution, each contributing to transforming traditional educational models into dynamic institutions that prioritize practical skills, experiential learning, and adaptability.

**Changing Workforce Demands:** One of the primary drivers behind the evolution of Skill Universities is the changing nature of workforce demands (Gardner, 2009). The job market has evolved to prioritize academic knowledge, and the ability to apply that knowledge in practical settings. Employers seek job-ready graduates who possess the skills necessary to excel in their roles.

**Technological Advancements:** The rapid advancement of technology has played a crucial role in reshaping education (Kuh, 2008). Skill Universities leverage technology to facilitate experiential learning, provide access to real-world tools and platforms, and offer innovative learning methods that prepare students for tech-driven workplaces.

**Globalization and Interconnectedness:** The world has become increasingly interconnected, with businesses and industries operating globally. Skill Universities recognize the importance of preparing students for this globalized workforce by offering diverse cross-cultural experiences that foster adaptability and a global perspective.

**Changing Student Expectations:** Today's students have different expectations from their educational experiences. They seek programs that offer practical value, employability, and opportunities for skill development (Liesa-Orús *et al.,* 2020). Skill Universities respond to these expectations by aligning their curricula with industry needs.

**Industry and Academia Collaboration:** Skill Universities bridge the gap between academia and industry by fostering close collaborations. These partnerships result in curriculum development directly informed by industry trends and demands, ensuring graduates are well-prepared for the workforce.

**Emphasis on Lifelong Learning:** Lifelong learning has become essential in a rapidly evolving world. Skill Universities provide initial education and emphasize reskilling and upskilling opportunities throughout a student's career, ensuring they remain competitive in the job market (García-Morales *et al.,* 2021).

**Recognition of Soft Skills:** In addition to technical skills, Skill Universities significantly emphasize soft skills such as communication, problem-solving, critical thinking, and adaptability (Bonfield *et al.,* 2020). These skills are recognized as crucial for success in a variety of professions.

**Entrepreneurship and Innovation:** Skill Universities foster an entrepreneurial mindset and encourage innovation. They create an environment where students can develop and test their ideas, potentially leading to startups and ventures contributing to economic growth.

The evolution of Skill Universities reflects a response to the changing needs and dynamics of the modern world (Winstone & Carless, 2019). These institutions are at the forefront of preparing students for the challenges and opportunities of the 21$^{st}$ century workforce, ensuring that higher education remains relevant and impactful.

**Skill Towers - A New Framework for Skill Development:**

Skill Towers are innovative educational models designed to address the evolving needs of the job market and provide students with diverse skills and competencies (Jackson, 2019). These towers represent a multidisciplinary approach to education, emphasizing the development of hard and soft skills essential for success in today's dynamic workforce.
Skill Towers combines various disciplines and fields of study under one educational framework. This approach allows students to explore various subjects and better understand their chosen field (Núñez-Canal *et al.,* 2022). Skill Towers typically offer a

structured progression of vertical and horizontal courses. Vertical progression involves advancing from foundational to advanced levels within a specific discipline, while horizontal progression allows students to explore different disciplines and acquire diverse skills. The curriculum in Skill Towers is often modular, allowing students to customize their learning path based on their interests and career goals (Mian *et al.,* 2020). They can select modules or courses from different disciplines to build a personalized skillset.

Skill Towers prioritizes experiential learning, including internships, apprenticeships, and real-world projects. This hands-on approach helps students apply their knowledge and develop practical skills professionally. In addition to technical skills, Skill Towers focuses on developing soft skills such as communication, critical thinking, problem-solving, teamwork, and adaptability (Elumalai *et al.,* 2021). These skills are crucial for success in any career.

Skill Towers aims to align its curriculum with industry needs and trends. They often collaborate with industry partners to ensure graduates are well-prepared for the job market. Skill Towers provides clear career pathways for students, helping them understand the opportunities available in their chosen field (Abad-Segura *et al.,* 2020). This clarity assists students in making informed decisions about their education and future careers.

Skill Towers often promotes a culture of continuous learning and upskilling. Graduates are encouraged to return for additional modules or courses to stay updated with industry advancements. Many Skill Towers offer flexible learning options, including online courses, part-time study, and evening classes, to accommodate the diverse needs of students, including working professionals (Neuwirth *et al.,* 2021). Skill Towers represents a shift in higher education towards a more dynamic and adaptable model that prepares students for the ever-changing job market. They offer a versatile and comprehensive approach to learning, empowering individuals to acquire the skills and knowledge necessary for a successful and fulfilling career.


*Figure 2: Building skills (Source: Neuwirth, Jović & Mukherji, 2021)*

**Learning by Doing: Experiential Learning in Skill Universities**

A crucial part of this new way of learning is ‘Learning by Doing,’ where students gain hands-on experience at Skill Universities. Experiential learning is a cornerstone of Skill Universities, offering students a hands-on approach to education beyond traditional classroom learning (Ellahi *et al.,* 2019). This pedagogical method immerses students in real-world scenarios, allowing them to apply theoretical knowledge to practical situations. Here, we delve into the concept of experiential learning in Skill Universities, its significance, and how it transforms students into job-ready professionals.

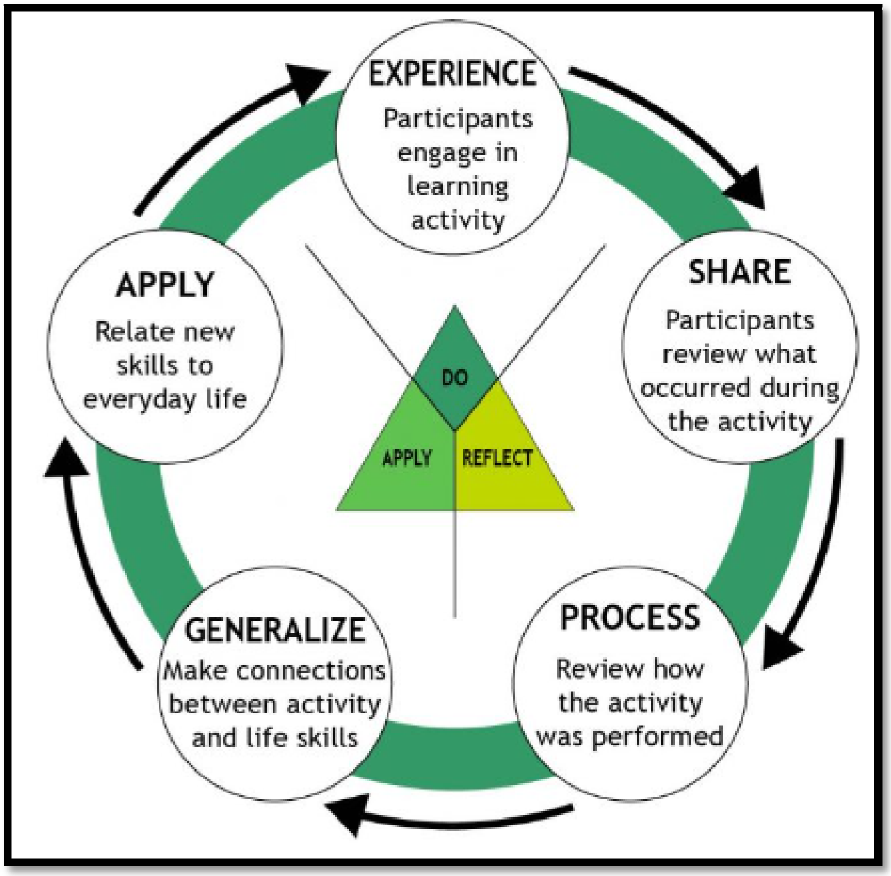


*Figure 3: Experiential Learning Model (Source: Zimmer & Keiper, 2021)*

**Significance of Experiential Learning**

- **Real-World Relevance:** Experiential learning bridges the gap between theory and practice, enabling students to gain practical skills and insights directly applicable to their chosen professions (Valentina, 2021). It ensures graduates are job-ready, possessing the competencies employers seek.
- **Problem-Solving Abilities:** Through hands-on experiences, students develop critical thinking and problem-solving skills. They learn to analyze complex situations, make informed decisions, and adapt to unexpected challenges, making them invaluable assets in the workplace.
  - **Confidence and Competence:** Experiential learning fosters confidence by allowing students to apply their knowledge in authentic settings. They become more self-assured and capable as they tackle real-world tasks and projects.

- **Soft Skills Development:** Beyond technical expertise, experiential learning cultivates essential soft skills such as communication, teamwork, and leadership (Zimmer & Keiper, 2021). These skills are vital in today's collaborative work environments.
- **Industry Alignment:** Skill Universities collaborate closely with industries to design experiential learning opportunities that align with current market needs. It ensures that graduates possess the skills and knowledge sought by employers.

**Modes of Experiential Learning in Skill Universities**

- **Internships and Co-op Programs:** Skill Universities facilitate internships and cooperative education (co-op) programs that provide students with immersive work experiences (Raman & Radhakrishnan, 2019). They gain practical insights, build industry connections, and often secure job offers from these opportunities.
- **Simulation and Labs:** Cutting-edge labs and simulation facilities allow students to practice skills in controlled environments. These facilities replicate real-world scenarios, making them ideal for skill development.
- **Project-Based Learning:** Students engage in projects that require them to solve real problems faced by businesses or communities (Dopson *et al.,* 2019). This approach enhances critical thinking and innovation.
- **Industry Partnerships:** Skill Universities collaborate with industry partners to offer on-site training, workshops, and mentorship programs. Students interact with professionals and gain insights into industry practices.
- **Field Studies and Site Visits:** Field trips and site visits expose students to different workplace environments and practices (Basham *et al.,* 2020). They gain a deeper understanding of how theory applies to the real world.

**Student Outcomes**

Experiential learning in Skill Universities yields graduates who are academically sound and equipped with practical skills, adaptability, and a profound understanding of their fields. These graduates are sought after by employers and make immediate contributions to their respective industries (Ruesch *et al.,* 2019). Thus, by combining theoretical knowledge with practical experiences, Skill Universities empower graduates to excel in their careers, making them assets to industries and society.

Reskilling and upskilling have become critical in today's fast-changing job market, characterized by rapid technological advancements and evolving industry needs. Here is an analysis of how Skill Universities offer flexible and relevant programs to address reskilling:

- **Tailored Programs:** Skill Universities design their programs with a strong emphasis on industry relevance. They collaborate closely with businesses and organizations to understand their skill requirements and align their curriculum accordingly (Keeling *et al.,* 2021). It ensures that students receive training in skills in high demand in the job market.
- **Continuous Learning:** Traditional Universities often follow rigid academic calendars, making it challenging for working professionals to acquire new skills. Skill Universities offer flexible learning options, including part-time and online courses, allowing individuals to pursue education while working (Aničić & Bušelić, 2020). This flexibility is crucial for those looking to upskill or reskill without interrupting their careers.
- **Skill Assessment:** Skill Universities often employ skill assessment tools to identify the specific areas where students need to upskill or reskill. These assessments help individuals understand their strengths and weaknesses, allowing them to focus on acquiring the necessary competencies for their chosen career paths.
- **Industry Collaboration:** Skill Universities foster strong ties with industries through partnerships, internships, and practical training opportunities (Clayton & Clopton, 2019). This collaboration ensures that the skills taught are up-to-date and aligned with industry standards, making graduates more attractive to potential employers.
- **Personalized Learning Paths:** Skill Universities recognize that each student has unique learning needs. They offer personalized learning paths that allow individuals to choose the skills and courses that align with their career goals. This approach ensures that students acquire the skills they need most.
- **Short-Term Certificates:** Skill Universities often offer short-term certificate programs focusing on specific skills (Eukel & Morrell, 2021). These programs are designed to provide quick, intensive training in high-demand areas, making them ideal for reskilling purposes.
- **Adaptability:** The curriculum of Skill Universities is agile and adaptable. It can quickly respond to emerging trends and technologies in the job market, ensuring that students always learn the most relevant skills.

Skill Universities play a crucial role in addressing the need for reskilling and upskilling in today's job market (World Economic Forum, 2020). Their flexibility, industry collaboration, personalized learning, and focus on relevant skills make them valuable institutions for individuals seeking to enhance their career prospects in a rapidly changing world.

**Role of NEP 2020 on Redesigning Skill Universities**

The National Education Policy 2020 (NEP, 2020) plays a pivotal role in transforming and redesigning skilled universities in India. Skill Universities are encouraged to provide a well-rounded education beyond traditional academic learning (Kusumawati, 2020). This approach aligns with the need for graduates to possess a wide range of skills, including soft skills, critical thinking, and problem-solving abilities. The policy promotes flexibility in curriculum design, allowing Skill Universities to offer programs more aligned with industry needs and market trends. This flexibility enables the integration of skill-focused courses and experiential learning opportunities. NEP 2020 recognizes the importance of vocational education and the need for students to acquire practical skills (Alharthi *et al.,* 2019). Skill Universities are encouraged to offer vocational courses and apprenticeships, ensuring that graduates are job-ready and equipped with employable skills.

The policy encourages the establishment of multidisciplinary educational institutions, including Skill Universities. This approach fosters collaboration between different disciplines and industries, developing well-rounded graduates with diverse skill sets. NEP 2020 places a strong emphasis on research and innovation. Skill Universities are encouraged to engage in research activities relevant to industry needs. It encourages a culture of innovation and problem-solving, which is essential for skill development (Alakrash & Razak, 2020). The policy promotes the use of technology in education. Skill Universities can leverage digital tools and online platforms to enhance teaching and learning, making education more accessible and aligned with the demands of the digital age. NEP 2020 recognizes the value of prior learning and skills acquired outside the formal education system (Adams, 2021). Skill Universities can offer pathways for individuals to have their prior learning and skills assessed and recognized, facilitating lifelong learning and upskilling.

The policy encourages global integration and collaboration. Skill Universities are encouraged to collaborate with international institutions, exposing students to global best practices and industry standards. NEP 2020 emphasizes the importance of quality assurance in Higher Education (Marginson, 2020). Skill Universities are expected to maintain high education standards and continuously improve the quality of their programs and services. Overall, NEP 2020 provides a comprehensive framework for redesigning and transforming Skill Universities in India. It promotes a student-centric, flexible, and skill-focused approach to Higher Education, aligning with the changing demands of the job market and the need for graduates to possess practical skills and competencies.


*Figure 4: Role of NEP 2020 in the Indian Education Sector (Source: Marginson, 2020)*

**Key Challenges Associated with This Transformation:**

Redesigning Skilled Universities to transform Higher Education for the future is challenging. These challenges encompass various aspects, from academic reforms to institutional adaptation and broader socio-economic factors. Designing skill-based curricula that align with industry needs and are adaptable to the fast-changing job market can be complex (Gao & Lee, 2018). Ensuring the curriculum remains relevant and up-to-date requires ongoing collaboration with industries and stakeholders. Preparing educators to facilitate experiential learning and hands-on training can be challenging. Faculty members may need additional training to shift from traditional teaching methods to more interactive and practical approaches (European Centre for the Development of Vocational Training, 2016). The transformation necessitates investments in infrastructure, technology, and faculty development. Skill Universities may face resource constraints and need innovative ways to fund these developments.

Achieving recognition and accreditation for Skilled Universities can be challenging, significantly, when they diverge from traditional models. Overcoming scepticism and gaining the trust of employers and students is essential (World Economic Forum, 2020). Incoming students may need to be more accustomed to experiential learning and skill-based approaches. They might require orientation and support to adapt to this new style of education. Fostering interdisciplinary learning can be complex, as it demands cooperation between academic departments and faculty members (OECD, 2019). Creating a seamless learning experience transcending traditional academic boundaries is significant. Developing effective assessment methods that accurately measure practical skills and competencies is an ongoing challenge. Traditional assessment techniques may not be suitable for skill-focused education.

Adhering to National Educational Policies while introducing innovative approaches can be challenging (Hart *et al.,* 2018). Skill Universities must navigate policy frameworks while advocating for flexibility in curriculum design. Ensuring that skill-based education is accessible to a diverse population of students can be a challenge. Addressing issues of affordability, inclusivity, and equal opportunities is vital. Overcoming the traditional view that a university education is solely for academic knowledge can take time and effort (Dello *et al.,* 2017). Skill Universities may need more support from students, parents, and the broader community. Skill Universities aiming to prepare graduates for the global job market may encounter challenges related to international recognition, credit transfer, and global partnerships. Staying updated with the latest technologies and ensuring students are technologically proficient is a constant challenge, given the rapid pace of technological evolution (National *et al.,* 2012).

Addressing these challenges requires a concerted effort from educational institutions, policymakers, industry partners, and other stakeholders. The transformation of Skill Universities is a multi-faceted journey that involves reimagining education and creating a more adaptive and responsive Higher Education system.

**Recommendations**

Recommendations to successfully redesign Skill Universities and transform Higher Education for the future are crucial in addressing the challenges and realizing the full potential of this innovative model. Below are some recommendations:

- **Collaborate with Industries:** Foster strong partnerships with industries and employers to ensure that curricula remain aligned with market needs. Regular consultations with industry representatives can provide valuable insights into evolving job requirements.

- **Faculty Development:** Invest in continuous training and development programs for faculty members. Equip educators with the skills and knowledge needed to facilitate experiential learning and mentor students effectively.
- **Flexible Funding Models:** Explore innovative funding approaches to secure resources for infrastructure, technology, and faculty training. These may include public-private partnerships, endowments, and grants.
- **Accreditation and Quality Assurance:** Work closely with relevant accreditation bodies to develop assessment and accreditation standards that are tailored to the skill-based educational model. Showcase the quality and rigour of programs through robust quality assurance measures.
- **Student Transition Support:** Provide incoming students with orientation programs and support services to help them adapt to skill-based learning. Offer career counselling and guidance to help students make informed choices.
- **Interdisciplinary Integration:** Promote interdisciplinary collaboration and create opportunities for faculty members from various departments to work together. Encourage the development of courses that transcend traditional academic boundaries.
- **Assessment Innovation:** Develop and implement innovative assessment methods that effectively evaluate practical skills and competencies. Utilize a mix of performance-based assessments, real-world projects, and other methods tailored to skill-focused education.
- **Advocacy for Policy Change:** Advocate for policy changes that accommodate innovative educational models while adhering to national educational standards. Engage with policymakers to communicate the advantages of flexibility in curriculum design.
- **Inclusivity and Access:** Prioritize inclusivity and equitable access to skill-based education. Implement scholarship programs, affordability measures, and community outreach to ensure that all students have the opportunity to benefit from this model.
- **Changing Perceptions:** Launch awareness campaigns and educational initiatives to change perceptions about the value of skill-based education. Highlight the success stories of graduates and the positive impact they have in the job market.
- **Global Partnerships:** Develop international partnerships to facilitate global recognition and integration. Collaborate with foreign universities and institutions to promote credit transfer and global opportunities for students.
- **Technological Integration:** Stay at the forefront of technological advances by integrating the latest tools and platforms into the educational process. Ensure that students are technologically proficient and adapt to evolving trends.
- **Long-Term Monitoring:** Implement a robust system for long-term monitoring and evaluation of the effectiveness of Skilled Universities. Collect data on graduate employment, career progression, and employer satisfaction to continually refine programs.

- **Government Support:** Seek government support and advocacy for skill-based education. Engage in dialogue with policymakers to establish a conducive regulatory environment and secure financial support for Skilled Universities.
- **Research and Innovation:** Encourage research within Skilled Universities to develop innovative teaching methods, technologies, and curricular approaches. Invest in research canters and projects that advance the field of skill-based education.

By implementing these recommendations, Skilled Universities can successfully navigate the challenges of transforming Higher Education. They can become agile, responsive, and pivotal institutions that prepare graduates to thrive in a rapidly changing job market, ultimately reshaping the future of education.

**Concluding Remarks**

According to a comparison of Skill Educational Institutions and Traditional Universities, the first prioritizes employment and acquiring practical skills. The increasing demand for graduates prepared for the workforce has led to the creation of Skilled Universities, whose curricula are frequently customized to fit the demands of businesses and employers. According to this comparative evaluation, Skilled Universities can close the knowledge gap between the classroom and the workplace, increasing the job prospects of their graduates.

As previously said, the development of Skilled Universities emphasizes the necessity of a paradigm change in educational institutions. The conventional knowledge-focused methodology adopted by these institutions has given way to a skill-centric one. The evolving needs of the labour market and the realization that academic expertise alone is frequently inadequate to fulfil modern labour expectations are driving this shift.

The “Skill Towers” framework provides a unique method for developing skills. The examined multi-tiered model emphasizes the systematic and continuous development of abilities. It fits industry requirements and gives students a straightforward way to acquire a wide range of abilities. A viable path for comprehensive training in skills is the “Skill Towers” structure.

The foundation of Skill Universities is experiential education, or learning by doing. These universities’ practical, hands-on method allows students to engage with real-world situations as a means of learning directly. This method differs from the passive assimilation of information frequently connected to conventional schooling. Two significant benefits of classroom instruction are enhancing real-world abilities and getting students ready for the changing needs of the workforce

It is impossible to overstate the impact of the National Education Policy (NEP) 2020 on developing skill institutions. An extensive plan for changing India's educational system is provided under NEP 2020. It supports a more competence-oriented and comprehensive approach, which aligns with the goals of Skilled Universities. NEP 2020 lays the groundwork for the ongoing development and expansion of Skill Universities by emphasizing adaptability, multi-disciplinarity, and the incorporation of practical skills. With the support of programmes like NEP 2020, Skill Universities have the opportunity to prepare learners for both the possibilities and difficulties of the future as the globe keeps shifting quickly. Skill Universities are leading this dynamic transformation towards a vibrant future for educational institutions.

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# 19
# BLUE ECONOMY FOR PEACE AND DEVELOPMENT ON EARTH IN THE THIRD MILLENNIUM

**Dr. Markandey Rai**

*The Blue Economy refers to the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of marine ecosystems. It encompasses various sectors, including fisheries, aquaculture, tourism, shipping, renewable energy, biotechnology, and seabed mining, among others. The concept emphasizes the importance of balancing economic development with environmental sustainability and social equity in coastal and marine areas. Additionally, it promotes innovative approaches to harnessing the potential of oceans and seas in a manner that supports long-term prosperity and resilience. This article discusses the challenges facing Blue Economy, the need for enhancing the contribution of Blue Economy in diverse sectors, the role of higher education in contributing to Blue Economy development, and the prospects of a consolidated information repository for the various sectors under the umbrella of Blue Economy.*

***Keywords:*** *Climate Change, Sustainable Development Goals, Sustainable Management Ecosystem, Ocean Health, Governance*

**Introduction**

The world is going through a difficult time when we are facing multiple impacts of Climate Change, COVID-19, and Conflicts like the Ukraine -Russia war. We are not able to accelerate the speed needed to achieve SDGs which has a slogan of "**Leave No One Behind (LNOB)".** It is the central, transformative promise of the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs).

According to the United Nations, the World population reached 8 billion people on 15 November 2022, a significant milestone in human development. Consumption per capita is increasing day by day. Many million have lost their jobs during the lockout in Corona time. Inflation is high throughout the world. In this situation, the Blue Economy is the hope for achieving SDG's for Peace and Development.

Two-thirds of our earth is Sea water. We have not explored it properly rather we have exploited and sent tons of plastic and other waste to the Ocean and scratched the seabed.

The 2nd Ocean Conference by the United Nations (UN) was held in Lisbon, 27th June to 1st July 2022. The United Nations, Secretary-General, Mr. Antonio Guterres in this Second Ocean Conference, on 27 June 2022, in Lisbon stated that:

- The ocean can be our biggest ally in responding to planetary crises of climate change, biodiversity loss & pollution. Next week's UN Ocean Conference is an opportunity to commit to a sustainable blue economy that can create jobs while protecting our planet.
- Ocean conference in Lisbon is Call to action. Listen to peoples' voice and the sound of nature
- I apologize to youth on behalf of my generation for not having protected the ocean. This week's UN Ocean Conference will be key to find ways to #SaveOurOcean for the benefit of people and planet. I count on young people's strength, dynamism, and action to rescue our planet

***World faces 'ocean emergency', UN warns, as activists urge action Oceans***

- The world is facing an "ocean emergency", United Nations chief Antonio Guterres has warned, as thousands of activists, scientists and leaders gathered at the UN Ocean Conference in Portugal's capital to call for strengthening sea-protection measures.
- "We have taken the ocean for granted," Guterres told policymakers, experts, and advocates at Monday's opening plenary in Lisbon, describing how seas have been hammered by climate change and pollution.
- Activists' slogan was "**As the sea dies, we die**".
- The two-day event brought together hundreds of youths from some 165 countries with a shared goal: protecting the Ocean.
- Speaking in front of 100 youth advocates who gathered to inspire, amplify, and accelerate youth action for our ocean, Mr. Guterres reiterated the need to **rescue the planet**. He further said: "My generation, and those who were politically responsible – which is my case – we were slow or sometimes unwilling to recognize that things were getting worse and worse in these three dimensions: oceans, climate, and biodiversity", Mr. Guterres told the lively crowd.

- Adding that globally, **the world is still moving too slow and must act now** to start rehabilitating the oceans, rescuing biodiversity, and halting climate change, the UN chief stressed that "it is a generational responsibility that goes far beyond political leaders".

***What Is 'Blue Economy'?***

The Blue Economy is the latest concept for solving the problems relating to the preservation of the health of the ocean ecosystem besides providing improved livelihoods and job creation, improved transportation, in addition to encouraging better stewardship of our ocean, carbon storage, coastal protection, cultural values and biodiversity. All these come under the blue resources and that is why all economic, scientific, social, cultural, technological. Environmental for the sustainable and judicious use of ocean resources are covered under the Blue Economy.

Accordingly, the blue economy takes place in the ocean, lakes and rivers; it uses output or consumption as a major source of economic growth in a sustainable manner. According to The World Bank, the blue economy is the "Sustainable use of ocean resources for economic growth, improved livelihoods, and job while preserving the health of ocean ecosystem."

UN Defined the Blue Economy as an economy that "comprises a range of economic sectors and related policies that together determine whether the use of ocean resources is sustainable. An important challenge of the blue economy is to understand the better manage the many aspects of oceanic sustainability, ranging from sustainable fisheries to ecosystem health to preventing pollution. Secondly, the blue economy challenges us to realize that sustainable management of ocean resources will require collaboration across boarders and sectors through a variety of partnerships, and on a scale that has not been previously achieved. This is a tall order, particularly for Small Island Developing States (SIDS) and Least Developed Countries (LDCs) who face significant limitations." The UN notes that the Blue Economy will aid in achieving the UN Sustainable Development Goals, of which one goal, number 14, is "Life Below Water". European Commission defines the Blue Economy as "all economic activities related to oceans, seas and coasts. It covers wide range of interlinked established and emerging sectors." The Commonwealth of Nations considers it "an emerging concept which encourages better stewardship of our ocean or 'blue' resources."

The Centre for the Blue Economy defines it as "it is now a widely used term around the world with three related but distinct meanings- the overall contribution of oceans to economies, the need to address the environmental and ecological sustainability of the oceans, and the ocean economy as a growth opportunity for both developed and developing countries." Conservation International adds that "blue economy also includes economic benefits that may not be marketed, such as carbon storage, coastal protection, cultural values and biodiversity."

The World Wildlife Fund begins its report Principles for a Sustainable Blue Economy with two senses given t this term: "For some, blue economy means the use of the sea and its resources for sustainable economic development. For others, it is simply referring to any economic activity in the maritime sector, whether sustainable or not." As it is reflected from various definitions and reports, there is still no widely accepted definition of the term Blue Economy despite increasing high-level adoption of it as a concept and as a goal of policy-making and investment.

The related terms of the Blue Economy are the Ocean Economy, Green Economy, Blue Growth, Blue Justice etc. On top of the traditional ocean activities such as fisheries, tourism and maritime transport, blue economy entails emerging industries including renewable energy, aquaculture, seabed extractive activities and maritime biotechnology and bioprospecting. Blue economy also attempts to embrace ocean ecosystem services that are not captured by the market but provide signific ant contribution to economic and human activities. They include carbon sequestration, Coastal protection, waste disposal, and the existence of biodiversity. The 2015 WWF briefly puts the value of key ocean assets over US$ 24 Trillion. Fisheries are now overexploited, but there is still plenty of room for aquaculture and offshore wind power. Aquaculture is the fastest growing food sector with the supply of 58 percent of fish to global markets. Aquaculture is vital to food security of the poorest countries especially. Only in the European Union, the blue economy employed 3362510 people in 2014.

There are several dimensions and challenges relating to blue economy. The World Bank specifies three challenges that limits the potential to develop the blue economy. Current economic trends that have been rapidly degrading ocean resources. The lack of investment in human capital for employment and development in innovative blue economy sectors. Inadequate care for marine resources and ecosystem services of the oceans.

These are the major sectors and dimensions identified for the study and research in blue economy:

- Aquaculture (fish farms, but also algaculture)
- Maritime biotechnology
- Bioprospecting
- Fishing

- Desalination
- Maritime transport
- Coastal maritime and maritime tourism (Blue Tourism)
- Mineral resources
- Offshore oil and gas
- Offshore wind power (also tidal and wave)
- Shipbuilding and ship repair
- Carbon sequestration
- Coastal protection
- Waste disposal
- Existence of biodiversity

Two third of our earth is Sea water. However, we have not explored it properly rather we have exploited and send tons of plastic and other waste through rives and other ways.

***Sea is called Ratnakar—Treasure of gems.***

According to Hindu mythology, during the churning of the ocean many wonderful treasures were brought up from the depths: Moon, Parijat, four -tusked Elephant Airavat, Kamdhenu Mandira, Kalpvriksh, Apsara, Celestial Horse Uchchaishrava, Lakshami, Panchajanya, Vishnu's Mace and Magic Bow, Various Gems and Dhanvantari carrying Amrit. Today also there is an urgent need for churning the ocean again for locating valuable resources for its judicious exploration with a view to giving a new dimension to Blue Economy for ensuring new jobs.

PM Modi while addressing the BIMSTEC countries heads during adoption of its Charter on 30th March 2022, he invited all the heads of BIMSTEC for the international conference on Blue Economy next year in August. The Encyclopaedia on Blue Economy will be a reference book and an assent for the conference and beyond. It had a wealth of references for further reading and research.

When India is celebrates the 75th year of its independence "Azadi ka Amrit Mahotsav" and aspires to become the third largest economy of the world soon and it will be the most populous country also, India has assumed the Presidency of the G-20, it is timely that India should take lead in the Blue Economy to address the problem of food security and unemployment and attaining the Sustainable Development Goals and champion the Ecological restoration by 2030. Teaching should be started in various universities in the field of Blue Economy and research should be conducted with exploration for tapping this enormous source of wealth. Here lies the key to address almost all the SDG's including the Poverty, food security and employment to youth.

The twentieth century saw the need and emergence of the green revolution, green technology, green economy, green economy indicators, and green economy policies, plans and programs all over the world. It was an all-out societal effort to help meet urgent societal needs of soil-based foods and nutrition. Largely because of enormous population growth worldwide and resulting disproportionate resource needs, soil-based resources and economies began to fall short. And thus arose an urgent need for more and more resources and more and more innovative strategies, technologies, and economies. The twenty first century is seeing imaginative water-based efforts in the making, akin to the twentieth century soil-based efforts. We are now witnessing the beginnings of the blue revolution, blue technology, blue economy, blue economy indicators, blue policies, plans, and programs not only to help feed the world, but also to help it survive and flourish climate change wise. There has been a great need to have in one place previously scattered pieces of information about numerous facets of blue economy. The two organizing editors of this unique eight volume encyclopedia have been able to bring together a large number of contributors and organize their contributions in a thematic format in this encyclopedia.

It is hoped that the Blue Economy community worldwide will find this encyclopedia of great value. Furthermore, those curious about the blue economy will use it for education, enrichment and motivation to do more. Our society needs it. Everyone desires to possess magical crystal balls! It is our hope that this informative encyclopedia will help trigger efforts to build meaningful multi- indicator-systemic crystal cubes as approximations for the unavailable crystal balls for speedy progress on issues involving blue economy. Interestingly, some of us were involved at one time in constructing a multi-indicator crystal cube for ocean degradation. We have received many best wishes and congratulations to the encyclopedia editors and the contributors.

The 8-volume World Encyclopedia of Blue Economy is the only publication of its type being brought out jointly under the aegis of the Indian Institute of Ecology and Environment (IIEE) and Confederation of Indian Universities (CIU) in association with the Inter-University Research Centre (IURC).

Volume Number 1 deals with the introductory aspects of Blue Economy including its sectors besides particular topics like Aquaculture; Seaweed; Fish; and Shrimp Farming; Freshwater Prawn Farming; Oyster Farming; Geoduck Aquaculture; Mariculture; Integrated Multi-Trophic Aquaculture; Copper Alloys in Aquaculture; Aquaculture of Salmonids; Pain in Fish; Pain in Invertebrates'; Algae; Algaculture; Microalgae in Hatcheries; Algae Fuel; Algal Bloom; Meat Analogue etc.

The Volume Number 2 deal with the areas specialized like Marine Biotechnology; Bioprospecting; Biomining; Convention on Biological Diversity; History of Fishing and Seafood; Recreational Fishing; Fishing Techniques; Fishing Practices; Fishing Tackle; Vessel; Industry and Commercial Fishing; Fish Processing; Fish Products; Fish as Nutritious Food; Deep Sea Fish; Big-Game Fishing; Fishing in the Dark; Seafood; Fish Market; Fisheries Management; Fisheries Science etc.

Volume Number 3 deal with the specialized areas like Sustainable Fishery; Desalination; Soil Salinity Control; Desalination by Country; Sea Lane; Sea Transport Systems; History of Ship and Shipping; Canal; Ship Canal; Watercraft; Ocean Transport; Maritime and Coastal Tourism; Blue Economy and Maritime Power; Maritime Power Constituents and Enablers etc.

Volume Number 4 deal with the specialized areas like Deep Sea Mining; Offshore Drilling; Oil Platform; Offshore Wind Power; Floating Wind Turbine; Environmental Impact of Wind Power; Offshore Wind Farms; Tidal Power; Wave Power; Shipbuilding; Carbon Sequestration; Carbon Farming; Iron Fertilization; Ocean Fertilization; Bioenergy with Carbon Capture and Storage; Biochar; Ocean Storage of Carbon Dioxide; Carbon Dioxide Removal; Blue Carbon etc. Volume Number 5 deals with the specialized areas like Marine Debris; Beach Cleaning; Coastal Pollution and Impacts; Circular Economy; Cruise Ship; Blue Justice; Marine Resources; Blue Economy Masterplan; Blue Economy vs. Standards etc. The Volume Number 6 deal with the specialized areas like Blue Economy for India and Partner Countries; India's Aquatic Ecosystem; Blue Economy and its Enablers; Blue Economy and Maritime Power Conversions; Vibrant Fisheries and Aquaculture; Importance and Priorities for Blue Economy Initiatives; Blue Growth; Sustainable Blue Economy and the Indian Ocean; Poverty, Environment, Coast and the Blue Economy; Skills for Blue Economic Growth; India's Plans and Policies for Blue Economy; Blue Economy Protection; Blue Economy and Ocean Health; Blue Economy for a Self-Reliant India; Fisheries, Organized Crime and Ocean Economy; Blue Economy and the Bay of Bengal; Human Impact of Ocean Related Crime; Role of Oceans in Industrial Development; Blue Economy, Sustainable Tourism, Ocean Wealth and Health; Blue Economy, Small Islands and Tourism; Deep-Sea Mining and India's Blue Economy Policy; Blue Economy and Tourism in India; Blue Economy Practices in Seychelles; Blue Economy and Clean Technologies; Marine Renewable Energy; Blue Economy, Ocean Health and COVID-19 etc.

Volume Number 7 deal with the specialized areas like Ocean and Maritime Security; Blue Justice; Ocean Health and Governance; Future Workplace and the Oceans; Youth

Empowerment for Blue Economy in Kenya; Opportunities in Blue Economy; Blue Economy in Africa; Potentials of Marine Resources for Blue Economic Development; Blue Economy Development Paradigm; Women's Empowerment and Blue Economy; Status and Vision of Blue Economy in India; Blue Economy and Youth Development; Heritage Management in Coastal and Fluvial Areas etc.

The Volume Number 8 deal with the specialized areas like Blue Economy Assessments; Global Trends Influencing Blue Economy; Ocean Environment and Ocean Economy; Science and Technology for Ocean Economy; Industry Based Blue Economy and Maritime Regulations; Blue Economy and its Contribution; Challenges and Dimensions of Ocean Based Industries; Blue Economy and Ocean Utilization by 2030; Ocean Management; Biodiversity and Climate; Recommendations for Blue Economic Development etc.

**Concluding Remarks**

In summary the article begins by highlighting the concurrent global challenges of climate change, the COVID-19 pandemic, and geopolitical conflicts, such as the Ukraine-Russia war, which have hindered progress towards achieving the Sustainable Development Goals (SDGs). The world population reached 8 billion in November 2022, with increased per capita consumption exacerbating issues like job loss and inflation. In this context, the Blue Economy emerges as a beacon of hope for sustainable development.

The Blue Economy encompasses sustainable use of ocean resources for economic growth, job creation, and improved livelihoods while maintaining ocean health. It includes activities such as aquaculture, maritime biotechnology, fishing, and renewable energy. The concept has gained traction, especially following the UN's 2nd Ocean Conference in Lisbon in June 2022, where Secretary-General Antonio Guterres emphasized the urgent need to protect oceans and harness their potential sustainably. The article defines the Blue Economy through various perspectives, including those of the World Bank, the UN, the European Commission, and other global organizations. Despite differing definitions, a common theme is the sustainable and judicious use of ocean resources to support economic activities, preserve marine ecosystems, and contribute to global goals like poverty alleviation and food security.

Key sectors within the Blue Economy include aquaculture, marine biotechnology, maritime transport, and renewable energy. The article also addresses the significant challenges limiting the Blue Economy's potential, such as ocean resource degradation, lack of investment in human capital, and inadequate marine resource management. Further the outlines of India's strategic position in advancing the Blue Economy, particularly as it assumes the G-20 presidency and celebrates its 75th year of independence have been explained. The Indian government is encouraged to integrate Blue Economy concepts into its educational curriculum and policy frameworks to address pressing issues like unemployment and food security. This book article underscores the critical role of the Blue Economy in addressing contemporary global challenges and achieving sustainable development, emphasizing the need for collaborative efforts, innovative strategies, and comprehensive educational resources.

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# 20
# DIGITAL TRANSFORMATION IN HIGHER EDUCATION: OPPORTUNITY AND CHALLENGES

**Prof. Govind Sharan Dangayach**

*The ongoing COVID-19 pandemic has brought about significant changes in various aspects of society, with the education sector being particularly affected. This article examines the impact of the pandemic on higher education institutions and explores the role of digital transformation in addressing the challenges and opportunities faced by the sector. We provide an overview of new technologies driving digital transformation, such as the Internet of Things, blockchain, virtual reality, augmented reality, mixed reality, artificial intelligence, and hyper-connectivity. Furthermore, we discuss the effects of digital transformation on different stakeholders in the education system, including students, professors, higher educational institutions, parents or guardians, and policymakers. Through a detailed analysis of the opportunities and challenges presented by online learning, we offer insights into how policymakers can leverage digital transformation to enhance access to education, promote lifelong learning, and address equity issues. This article also contributes to the ongoing discourse on the future of education in the digital age and provides valuable recommendations for policymakers, educators, and stakeholders in navigating the complexities of digital transformation in higher education.*

***Keywords:*** *Qualitative, Digital Transformation, Higher Education, Quality Assurance*

## Introduction

The current COVID-19 pandemic has changed the way of thinking, living and communicating worldwide. The most affected sector is the education sector, mainly higher educational institutions. Due to lockdowns and social distancing, educational institutions must conduct online classes rather than taking traditional offline classroom teaching. "Necessity is the mother of invention" is a well-known proverb that states that the need is the primary driving force of any invention. The world-wide pandemic situation was a new experience for the various stakeholders in the Education sector vice, students, teachers, higher educational institutes, parents, and policymakers. This article explores the opportunities and challenges faced by in the Education sector and the role of Digital technology in transforming Higher Education.

**Overview of New Technologies in Digital Transformation**

**IoT** The Internet of Things (IoT) now contains billions of connected devices and has proliferated. IoT is evolving into a worldwide infrastructure that enables cutting-edge services by connecting objects in real and virtual worlds.

- **Blockchain** Blockchain, which has the qualities of decentralization, permanence, anonymity, and audibility, was created to support Bitcoin money.
- **Virtual Reality/ Augmented Reality/ Mixed Reality** Whether from scientists, businesspeople, government decision-makers, or regular individuals, the need for interactive experiences will keep rising.
- **Artificial Intelligence (AI)** One of the most well-known technologies developed at the moment is brain-inspired computing. This broad term encompasses deep learning, knowledge graphs, and other concepts.
- **Hyper-Connectivity** The amount of already available data is expanding at an unheard-of rate.
- **5G, Fog/Edge Computing** Huge amounts of data must be sent to the cloud for storage and processing by many linked devices, including those that use AI. This demand, specifically the demand for real-time processing services, will rise rapidly with the introduction of the 5G (the fifth generation of mobile wireless technologies) network.
- **Progress in Computing and Microelectronics** To support parallel and tensor processing, overcome the latency issue in traditional computer architecture, embedded machine learning, use processor-in-memory, implement 4D virtual reality and augmented reality, visualize, and, most importantly, use less energy, big data analytics and AI require new types of computing.
- **In-memory Computing** Instead of using databases hosted on discs, in-memory computing keeps data in RAM. Therefore, I/O latency and the requirement to reliably and consistently implement database transactions are eliminated.

**Effect of digital transformation on various stakeholders**

In education system must satisfy aa the stakeholders in the present era. Multiple stakeholders in higher educational institutions are Students, Professors, Higher Educational Institutions, Parents or Guardians and Policy Makers.

**a) Students**

***Opportunities***

- **Increased access to education:** Digital technologies can allow students to learn anywhere, anytime. This can be done by providing online access to textbooks, course materials, and other resources. This can help increase education access for students who live in rural areas, have disabilities, or work full-time.
- **Access to resources:** Digital technologies also makeaccessing a more comprehensive range of educational resources easier for students. This includes access to online textbooks, journal articles, and other scholarly materials.
- **Collaboration:** Digital technologies also make it easier for students to collaborate with the faculties. This can be done through online discussion boards, group projects, and other tools that allow students to work together on projects and assignments.
- **Improved student outcomes:** Digital technologies can personalize learning, provide real-time feedback, and offer students more flexibility in learning. This can lead to improved student outcomes, such as higher grades and graduation rates.
- **Personalized learning:** Digital technologies can personalize learning by providing students with customized instruction based on their individual needs and interests. This can be done through adaptive learning platforms, which track student progress and adjust the difficulty of the content accordingly.
- **Real-time feedback:** Digital technologies can give students real-time feedback on their work. This can be done through online quizzes and assessments, as well as through tools that allow students to collaborate with their peers and receive feedback from their instructors.
- **Flexibility:** Digital technologies can offer students more flexibility in learning. This can be done through online courses, which allow students to learn at their own pace and from anywhere in the world.
- **Self-paced learning:** Online classes often allow students to learn at their own pace. They can review materials, pause or rewind lectures, and spend more time on challenging topics. This individualized approach can enhance learning outcomes for students.

***Challenges***

- **Risk of widening the digital divide:** Digital technologies can widen the digital range between students with access to technology and those without access.

Institutions must ensure all students can access the technology they need to succeed.

- **Lack of hands-on experience:** Certain fields of study, such as laboratory-based sciences or hands-on skills development, may be more challenging to teach and learn online. Students may miss out on practical experience or face difficulties in gaining the necessary hands-on skills.
- **Increased screen time and isolation:** Extended online learning periods can lead to increased screen time, which can be tiring and strain the eyes. Additionally, some students may experience feelings of isolation or a lack of social interaction due to the absence of in-person classroom dynamics.
- **Lack of face-to-face interaction:**Online learning can lead to a lack of face-to-face interaction with instructors and peers. This absence of direct human contact can limit opportunities for immediate clarification, discussion, and building relationships, which may impact the learning experience for some students.
- **Technical issues:** Technical difficulties, such as internet connectivity problems, software glitches, or hardware issues, can disrupt the learning process and cause frustration for students. These challenges may hinder access to course materials, participation in live sessions, or timely submission of assignments.
- **Self-Motivation and Discipline:** Online classes demand high self-motivation and discipline from students. Without regular in-person classes and set schedules, students must manage their time effectively, stay organized, and maintain focus to complete assignments and meet deadlines.
- **Different Learning Style Requirements:** Online learning often requires students to adapt to various learning styles, as the teaching methods and materials may vary from what they are used to. Some students may find it challenging to adjust to new instructional approaches.
- **Increased responsibility:** Online learning places a greater responsibility on students. They must take the initiative to manage their learning, stay organized, and seek help when needed. This increased autonomy can be overwhelming for some students who struggle with time management or self-direction.
- **Lack of Social and Cultural Engagement**
- **Online assessment**

Students mustknow these opportunities and challenges and develop strategies to maximiseimize online learning while mitigating potential difficulties. Effective time management, regular communication with instructors and peers, and active participation in virtual discussions can help overcome many challenges and enhance the online learning experience.

**b) Professors**

***Opportunities***

- **Expanded reach**: Online classes allow teachers to reach a broader audience beyond their local community or school. They can teach students from different geographic locations, allowing for greater diversity and cultural exchange in the virtual classroom.
- **Enhanced teaching tools and resources:** Online platforms offer various digital tools and resources that can enrich the teaching experience. Teachers can utilize multimedia content, interactive simulations, online quizzes, and collaborative platforms to engage students and facilitate learning.
- **Professional development:**Online teaching encourages teachers to develop and enhance their digital literacy and technological skills. They become proficient in using various online platforms, learning management systems, and collaboration tools, which can benefit their professional growth.
- **Personalized instruction:** Online classes enable teachers to provide individual students with customized instruction and support. They can offer targeted feedback, tailor assignments to meet students'needs and monitor progress more closely through online assessment tools.

***Challenges***

- **Technological difficulties:** Teachers may face technical challenges such as unreliable internet connectivity, software compatibility issues, or limited access to necessary devices. These obstacles can disrupt the teaching process and frustrate the teacher and students.
- **Adaptation to new teaching methods:** Transitioning from traditional classroom teaching to online instruction requires teachers to adapt their teaching methods and pedagogical approaches. They may need to learn new instructional strategies to engage students in a virtual setting effectively.
- **Limited non-verbal cues and engagement:** In an online environment, teachers may struggle to gauge students' understanding and attention due to the absence of non-verbal cues and direct interaction. Reading students' body language or quickly addressing questions or concerns can be more difficult.
- **Increased workload and time management:** Online teaching often demands more time and effort for preparation, course management, and grading. Teachers may struggle to balance their workload and ensure timely responses to student queries and submissions.

- **Reduced social interaction and connection:** Online teaching can isolate teachers, limiting face-to-face interaction and the opportunity for spontaneous discussions and collaboration with colleagues. Building a sense of community and maintaining solid teacher-student relationships may require extra effort in the virtual environment.

To overcome these challenges, teachers can use professional development opportunities to improve their online teaching skills, collaborate with colleagues to share best practices, seek technical support when needed, and foster an interactive and supportive online learning environment for their students.

When parents support their children's online learning by taking on a more active role, they encounter opportunities and challenges. Here are some of the opportunities and challenges faced by parents when their children are taking online classes:

**c) Parents or Guardians**

***Opportunities***

- **Increased involvement in their child's education:** Online classes allow parents to be more actively involved in their child's education. They can closely monitor their child's progress, engage in discussions about their learning, and provide guidance and support throughout the educational journey.
- **Flexible scheduling and family dynamics:** Online classes allow for more flexibility in scheduling. Parents can adapt their routines to accommodate their child's online learning, which can be particularly beneficial for families with unique circumstances, such as working parents or children with special needs.
- **Enhanced communication with educators:** Online learning often requires increased communication between parents and teachers. This presents an opportunity for parents to interact regularly with educators, receive updates on their child's academic performance, and collaborate on strategies to support their child's learning.
- **Gaining knowledge and skills:** Parents can benefit from online classes by participating in educational opportunities. They can use online courses or resources to enhance their knowledge and skills, positively impacting their ability to support their child's learning.

***Challenges***

- **Technological proficiency:** Parents may face challenges related to their familiarity with technology and online platforms. They may need to learn how to navigate the learning management systems, troubleshoot technical issues, and effectively assist their child using digital tools.

- **Balancing multiple responsibilities:** Managing their responsibilities while supporting their child's online learning can be challenging for parents. They may need to juggle work commitments, household chores, and other family responsibilities, making time management crucial.
- **Providing academic support:** Parents may find it challenging to provide educational support to their children, especially if they are unfamiliar with the subject matter or teaching methods. They may need to seek additional resources, collaborate with teachers, or explore tutoring options to ensure their child receives the necessary academic guidance.
- **Engaging and motivating their child:** Keeping children engaged and motivated in an online learning environment can be more difficult for parents. They may need to find creative ways to encourage active participation, establish a structured routine, and create a conducive learning environment at home.
- **Limited social interaction:** Online classes can reduce children's social interactions. Parents may need to explore opportunities for their child to engage in social activities outside of online classes, such as virtual study groups or extracurricular programs, to promote socialization and peer interaction.

To address these challenges, parents can seek guidance and resources from the school or educational institution, collaborate with other parents to share strategies and support one another, establish a dedicated learning space at home, communicate regularly with teachers, and maintain open lines of communication with their child to understand their needs and provide appropriate support.

**d) Higher Educational Institutions**

Higher educational institutions face various opportunities and challenges when offering online classes. Here are some of them:

***Opportunities***

- **Expanded reach and accessibility:** Online classes allow institutions to reach a broader audience beyond their geographical limitations. They can attract students from different regions, countries, or even international students who may not be able to attend physical classes. This can lead to increased enrolment and revenue.
- **Diverse course offerings:** Online classes provide the opportunity to offer a broader range of courses and programs. Institutions can expand their curriculum

and provide specialized or niche courses that may not be feasible in a traditional classroom setting. This can attract students with diverse interests and meet the demands of a rapidly changing job market.

- **Flexibility and convenience:** Online classes offer flexibility to both students and faculty. Students can access lectures and course materials at their own pace and comfort, while faculty members can create and deliver content based on their schedules. This flexibility can appeal to non-traditional students, working professionals, or those with family commitments.
- **Enhanced technological infrastructure:** Offering online classes requires institutions to invest in and develop robust technical infrastructure. This can lead to improved IT systems, digital resources, and learning management platforms that benefit online and offline teaching and learning.

***Challenges***

- **Quality assurance and accreditation:** Maintaining quality standards in online education can be challenging. Institutions must ensure that online courses meet the same academic rigour and learning outcomes as their traditional counterparts. Obtaining proper accreditation and ensuring program credibility can require additional efforts and resources.
- **Faculty training and support:** Faculty members need training and helpto effectively transition from traditional teaching methods to online instruction. They must learn to navigate online platforms, utilize digital tools, and design engaging online learning experiences. Providing ongoing professional development opportunities is crucial for faculty success.
- **Student engagement and retention:** Online classes can present challenges in student engagement and retention. Without face-to-face interactions, students may feel disconnected or lack motivation. Institutions must develop strategies to promote student engagement, encourage active participation, and foster a sense of community and belonging.
- **Infrastructure and technical support:** Offering online classes requires robust technical infrastructure and reliable support systems. Institutions must ensure stable internet connectivity, access to necessary software and platforms, and prompt technical support for students and faculty. Technical issues can disrupt the learning process and impact student satisfaction.
- **Assessment and academic integrity:** Assessing student learning and maintaining academic integrity online can be challenging. Institutions must develop effective online assessment methods that ensure fairness and prevent cheating. Implementing secure proctoring solutions or alternative assessment strategies may be necessary.

- **Resource allocation and cost considerations:** Offering online classes requires significant investment in technology, software licenses, infrastructure upgrades, and faculty training. Institutions must carefully allocate resources and consider the cost implications of developing and maintaining online programs.

To address these challenges, higher education institutions can provide faculty development programs for online teaching, establish quality assurance measures, foster student support services, collaborate with industry partners for expertise, leverage technology to enhance the online learning experience, and regularly evaluate and adapt their online programs based on feedback and emerging best practices.

**e) Policy Makers**

Policymakers face opportunities and challenges when considering integrating online classes into educational policies. Here are some of them:

***Opportunities***

- **Increased access to education:** Online classes can provide an opportunity to increase access to education, particularly for individuals in remote or underserved areas. Policymakers can leverage online learning to bridge educational gaps and ensure equitable access to quality education.
- **Flexible learning options:** Online classes offer flexibility in scheduling and location. This flexibility can cater to diverse learner needs, such as working professionals, individuals with family responsibilities, or those with disabilities. Policymakers can promote policies that support flexible learning options to accommodate a broader range of learners.
- **Cost-effectiveness and resource optimization:** Online classes have the potential to be cost-effective for educational institutions and students alike. Policymakers can explore policies that encourage institutions to leverage online learning to optimize resources, reduce operational costs, and make education more affordable for students.
- **Technological advancement and innovation:** Embracing online classes can stimulate technological advancement and innovation in education. Policymakers can promote policies that encourage the integration of emerging technologies, such as virtual reality, adaptive learning platforms, and artificial intelligence, to enhance the learning experience.
- **Lifelong learning and upskilling:** Online classes provide opportunities for individuals to engage in lifelong learning and upskilling. Policymakers can develop policies that incentivize continuous learning, recognize non-traditional

credentials, and facilitate the recognition of prior knowledge through online programs.

### *Challenges*

- **Quality assurance and accreditation:** Ensuring the quality and accreditation of online programs can be challenging. Policymakers need to establish robust quality assurance mechanisms that evaluate the effectiveness and rigour of online classes to maintain the integrity of education.
- **Equity and access disparities:** While online classes can increase access to education, policymakers must address potential differences in access, particularly among individuals from disadvantaged backgrounds. Adequate support, such as internet connectivity and device access, must be ensured to mitigate the digital divide.
- **Privacy and data security:** Online classes involve collecting and storing student data. Policymakers need to develop policies that protect student privacy, ensure data security, and regulate the use of student data by educational institutions and online platforms.
- **Teacher training and professional development:** Effective online instruction requires teachers to possess digital skills and pedagogical training. Policymakers must invest in teacher training and professional development programs to equip educators with the competencies required for online teaching.
- **Monitoring and evaluation:** Policymakers need to establish monitoring and evaluation mechanisms to assess the effectiveness and impact of online classes on student learning outcomes. This requires ongoing data collection, analysis, and feedback loops to inform policy decisions and program improvements.
- **Social interaction and well-being:** Online classes may lack the social interaction and sense of community that traditional classrooms provide. Policymakers should consider strategies to promote student engagement, well-being, and peer collaboration in online learning environments.

## Concluding Remarks

The author examines various new technologies driving digital transformation, such as the Internet of Things, blockchain, virtual reality, augmented reality, mixed reality, artificial intelligence, and hyper-connectivity. The article discusses the effects of digital transformation on different stakeholders in the education system, including students, professors, higher educational institutions, parents or guardians, and policymakers. It provides a comprehensive analysis of the opportunities and challenges presented by online learning, highlighting issues such as access disparities, quality assurance, teacher training, and data privacy. The article concludes with recommendations for policymakers, educators, and stakeholders to leverage digital transformation effectively in higher education, promote equitable access to education, and foster lifelong learning initiatives. Policymakers can address these challenges by consulting with educational experts, involving stakeholders in policy development, conducting pilot programs to gather data and feedback, promoting research on online learning effectiveness, and establishing regulatory frameworks that protect students' interests and maintain educational quality standards.

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# 21
# EDUCATION FOR SUSTAINABLE AGRICULTURE DEVELOPMENT

**Dr. Gyanendra Singh**

*Agriculture is like backbone of the nation building process. This book article explores the importance of education in promoting sustainable agriculture development. By providing farmers with the knowledge and skills necessary to adopt environmentally friendly practices, education plays a crucial role in ensuring the long-term success of agriculture. The article discusses the various initiatives and programs that have been implemented to educate farmers on sustainable agriculture practices and highlights the positive impacts that these have had on both the environment and the livelihoods of farmers. Additionally, the article examines the challenges and barriers that exist in promoting education for sustainable agriculture development and offers recommendations for overcoming these obstacles. Overall, this article stresses the importance of education in achieving sustainable agriculture development and calls for continued investment in this critical aspect of agriculture.*

***Keywords:*** *Development, Agriculture, Sustainable Agriculture, Education, Technology*

## Introduction

Education is a prerequisite for development, and agriculture is no exception to that. During pre-independence days, in the absence of resources, food grains productivity has been very low. The country has water resources but in the absence of assured irrigation facilities productivity was low. This was realized by the respective governments after independence and thus irrigation development projects were started. As per the Land Use Statistics 2018-19, the total geographical area of the country is 328.7 million hectares, of which 139.3 million hectares are the reported net sown area and 197.3 million hectares are the gross cropped area with a cropping intensity of 141.6%. The net area sown is estimated at 42.4% of the total geographical area. The net irrigated area is 71.6 million hectares. India thus achieved phenomenal growth in agriculture because of the adoption of scientific agricultural technology by the farmers. Education and training have played a major role in providing technological support.

## Agricultural Growth

### *Food grains*

The food grains production in India has increased from 51 million tonnes (m ton) in 1950-51 to 308.65 million tonnes in 2021-22 (5.82 times) from an area of 127.59 MHA (Figures 1 to 2) registering an average annual growth of 3.2% almost double the population growth of 1.7 percent per annum. The wheat crop recorded the highest increase in production during this period (16.65 times) followed by oilseeds (6.48 times) and rice (5.75 times). Nutri-crops production also recorded an increase in production even though the area under cultivation has reduced drastically from 37.67 million hectares (MHA) to 24.02 MHA. The production of pulses and oilseeds, however, does not feed the growing population. The per capita availability of pulses has reduced from 22.1 kg/year (1950-51) to 17.5 kg/year (2019-20). There are a lot of scopes to increase the yield of pulses as the country imports significant amounts of pulses.

### *Organic foods*

The demand for organic foods has increased, especially in the global market. Organic rice, vegetables, coffee, cashew, oil seed, wheat and pulses, bananas, mangos, and oranges are the most preferred organic products. As per the statistics, India ranks 8th in terms of the World's Organic Agricultural and 1st in terms of the total number of producers as per 2020 data. The total area under organic certification (registered under the National Programme for Organic Production) is 4.34 MHA as of 31st March 2021 (APEDA, 2020-21). Organic foods are produced using green manure, vermicompost, and plant-based pesticides. Among all the states, Madhya Pradesh has covered the largest area under organic certification, followed by Rajasthan, Maharashtra, Chhattisgarh, Himachal Pradesh, Jammu & Kashmir, and Karnataka. A massive training program is required for growing and marketing organic produce. The demand for organic foods has increased, especially in the global market. Organic rice, vegetables, coffee, cashew, oil seed, wheat and pulses, bananas, Mangos and oranges are the most preferred organic products. As per the statistics, India ranks 8th in terms of the World's Organic Agricultural and 1st in terms of the total number of producers as per 2020 data. The total area under organic certification (registered under the National Programme for Organic Production) is 4.34 MHA as of 31st March 2021 (APEDA, 2020-21). Organic foods are produced using green manure, vermicompost, and plant-based pesticides. Among all the states, Madhya Pradesh has covered the largest area under organic certification, followed by Rajasthan,

Maharashtra, Chhattisgarh, Himachal Pradesh, Jammu & Kashmir, and Karnataka. A massive training program is required for growing and marketing organic produce.

**Table 1: Projected demand of food grains in India**

| | Supply, 2019-20 | Projected demand, 2029-30 |
|---|---:|---:|
| Food grains | 296.65 | 319.81 |
| • Rice | 118.43 | 117.56 |
| • Wheat | 107.59 | 108.62 |
| • Nutri- | 47.48 | 60.99 |
| cereals | 23.15 | 32.62 |
| • Pulses | 33.42 | 86. |
| Oilseeds | 211.29 | 316.37 |
| Vegetables | 115.25 | 178.74 |
| Fruits | 36.07 | 44.77 |
| Sugar | | |

*Source: Niti Ayog, Government of India, February 2018 and Pocket Book of Agriculture Statistics, 2020, Department of Agricultural Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of India.*

**Variability in agricultural yield**

The capital-intensive technology-facilitated higher crop yield; but large variability exists in the growth of agriculture in different states. The key factors affecting agricultural productivity are continued dependence on the monsoon, inadequate access to irrigation, loss of fertility of the soil, lack of access to formal agricultural credit, and failure to provide remunerative prices to farmers. Besides bio and chemical inputs, the farmers require appropriate farm tools and machinery to ensure timely farm operations. The country has 86% small and marginal farm holders out of 146 million farm holders, and they share only 47% of the total farmland. These farmers have limited resources to invest in agriculture due to low household income. The small farmers and farmers of hilly regions are still using human and draught animal-operated farm machinery.

*Capital-intensive technology has brought about soil health and environmental issues, and thus, there is a need for sustainable agriculture. Sustainable agriculture development requires knowledge of better inputs management through low investment and maintaining the ecosystem and soil health.*

## Agricultural Inputs

### Soil health and nutrients management

The soil provides plant nutrients for proper growth and yield, besides anchoring to the plants. Indian soils are comprised of four major groups: (1) red soils (105.5 MHA, (2) black soils (73.5 MHA), (3) alluvial soil (58.4 MHA), and (4) laterite soil (11.7 MHA). The availability of nutrients in the soil depends upon the sources of formation of the soil and organic contents (humus and carbon) present in it. The nutrients are classified as primary nutrients (Nitrogen, phosphorous, and potassium); secondary nutrients (Sulphur, calcium, and magnesium); and micro-nutrients (Zinc, Iron, manganese, etc.). The higher the humus and carbon content in the soil, the better is the nutrient uptake by the plants. Unbalanced use of fertilizer and poor organic matter in the soil does not allow soil nutrients to be absorbed by the plants. The health of the soil is measured by the available nutrients for the plants, which is measured by the Nutrient Index. (N.I) (Singh et al., 2016). The fertility of the topsoil is reduced due to high-intensity rainfall and excessive plowing, which causes scouring and soil erosion.

The highest degradation of soil has been recorded in Rajasthan, Maharashtra, Gujarat, Arunachal Pradesh, Himachal Pradesh, J&K, Jharkhand, Karnataka, Odisha, and Telangana were due to the loss of vegetation, wind erosion, and heavy rainfall. The nutrient deficiency is supplemented by manure and fertilizers. There is a considerable difference in fertilizer application in different states. The farmers in the North Zone (179 kg/ha), South Zone (169.93 kg/ha), and East Zone (141.93 kg/ha) are using a higher dose of fertilizer compared to all India's average of 133 kg/ha in 2018-19 The average fertilizer consumption in West Zone is low (96.28 kg/ha). This affects the yield of the crops. The conservation tillage, proper drainage, in situ incorporation of Agro-waste, and balanced use of organic and chemical fertilizers may improve soil health. The farmers need to be educated to apply fertilizer as per the requirement of crops.

### Rainfall and surface water development for Irrigation

The total volume of the water on earth is estimated at 1.4 billion km3 but fresh water is only 2.7% (35 million km3). Of this, 2.05% is locked in icecaps and glaciers and 0.7% is available for human use. Groundwater represents 90% of the world's readily available fresh water. The crops require timely water for nutrient uptake and evapotranspiration. This is met by surface and groundwater which accumulates because of rainfall. The rainfall in India is highly erratic and variable all over the country. The state of Rajasthan receives the lowest rainfall of 250-500 mm; the other 7 states 500-1000 mm; 16states 1000-2000 mm; 3 states 2000-3000 mm, and 6 states more than 3000 mm. The country has 10360 rivers and distributaries longer than 1.6 km, each with a mean flow of 1869 km3. But not enough attention was paid to exploiting this for irrigation before independence. The rainfall is also concentrated in a few months with high intensity. As a result, floods are common and water flows to the sea through rivers. As per the Ground Water Year Book India-2019-20, the average distribution rainfall is as indicated below:

Total rainfall 1182.0 mm

- June (13.8%)
- July (24.2%)
- August (21.2%)
- September (12.2%)
- Pre monsoon (March, April, and May) (11.0%)

The utilizable water in India is estimated to be about 1123 BCM; (comprising 690 BCM surface water and 433 BCM replenish able groundwater). Ganga, Brahmaputra, Barak, Godavari, Indus rivers, Krishna, Mahanadi, and Narmada are the major river basins that provide surface water. Agriculture, deforestation, mining, sedimentation of reservoirs and water bodies, wastewater and pollution from agriculture, industries, and domestic uses; excessive surface and groundwater extraction, and global warming are depleting the groundwater table.

**Groundwater utilization**

In the early 1950s, groundwater from the wells and ponds was lifted through Persian Wheels, swing baskets, and *Dhekli* (traditional manual water-lifting device). These systems of water lifting were slow but continued till Diesel engines and electric motors were introduced. The Central and provincial governments initiated the construction of dams, reservoirs, farm ponds, and tube wells in 1951. This continued up to 2012 to create a cumulative irrigation potential of 113 MHA. To exploit the groundwater, the farmers were provided subsidies for digging tube wells and the purchase of pumps. Today, the country has a gross cropped area of 197.05 MHA of which irrigated area is 96 MHA. Credit for the purchase of pumps and boring of tube wells was provided. Today, more than 42.96mha net crops are irrigated by tube wells and wells. Precision irrigation (drip and sprinkler) has been adopted by the farmers in recent years, where the availability of water is a constraint. More than 12.54 MHA crop is under drip and sprinkler irrigation. An *Accelerated Irrigation Benefit Programme* has been initiated by the Central Government to complete the irrigation projects in the year 1997-98, and up to 2016 irrigation facilities for 9.089 MHA land have been created. Since 2015-16 *Pradhan Mantri Kissan Sinchayi Yojana* (PMKSY) has been initiated by integrating all water resource development programs in the country.

**Problems in the utilization of water resources**

- High runoff due to deforestation and loss of vegetation
- Gradual negligence of traditional water harvesting systems (cultivation practices, ponds, wells, check dams, micro, and mini-reservoirs, etc.)
- Regional differences in river basin water resource management;
- Irrigation potential created and utilized - widening gap, about 15%;
- Poor water holding capacity of soil in North-East and Hill regions, even though these regions have high rainfall.
- Misuse of water due to flood irrigation (low water use efficiency) and lack of adoption of precision irrigation.
- Conveyance losses of water due to poor maintenance of irrigation systems and low recovery of water charges.
- Lack of public awareness in conservation of water and management of wastewater.

**Waste water utilization**

Higher use of chemical fertilizer leads to infiltration of nutrients like Ca and Mg into groundwater and flow into the nearest water bodies at the onset of the monsoons or whenever there are heavy showers. The pesticides DDT, BHC, Carbamate, Endosulfan, etc. are the most common pesticides used in India. A few organochlorines (lindane DDT), and organophosphorus (malathion, chlorpyrifos) insecticides have also been detected in river water. These are highly toxic insecticides. Urban wastewater and sewerage and domestic wastewater require tapped water for domestic and Industrial use of rivers, streams, lakes, ponds, wells, etc. The demand is much larger for flushing, bathing; washing of clothes, utensils, etc., and these generate large quantities of wastewater. It is estimated that about 38,254 million liters per day (MLD) of wastewater are generated in urban centers. This has created wastewater generation and its collection, treatment, and disposal besides environmental pollution problems.

According to an estimate by CPCB, only about 40-50% of the population of the major cities like Delhi, Mumbai, Kolkata, Chennai and Bangalore are served by sewerage systems. The majority of towns and cities, however, have no sewerage and sewage treatment. All this has resulted in a large quantity of wastewater, uncollected and untreated sewerage water reaching the streams, polluting the water. Industrial wastes and effluents equally pollute rivers and other sources of water. Major polluting industries are electroplating units, paper mills, steel plants, textile, sugar industries, and distilleries. Both large-scale and small-scale industries contribute to water pollution. While many large-scale industries claim to have installed treatment and disposal equipment, these are often not in proper working order. Measures have to be taken for the augmentation of water resources and to reduce wastewater to meet the demand for agriculture, domestic and industrial uses. Major issues that need the attention of water scientists are:

- Extensive rainwater harvesting assisted by space-based maps of catchment areas using GPS, GIS, and remote sensing technology.
- Arresting runoff water and water storage by de-siltation of existing water storage ponds, reservoirs, and other water bodies.
- Comprehensive aquifer mapping and extensive groundwater recharge.
- Conservation of water through precision irrigation; sprinkler and drip irrigation and away from flood irrigation.
- Pollution control measures for use of excessive application of fertilizer and pesticides by promoting bio-fertilizers and bio-pesticides, including bio-control measures.
- Integration of these activities with existing surface reservoir-based canal irrigation.

Promotion of domestic water conservation and wastewater treatment facilities

- To meet the water requirement for the growing population, measures have to be taken to increase the water resources and use it judiciously, such as:
- Arresting water in catchment areas (check dams, percolation ponds, farm ponds, new village tanks.
- Increasing groundwater recharge and water storage.
- Crop selection, reducing water wastage in the irrigation system, and adoption of Precision irrigation.
- Pricing system of use of water to avoid excessive use.
- Reuse of wastewater.
- Training of farmers in the conservation of water through use of appropriate irrigation methods such as bed and furrow system, sprinkler, and drip irrigation.

**Quality seeds**

The crop selection and the Quality of seeds are essential for higher yields. The quality of seed is affected by genetic purity, methods of production, harvesting, processing, and storage. The farmers use home-grown and certified seeds. The traditional seeds or local varieties, that the farmers use an account for 65-70% of the total seeds used by the farmers as per the report of the Department of Agriculture and Co-operation, Ministry of Agriculture and Farmers Welfare (Government of India -2016). The certified quality seeds are expensive as compared to homegrown traditional seeds. The Union and State Governments, through Seeds Corporations and private seed growers, are encouraging farmers to replace traditional seeds with certified seeds. There are more than 110 Seed

Testing Laboratories in India. Each state has its seed testing laboratories besides agricultural universities. The Indian Council of Agricultural Research (ICAR) through its 63 National Seeds Project centers, supplements the state's seeds requirement. The private seeds industries and farmers are also involved in the production and sale of certified seeds.

Seed production and plant propagation are highly skilled jobs. Plant breeding hybridization, biotechnology, genetic engineering, and grafting techniques are used by scientists for the development of high-yielding and disease-free varieties. The farmers can also be trained in the multiplication of seeds and horticultural plants.

**Mechanization of agriculture**

Increased net and gross cropped area and, to ensure timeliness, advanced farm equipment is required. Animate power-operated tools and farm machinery fabricated by local artisans have exclusively been used in India for different farm operations. On the small and marginal farms and in hilly and North-East regions, the animate power-operated farm tools and farm machinery continue to have relevance. The country has a total of 250.03 million workforce as per the 2018-19 estimate of the Labour Force Survey. There has been a reduction in agricultural workers due to *Mahatma Gandhi's National Rural Employment Guarantee Act* (MANREGA); besides, educated rural youths are reluctant to work in farming activities. To facilitate the drudgery of farm workers improved hand tools for different farm operations have been developed like: Sickle, spade, hand hoes, seed drills, paddy seeder, paddy transplanter, weeders, sprayers, gardening tools pedal-operated paddy thresher, decorticators/sellers, hand cleaners, winnowers, graders, and other processing machinery.

The power-operated irrigation pumps, threshers, tractors, seed drills, planters, sprayers, and combine harvesters were the priority farm machinery that was introduced in the 1960s and 70s. Gradually, complex farm equipment like LASER LEVELERS, rice transplanters, sugarcane planters, harvesters, potato planters, drone-operated sprayers, and precision irrigation systems are being used by the farmers in a few progressive states. India is now the leading tractor manufacturer and exporter; the domestic sale has increased to more than 890,600 in 2018-19. But there has been skewed growth of adaptation of mechanization due to Agro-climatic diversity and socio-economic disparity. The main limitation in deploying farming machines is the capacity of a farmer to own such equipment and, therefore, they are encouraged to use suitable farm equipment on a custom hire basis. The farmers generally practice agriculture with the traditional system and only limited farmers have acquired advanced training through Krishi Vigyan Kendras and Farmers Training Centre. Thus, formal and informal education and training are required in mechanization and processing.

**Post-harvest and value addition**

The income of the farmers can be increased by reducing post-harvest losses and value addition. The majority of the farmers in India have the skill of cultivation and lack value addition and marketing. The middlemen take the advantage of their ignorance. Some of the crops are highly perishable and cannot be stored unless processed. The government supports the farmers in the procurement of selected crops at a minimum support price (MSP). Large farmers take the advantage of this scheme, but small and marginal farmers are deprived of this scheme due to insufficient quantity to sell the produce in the *Mandies; rather,* they prefer to sell in the local village market or to the local merchants. Export of Agro-produce, especially rice, fruits and vegetables, cotton, tobacco, marine products, dairy products, meat, cashew nuts, sugar, coffee, and many other items, has increased considerably provided the quality of Agro-produce is of global standards.

There are more than 39,741 registered organized and 24,59,929 unorganized micro Agro-processing units in the country as per the report of the Annual Survey of Industries (ASI) 2016-17. The top five states with registered food processing industries are Andhra Pradesh (5861), Tamil Nadu, 5077, Telangana (3969), Punjab (2906), and Maharashtra (2808). These processing units improve the quality of products and increased income and employment for rural and urban people.

**Investment in agriculture**

Intensive agriculture requires higher investment. The majority of the rural population depends upon agriculture and Agro-based industries for their livelihood. Agriculture, horticulture, forestry, milk, dairy products, fisheries, Agro-processing, and agro-based cottage industries are the main sources of income. Financial incentives are provided by the Government for the adoption of scientific agriculture, but a large percentage of farmers depend upon their income for investment in agriculture. To increase the agricultural income of the farmer's Government has initiated programs like (i) improvement in crop productivity; (ii) improvement in livestock productivity; (iii) resource use efficiency or reduction in the cost of production (iv) increase in the cropping intensity; (v) diversification towards high-value crops; (vi) improvement in real prices received by farmers (minimum support price-MSP); and (vii) shift from farm to non-farm occupations. The majors that have been initiated to facilitate agriculture production are: (i) supply of seeds at concessional rates, (ii) *Pradhan Mantri Krishi Sinchai Yojana*, (iii) subsidized fertilizer, (iv) subsidy and custom hire services on mechanization and processing equipment, (v) post-harvest and value addition of farm produce (vi) subsidy and credit for the construction of *Storage God owns,* (vii) digital marketing and export promotion, and (viii) training and skill up-gradation of farmers and processors.

## Agricultural credits

The farmers require credit for the purchase of inputs for agriculture and allied activities. The credit requirement is met by the Non-institutional Sources that include money lenders, traders, commission agents, friends and relatives. The interest rates borrowed from these non-institutional sources are generally very high, but farmers prefer these sources to avoid the complex procedures involved in getting the loan from Banks. The Internal Working Group of the Reserve Bank of India (RBI) while reviewing the Agricultural Credit, observed that only 41% of small and marginal farmers had been covered by the Banks. The National Bank for Agricultural and Rural Development (NABARD) refinances the formal Banking Systems (Institutional Credit sources) that include cooperatives and commercial banks. The intuitional credit sources have been grouped as *Short Term credit* to meet the needs for the purchase of seeds, fertilizers, plant protection chemicals, paying wages to hired workers, etc. for less than 15 months. Such loans are generally repaid after harvest.

The *Medium-term credit* is required for purchasing cattle, pumping sets, agricultural implements, tractors, combine harvesters, etc. for a period ranging between 15 months to 5 years. *The Long-term credit* is required to buy tractors, combine harvesters, buy additional land, or make any permanent improvement on land like the sinking of wells, reclamation of land, etc. for more than 5 years. The share of institutional credit in agriculture has increased to 72 percent in 2015. About 40 percent of small and marginal farmers can access sources of formal credit (Down to Earth, July 6, 2020). During 2019-20 Agricultural Credit was fixed at Rs.13,50,000 crores by the Government and against this target, the achievement was ` Rs. 13,92,469.81 crores (Short term-Rs.825151 cr; medium and long term- Rs. 567579 cr). Due to a lack of knowledge of government schemes, a majority of inept farmers are not able to avail of credits and financial incentives. Massive training is required to educate the farmers to avail the financial schemes of the government.

## Challenges in Agriculture

Although the yield of the various crops has increased it is still very low compared to other Asian and Western countries. There is large variability within the country because of Agro-economic and the use of inputs. A wide gap between lab and land experiments, Low productivity, and high cost, resulting in decreasing profitability and Inefficient use of Agro-inputs. Soil degradation and depleting quality of natural resources. Inadequate natural disaster management system, Labor shortage and low level of mechanization and value addition, Lower quality of farm produce for a global market, Poor self-life of farm produce and inadequate supply chain management, Lack of qualified manpower to address the new and emerging challenges,

**Agricultural Education**

Technological development requires scientific knowledge through education and research, and dissemination of knowledge requires formal and informal training. India has one of the best education and research system to provide scientific inputs to agriculture leading to graduate, post-graduate, and Ph.D. degrees. The Indian Council of Agricultural Research (ICAR) and University Grants Commission, New Delhi, are authorized to conduct accreditation of courses run by Agricultural Universities and Colleges. The ICAR provides support for the policy, quality assurance through accreditation, common academic regulations, updated and contemporary course curricula and delivery systems, improvement of faculty competence, promoting excellence through scholarships/fellowships, experiential learning, National Professors, National Fellows, Emeritus Scientists, admissions of the student through All India competitions, modernization of farms, IT support and up-gradation of infrastructure and facilities including libraries (NAEP, 2020). It is, however, recognized that the major support comes from the respective state governments.

To cater to the requirement of a talented pool in agriculture and allied science disciplines in the country, the Agricultural Education Division of ICAR annually conducts the All India Entrance Examination for Admission (AIEEA) for undergraduate [AIEEA (UG)] and postgraduate (AIEEA (PG) programs along with the All India Competitive Examination for admission to doctoral degree programs AICE-JRF/SRF(PGS) in Agriculture and Allied Science subjects in the accredited universities under the ICAR-SAU system.

The SAUs in each state also conduct state-level Entrance Examination for students' admission. The major subjects that are taught in 4 years (8 Semester) are related to Agronomy, Plant genetics, Seed production, Soil management, Crop production, Irrigation technology, Plant protection, Agricultural engineering, Economics, Marketing and Agribusiness, and Import–Export. Nine courses have been granted the recognition of 'Professional Degrees' namely: Agriculture, Horticulture, Agriculture Engineering, Sericulture, Forestry, Food Technology, Biotechnology, Home or Community Science, Food Nutrition and Dietetics. Practical and Hands-on training is compulsory.

**Table 1: The list of educational institutes**

| | |
|---|---|
| Total Agricultural Universities | 74 |
| State Agricultural Universities | 63 |
| Central Agricultural Universities | 3 |
| Central Universities with Agriculture Faculty | 4 |
| Deemed Agricultural University | 4 |
| Of this Veterinary and Animal Science University | 15 |
| Horticulture University | 5 |
| Fisheries | 3 |
| Dairying | 1 |

The intake capacity of students,

- 1960 less than 5,000
- 2020 40,000

There are also degree colleges affiliated with traditional universities that provide certificate and vocational degrees in agriculture and allied subjects.

**Eligibility criteria for B.Sc. (Hon) Agriculture and Horticulture**

The interested candidates who wish to pursue courses in agriculture are required to follow a certain selection process depending upon the participating institutions. College/institute/university. The common eligibility criteria for admission into B.Sc. (Hon.) in Agriculture are as follows:

- Candidates completing their 10+2 level examination or equivalent are eligible to apply for admission in B.Sc. (Hon) Agriculture and allied subjects.
- The 10+2 must have been completed with Physics, Chemistry, and Mathematics/ Biology at the 10+2 level.
- Candidates must obtain a minimum score of 50% in the 10+2 examination or any equivalent examination.
- Some of the institutes/ universities will have their own admission process, and so will the eligibility criteria.

Note: Some of the colleges and private Universities approved by UGC are awarding 4 years B.Sc. Agriculture degree which is not accredited by ICAR.

The Horticulture courses are offered at graduate, postgraduate, doctoral, and diploma levels besides certificate and vocational courses. The cultivation of horticulture crops (fruits, vegetables, spices, medicinal and aromatic) plants production in 2021-22 is estimated to be 333.3 million tonnes. The Fruits production is estimated to be 102.9 million tonne and the production of vegetables is estimated to be 199.9 million tonne produced the largest share of horticultural crops in India, accounting for 13 percent, West Bengal came in second at over ten percent. This has been possible due to the education and training infrastructure created in the country. For promotion, a National Horticulture Board (NHB) has been established to ensure seed/plant production, financial support for the supply of seeds and planting materials, greenhouse, plant protection, post-harvest and value addition, cold storage, transport and cold chains, and facilitating export.

Veterinary and forestry education are regulated by the Veterinary Council of India (VCI) and the Indian Council of Forestry. Bachelor of Veterinary Sciences & Animal Husbandry (B.V.Sc. & AH) is an important discipline in higher education. The degree course enables graduates to diagnose animal diseases and prescribe medicines for different diseases and the management of livestock. The course curriculum comprises a detailed study of animal anatomy, physiology, veterinary public health, nutrition, and medical diseases.

The Agricultural Engineering education focuses on the efficient production and processing of food, feed, fiber, and fuels using engineering science disciplines. The AICTE regulates engineering education in India, including Agricultural Engineering. The Graduate Aptitude Test in Engineering (GATE) examination for the M.Tech. The course is offered at top institutes in India. The ICAR has launched the NAEP 2020, which focuses on reorienting India's school and higher education systems, as well as instilling research-based studies and innovation in our educational systems. The ICAR awards over 4,500 scholarships each year to deserving students who are chosen through the National Testing Agency's.

The Quality of education depends upon pre-education opportunities for students; infrastructure and teaching faculties; curriculum and pedagogy; student evaluation system; commitment to the education management system, interaction of students with farmers and industries, continuous Up-gradation of faculties, and students' evaluation system. However, there is a limitation of infrastructure, and a shortage of faculties as per UGC norms in most of the Universities and colleges due to financial constraints.

**Training and skill up-gradation**

The formal and informal training is a part of the degree programs of the students and trainees. Hands-on training and interaction with farmers for skill up-gradation; involvement of students in seed/plant, bio-chemicals, and bio-fertilizer production; soil. Seeds and food quality testing Interaction with inputs industries, government departments, and banking organizations for employment of students; skills in preservation of perishables and semi-perishable; training in digital and smart agriculture, including precision farming; and farm machinery training and testing are part of Rural Awareness with Experience (RAWE)

**Career Opportunities in Agriculture**

The agricultural graduates have scope in government, and private sectors, research and education, Banks, and financial sectors, Agri-inputs industries, Rural Marketing, international trade, food processing, packing and transport, Rural credit, insurance, and warehousing, Agribusiness, and Agri-Tech Startup. The list of Startup in post-harvest and Agro-processing includes:

1. Primary processing: drying, cleaning, sorting, grading, parboiling, tempering, hulling, rice milling, oil milling, grinding,v size reduction, sieving, ready to cook, etc.).
2. Secondary processing: Powdered spices, including coconut, soymilk, soy paneer, dehydrated mushroom, honey, fermentation, baked,b extruded products puffing, flaking, frying, extrusion, juice extraction, micro-filtration, etc.); and
3. Tertiary processing: Ready to eat, roasted and salted, bakery products, squash, wines, jam, jellies, pickles, milk processing (powder, ice cream, butter, butter oil, cheese, curd, butter milk (lassi), cottage cheese (paneer), sweets, non-vegetable processing (meat, fish, egg, poultry, etc.), jaggery products, animal feed manufacturing unit. etc.

The governments are conscience of the promotion of the value addition of farm produce. Favorable government policies to promote Agro-processing include:

- Cluster approach for the production of crops; Post-harvest and value addition facilities in rural areas with required infrastructure;
- Skill up-gradation and entrepreneurship;
- Start-up, quality control and certification facilities, and financial assistance.

New frontier research areas that will increase the productivity of crops include:

- Precision farming based on Agro-climate, land qualities, and water resources;
- Biotechnology, genetic engineering and nanotechnology;
- Smart farming and Digital technology; GIS and Remote sensing and Agro-informatics.

**General Higher Education Trends in India**

The ancient Vedic education system–(Ashrams; Gurkuls; Pathshala) emphasized more on religion and cultural development of the society. Basic PHILOSPHY was to educate elite groups which will lead to trickle down to lower levels. Education to Women of upper castes and men and women of all lower castes was not to be given (Yojna 2012). During the Vedic period, astronomy, medical science, civil engineering, metallurgy, and agriculture were also given importance. Charak, Panini, Patanjali, Ghagh, and Aryabhatt were some the famous scientists; thus astronomy, zero concepts, physics, mathematics, and plant science flourished. During Muslim rules, arts, language, civil construction architecture, irrigation systems, and road construction works were undertaken.

The British Education System in India was more to Manage Administration, but a systemic education system was also introduced for industrialization and agriculture development. This led to the establishment of colleges and universities. British Education Advisor (1944) submitted education reform to the Central Education Board in India that included free and compulsory education for all up to the age of 14 years. There were limited schools, colleges, and universities at the time of independence. The comprehensive education policy was initiated after independence. Status of colleges and Universities in India:

**1947:** Schools – 180601; Colleges- 496; Universities - 17
**2019:** Schools -1.5 million; Colleges - 35000 ; Universities - 751
**2020**: Universities - 1000

The FIRST EDUCATION COMMISSION **w**as appointed under the Chairmanship of Dr. Sarvepalli Radhakrishnan in 1948/49, The Report emphasized university education, Rural education, and agricultural colleges with rural Universities women's education; and religious education. Knowledge and technology keeps on changing through inventions and innovations and thus FIRST NATIONAL EDUCATION POLICY **w**as prepared under the Chairmanship of the KOTHARI COMMISSION and was released in 1968. It emphasized the three-language formula in secondary education and the Regional language in Higher Education. It also emphasized specialization in higher education, adult education, vocational education, and Navodya Schools. experimental learning (hands-on learning), peer learning (interaction with teachers and classmates, distance, and online education were also introduced. The policy was further modified in 1986 by Acharya Ramamurti).

**National Education Policy 2020**

It was realized that the earlier policies were too heavy-handed and regulatory system with too little effect, rigid separation of disciplines, suboptimal governance and leadership of higher education, and large affiliating Universities. A policy document (NEP 2020) under the Chairmanship of Dr. Kasturirangan Committee was formulated. The basic aim of the policy was:

- To create vibrant knowledge (shape India into Global knowledge); Three language formula to continue.
- Ensure inclusive and equitable quality education (access, equity, and quality); development of the creative potential of each student (holistic, flexible, and multidisciplinary).; and
- Three language formula to as per earlier policies

To achieve this, one higher education Institute/ college is to be established in every district to increase the GER to 50 by 2035 from the present 26.3. The Committee also recommended a Flexible Exit System; 4 years of graduation with multiple exist (Certificate after one year, Diploma after 2 years; Degree after 3 years, Degree after 4 years. (3+1 year research). After one year of research, the student can directly enter for a research degree,

- Master's degree: Two years after 3 year's degree course or One year after 4 years degree course, and 5 years integrated course,
- M.Phil.–to discontinue and Ph.D. with course work.
- For Peer-reviewed research, a NATIONAL RESEARCH FOUNDATION has been recommended.
- The UGC and AICTE are to be dismantled and HIGHER EDUCATION COMMISSION OF INDIA to be formed with four independent vertical pillars;
- Higher Education Regulatory Council (excluding medical and legal).
- National Accreditation Council
- Higher Education Grant Council
- General Education Council.
- The existing councils, such as NCTE, ICAR, IVC, NCTE, etc. will be PROFESSIONAL STANDARD-SETTING BODIES. These bodies will be members of the GEC.
- Stand-alone universities shall become a part of the multidisciplinary universities.

**EVALUATION OF STUDENTS** shall be based on:

- Self-evaluation,
- Peer assessment and
- Project-based learning

**Globalization of education**

It is recommended to open the top 100 Universities open their campus in foreign countries. Likewise, 100 top universities from foreign countries will be allowed to open their campus in India. India provides higher education and training to students from Asian and African countries.

**Concluding Remarks**

Education expands knowledge and enables us to undertake research and development. A lot of development took place during the Pre-Vedic and Vedic periods. These still have relevance but remain confined to a selected few. In the later periods, a lot of development work was undertaken which included road and rail construction, dam construction, irrigation development, agriculture, metallurgy, architecture, medical sciences, and limited schools, colleges, and universities. The major educational and research programs were initiated after independence. India is now the leading country that has a quality agricultural education system. This led to technological development, including in agriculture. National Education. Policy NEP 2020 further recommended to improve the infrastructure and facilitated for the education and research system by reorganizing the education system. The Seed and plant development, irrigation, fertilizer, plant protection, mechanization, post-harvest, and value addition and storage facilitated agricultural production.The government provided training and financial incentives for the farmers to adopt agricultural inputs to increase the yield. The growth in agriculture has been phenomenal. The country is now not only self-sufficient in food but in exports to other countries. The intensive agriculture technology has brought constraints to small and marginal farmers and thus, there is a need to bring in sustainable technology.

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# 22
# SUSTAINABLE AGRICULTURE AND CLIMATE CHANGE

**Prof. P B Sharma**

*In this article we delve into the critical intersection of agriculture and environmental challenges in the context of India's agro-industrial economy. The article begins by highlighting the significance of Climate Resilient Agriculture and the imperative to advance research and innovation for sustainable agricultural practices. Despite India's substantial agricultural output and global standing in key produce, inefficiencies in resource utilization and post-harvest losses pose significant challenges. The article underscores the sector's importance as a major employer, economic backbone, and pillar of food security. Addressing the impact of climate change on agriculture, the article emphasizes the urgent need for sustainable practices in the face of rising global temperatures and greenhouse gas emissions. The consequences of climate change, exacerbated by poor awareness and outdated technologies, have adverse effects on agricultural yields, air and water quality, and water resources. The article references the IPCC's findings on climate change's implications for global food security, with a particular focus on South Asia. To tackle these challenges, the article advocates for the adoption of smart-water technologies, effective water management systems, and high-tech agricultural solutions. It calls for comprehensive policies and actions to promote sustainable water resource usage, enhance agricultural productivity, and address water and energy security concerns. By emphasizing the importance of implementing strategies to mitigate climate change impacts and promote sustainable agriculture, the article underscores the urgent need for coordinated efforts to navigate the twin challenges of climate change and sustainable agricultural development.*

***Keywords:*** *Agriculture, Climate Change, Deforestation, Water Management, Sustainability, Global Warming, Ecosystem*

Hon'ble Vice Chancellor of Dr Hari Singh Gour University, Distinguished Guests of Honour, Deans, Members of the Faculty, Enlightened Delegates, Ladies and Gentlemen.

A very Good Morning to All of you. It gives me immense pleasure to be with you this morning at this august gathering of eminent scientists and researchers in the field of Agriculture and Climate Sciences. I wish to thank you Hon'ble Vice Chancellor for giving me the opportunity to visit your esteemed university and to be a part of this great National Symposium devoted to a theme, dear to my heart, i.e. Sustainable Agriculture and Climate Change.

Ladies and Gentlemen, let me say a few words from my heart about this great University. Firstly, I have great respect for Dr Hari Singh Gour, a highly distinguished academician, legal luminary of his time who was the founder Vice Chancellor of the prestigious University of Delhi from 1922-26, during the days when India was under the British rule. To become the founder Vice Chancellor of a University and that too at the seat of power, Delhi was no small a recognition of genius of Dr Gour. In fact, universities were set up earlier at Mumbai, Madras and Calcutta, in the three other metropolitan cities as the great centres of learning and scholarship in 1857. Everywhere, British luminaries were appointed as the founding Vice Chancellor, except at Delhi, where the honour was given to Sir Dr Hari Singh Gour, who was born in a farmer's family near here in the district Sagour and it is from here that he rose to great eminence on the strength of education in India and also at Cambridge University, UK.

Despite being well set in his legal profession and being a highly respected statesman of his time in Delhi, it was his earnest desire to serve his homeland with quality education and research and that is why he chose to establish the University of Saugor, from his lifetime savings in 1946. The University of Saugor rose to great eminence during the time of Dr Gour and continued its eminence in disciplines like Law, Pharmacy and Philosophy. Myself, belonging to nearby town of Vidisha have great memories of the eminence of University of Saugor and I know that it was a great temple of learning that gave rise very many eminent pharmacists of our country that included Dr CK Kokate, Former President of Pharmacy Council of India and very many other who occupied prominent positions in academia and in the pharmaceutical industries in India and abroad. What more philosophers of eminence such as Acharya Rajneesh studied here and it is from here they went around to lead the world. I feel so delighted to visit the University today and be part of this great National Symposium. Let me share some of my thoughts on the subject.

**Sustainable Agriculture and Climate Change**

I also feel truly delighted that this Symposium is being organized on a topic so Important as Climate Resilient Agriculture and to explore avenues for fostering a new era of research and innovation for accelerating our march on the pathways of Sustainable

Agriculture. Despite massive thrust on industrialization, India still remains a strong agro-industrial economy with approximately 15.4% of GDP being contributed by agriculture, while Industry contributes 23% and the Service Sector 61.5%. India had the second-highest agricultural output at $403.5 billion in 2020. What more, India is the world's largest producer of milk and pulses (dry beans, lentils, and chickpeas) and is the second-largest producer of rice, wheat, sugarcane, fruits, vegetables, cotton, and groundnuts in the world. It must make us feel immensely proud. But, despite achieving self-sufficiency in grain production, India still continues to remain heavily dependent on monsoon and its low productivity is dictated by the inefficient use of limited resources, resulting into crop yields below the global average.

What more, the shortcomings in infrastructure, distribution and marketing system have caused post-harvest losses of up to 40% for some crops, including wheat fruits and vegetables. It is, however, heartening to note that the storage capacity in the rural sector has been recently greatly augmented by the construction of warehouses throughout India under the various Govt subsidies for the growth of warehouses in the private sector. Despite all these healthy developments, the agriculture sector remains as one of the most stressed sectors in the country. The agriculture is a major employer of our rural work force and is the backbone of our economy and a strong pillar of food security. This is a sector that requires a great care and support of innovative technologies for its rapid transformation on the pathways of sustainable and climate resilient agriculture.

**Climate Change: A Major Challenge to Sustainable Agriculture**

Due to rapid growth of industrialization, urbanization and economies, the entire world is under the threat of rise in global average temperature, global warming and climate change. These consequences are due to the extensive use if fossil fuels such as Coal, Petrol, Diesel and Natural Gas for transportation and power generation, and use of Furnace Oil in industries, deforestations that has largely contributed to the emission of greenhouse gases (GHGs), responsible for increase of atmospheric temperature and green house effects. These dire consequences are causing climate change and adversely affecting the agriculture yields. What more, due to poor awareness and lack of availability of innovative technologies, the agricultural sector continues to contribute to the degradation of air and water quality due to crop residue burning and unmindful use of pesticides and fertilizers. While water remains as one of the major natural resources for agriculture, lack of water conservation measures has made Indian agriculture as one of the most water stressed sectors. Extensive use of groundwater in agriculture has led to depletion of groundwater resources and deepening of groundwater levels in most parts of the country. The situation is surely alarming as the map of water stressed India to the right, so clearly depicts.

The sixth Assessment Report of the IPCC of 2021 (Inter Governmental Panel on Climate Change) has also asserted that climate change and its observed consequences have affected the world food security, more in South Asia and in African countries. In addition to this, several findings have indicated that crop production in India could be significantly impacted due to abrupt variations in the patterns of rain fall, climate frequency and intensity of extreme floods and droughts.

The challenges of global warming and climate change are to be met through the judicious application of water technologies in agriculture through smart-water technologies. There is an urgent need to address the challenges of increased food production, improving quality of life of the rural people and also to address the challenge of water and energy security in India. The abrupt climate cycle has resulted into frequent occurrences of floods, damage to agriculture crops, droughts in some areas and thus the twin challenge of achieving the goal of sustainable agriculture and mitigating climate change are to be met with implementable policies and actions on a war footing. The focus of these policies should be to promote sustainable use of water resources, effective water management systems and to promote high tech agri-tech solutions in a big way to relieve the pressure of water security while at the same time boosting both the quality as well as the yield of agriculture produce.

The NITI Aayog, the prime "Think Tank" of Govt of India has also laid a great emphasis on the conservation of water resources, and on cleaning of holy rivers such as the Ganges, Yamuna and other holy rivers of the country through Namami Gange and Ganga Action plan etc. Several policies have been initiated by the respective State Governments under the direction of Central Government to implement technology innovations in the areas of agriculture water management. These innovations include extensive water harvesting, micro-irrigation and resource conservation farming to ensure efficient water usage in agriculture and other critical services in the agriculture sector. "We need to go Rural with a High-Tech Mind and with Scientific Solutions" to build a New India of our dream in which the Rural India shall be a vibrant growth engine of India's economy that shall meet the twin challenge of inclusive and sustainable development.

I am of the firm view that mere urbanization based economic and industrial growth would not suffice for a country like India which has a large population in its rural sector. The exodus of rural population to mega cities, while depriving rural India of its legitimate contribution to nations agro-industrial economy, has already caused mega cities and towns great stresses and raised great slums of poverty in and around the cities of India. Strategies for ndia@80 in 2027 require a major shift in our approach to planning for the

New India. What India needs that alongside with SEZs in urban areas, we need to create Rural Clusters of SEZs to promote whole lot of industries including Food Processing, IT Call centres, Greentech, High-Tech Agri-Tech and also High-Tech Handicrafts and Social businesses which together with urban clusters of economic growth engines shall fast track Indian economy to achieve the goals of sustainability and inclusivity

**Declining Pattern of Agriculture Productivity in India**

Increased use of land, irrigation and agro-chemicals played a major role in the growth of agricultural production during the Green Revolution in India. However, it is now recognized that the gains of Green Revolution were often accompanied by negative effects on natural resource base, including land degradation, salinization of irrigated areas, over-extraction of groundwater, the build-up of pest resistance and the erosion of biodiversity. Agriculture has also damaged the wider environment through deforestation, emission of greenhouse gases and nitrate pollution of water bodies.

As per the UN Food and Agriculture Organisation, UN FAO Report 2021, the world's population would reach 9.73 billion in 2050. As such in sub-Saharan Africa and South Asia, the agricultural output would need to be more than doubled by 2050 to meet the increased demand of food and vegetables. In the rest of the world the projected increase would be about one-third above the current levels. This monumental challenge of food security is to be met through sustainable agriculture and by taking the challenge of soil regeneration and rebuilding the highly water stressed areas, besides the mitigation of climate change.

India has been facing tremendous challenges of declining of agriculture productivity over the last few years. The estimated impacts of climate change on cereal crop yields in different regions of India indicate that the yield deficit could be up to -35% for Rice, -20% for Wheat, -13% for Barley and -60% for Maize depending on the location, future climate patterns; etc.

**Water as a strong Indicator of Sustainable Agriculture**

Water can be considered as a strong indicator for agriculture sustainability and economic prosperity. 70% of the Earth's surface is covered with water but 97.3% of the total water on the Earth in saline and only 2.7% is available as fresh water. Almost 85% of water from different sources in India is used for agriculture purposes. The impact of global warming on climate change has affected regional hydrological cycle and thereby water resources which reduce the availability and reliability of water supplies in various need-based demands. Finally, such situations create threats of water security. We need new and innovative technologies for agriculture and for water conservation in the agriculture sector.

## Water Resources and their use in India

India has a geographical area of 329 million hectares which amounts to 4000 billion cubic miles (BCM) of water from annual precipitation. Due to large spatial and temporal variability in the rain fall, the distribution of water resources is highly skewed in India. Surface and ground water resources have played an important role in the socio -economic development of India.

The Comprehensive Water Management Index (CWMI) 2019 measures the performance of States on a comprehensive set of water indicators and reports relative performance in 2017-18 as well as trends from previous years (2015-16 & 2016-17). Such a benchmarking exercise can go a long way in creating a common frame for progress for water in India and also highlight the need for specific improvements (2).

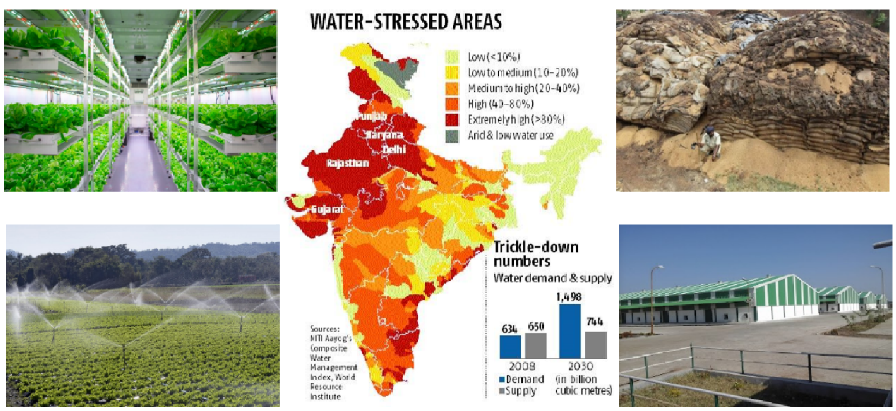


**Table 1:** Total water requirements for various sectors

| S. No | Sector | Water demand (BCM) | | | | |
|---|---|---|---|---|---|---|
| | | **1990** | **2000** | **2010** | **2025** | **2050** |
| 1. | Irrigation | 437 (87.05%) | 541 (85.33%) | 688 (84.62%) | 910 (83.26%) | 1072 (74.08%) |
| 2. | Drinking | 32 | 42 | 56 | 73 | 102 |
| 3. | Industrial | - | 8 | 12 | 23 | 63 |
| 4. | Energy | - | 2 | 5 | 15 | 130 |
| 5. | Others | 33 | 41 | 52 | 72 | 80 |
| 6. | Total | 502 | 634 | 813 | 1093 | 1447 |

*Source: Min of water resources, GOI, 2019*

Demand for agriculture water is likely to increase significantly in future. Therefore, there is a need of judicious utilization of available water resources in agriculture and also proper planning is required for water storage, conveyance, distribution, harvesting and conservation for the sustainability of agriculture in the country.

**Emerging Technolgy Integration in Agriculture**

The global demand for food continues to rise and is projected to increase up to 102% to satisfy the requirements of 9 billion people by 2050. Consequently, agricultural production needs to also increase by 60%–70% to ensure the supply of raw materials for food, feed, and fiber. Ensuring a sustainable future, despite today's sustained and intensified pressure on global resources, means that each actor in the food system needs to commit themselves to develop and enforcing practices that will reduce the use of natural resources where possible, and reuse, recycle, and repurpose them otherwise. Government entities can aid these efforts by implementing policies and strategies for efficient resource management on both national and local levels. Adopting sustainable farming practices worldwide is contributing to the agroecosystem's efforts to meet the world's current food needs while also ensuring that future generations will be able to meet theirs with the limited resources that they will have. These practices also focus on holistic development that incorporates environmental, social, and economic sustainability which are the three fundamental pillars of sustainable development.

Technological advancements are today integral to attaining sustainability goals in agriculture. Satellite and GPS technologies, sensors, smart irrigation, drones, and automation, to list a few, provide the means for precision agriculture, which further aids in effective resource utilization. On the one hand, they reduce the use of harmful agrochemicals and, on the other, they help conserve non-renewable resources. They also help agriculturists to prepare days in advance for unseasonal or extreme weather events, thereby reducing crop losses during such events. Other technologies that hold the promise of promoting sustainability are blockchain technologies for food safety through greater transparency, controlled environmental agriculture, and biotechnology, along with 3D printing technology that allows the production of food products while saving both time and energy. Scientific research and advancements in agriculture enable farmers to utilize the best of traditional and technology-led crop production for nutritious, high-output yield while causing as little damage to the environment as possible and ensuring cost-effectiveness. With adequate and timely information at hand, even remotely-located rural farmers can adopt practices for sustainable and climate-smart agriculture that result in economic gains. (3)

While water conservation is one of the most important area that requires innovative cost-effective solutions, the university research in agriculture universities need to take on board a renewed focus on interdisciplinary and integrative technologies that have a direct bearing on increasing productivity as well as environmental sustainability. Whole lot of integration of agrisciences starting from plant biology, nano-biotechnology, plant genomics and hitech aegrotech is required to achieve the gole of sustainable agriculture that shall also make the farming and food technology sector economically viable. The emergence of new and innovative technologies such as AI for climate and soil surveillance, drone assisted smart and intelligent farming, Hydroponic cultivation, vertical farming practices have begun to revolutionize the farming sector in India and as such it would higly desirable for the new gen professionals to "go rural with scientific mind and technology innovations" to make the farming sector a strong piller of growth of India's vibrant economy and support new gen startups and mass entrepreneurship to usher Green Revolution 4.0.

## Concluding Remarks

Food and Water security are two major goals that we in India, being a populous country must keep as our high priority goals for building an India of our dream. Sustainable agriculture shall thrive on our success to implement innovative solutions for water conservation in agriculture alongside with extensive rainwater harvesting and ground water recharge. We need to put in place water smart agriculture technologies and ensure their increasing use in rural India both for boosting the agriculture productivity as well as improving the water table in rural India. There is strong case for High-Tech Agriculture utilizing a minimum of water resources and yet maximizing productivity and quality of nutrients in Agriculture produce. Sustainable agriculture is intrinsically associated with increased used of green energy and green technologies in various sectors of nation's economy. As such, mass entrepreneurship is possible in rural India that shall create million of jobs and support the cause of inclusivity.

Increased forest cover goes a long way in creating great sinks of carbon dioxide, as such social forestry and plantation drive in rural areas should be promoted as a good social business. There is of course a great opportunity for plantation and eco-farming along both the sides of highways and expressways and along the rural and urban roads in India. Here again we should be careful while doing plantation as the current love for decorative plants like palm trees is highly water consuming. To ensure future sustainability in agriculture, not only water but also other key components like, natural fertilizers, natural pesticides and innovatively designed farm machinery need to be promoted as local industries, this will also create millions of jobs in rural India besides promoting organic farming. For Promotion and adoption of climate resilient strategies, we need to fund innovative research for development in our universities and colleges in India and fund the startups in water efficient agriculture technologies.

Before I Conclude, I would like to share with this August gathering the Quotes of some of the Visionaries of the world.

- The former President of America, Noble Laureate of Peace, Shri Barak Obama said "*Let us resolve that we will not leave our children in a world where the oceans rise, famine spreads and terrible storms devastate our lands*".
- The former UN Secretary General Mr Ban Ki Moon said "*Sustainable development is the pathway to the future we want for all. It offers a framework to generate economic growth, achieve social justice, exercise environmental stewardship and strengthen governance'.*
- I also agree with Mr. Thill Harding who said,
- "*Without Environmental Sustainability, Economic Stability and Social Cohesion cannot be achieved."*

Let me close by quoting our visionary Prime Minister Shri Narendra Modi Ji who while addressing the India Economic Convention 2014 Delhi, on 27th February, 2014 has said,

> *"We must build an agenda for speedy, yet sustainable economic growth that is inclusive for all, is respectful for individuals, responsive to innovations and responsible towards the future generations".*

I am sure that the universities of today and surely that of tomorrow shall redesign their agricultural education and research to foster a new era of increased agriculture productivity alongside with unwavering commitment to water conservation and environmental sustainability. we are implementing this agenda with all sincerity and commitment to build India of our dream.

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# 23
# INTEGRATING EDUCATION AND RESEARCH

**Prof. Dr. Panuganti C S Devara**

*The nexus between research and teaching has become a critical concept in higher education over the last three decades, emphasizing the interdependence of these functions. This article systematically reviews literature to explore the evolution and application of this idea, identifying that while a global linkage exists, local nurturing is necessary. The article examines the varying forms and strengths of the research-teaching link across disciplines and education levels, noting its strongest presence at the PhD level. It also discusses the influence of national and international policies on this relationship, proposes indicators to measure it, and reviews the evolution of the Indian education system, focusing on recent developments like NEP 2024. The article concludes by highlighting the importance of educational research, climate education, outreach programs, and the internationalization of education, and offers future strategies for enhancing the research-education nexus.*

***Keywords****- Higher Education, NEP-2020, Educational Research, Curriculum Development, Climate Education, Outreach Programs, Academic Evaluation, Technology Integration in Education*

## Introduction

The idea of the research/teaching nexus has become of increasing importance in thinking about higher education over the last three decades. In essence, this idea recognizes the two key functions of higher education – teaching and research – and argues that they are, or should be, closely linked. This article explores the derivation and development of this idea, and considers its application and critique, through a systematic review of the literature. It concludes that, while there is clearly a linkage between research and teaching at a global level, it needs nurturing locally. We might do well to limit the emotional commitment often embodied in thinking about the association between research and teaching and do more to explore in detail what actually happens in practice.

This session examines the state-of-the-art literature on "Relationship Between Research and Education" and "To Develop an Evaluation Model ("Integrated Academic Evaluations") for academic research, education, and the interplay between these two. The literature review shows that the research-education link can take various forms and directions and might vary according to disciplines and program levels. Thus, this session provides a preamble of two fundamental elements, namely, Education and Research. The curriculum itself should be based on research-linked knowledge. While student active-learning forms are considered beneficiary, a research-based approach to curriculum would emphasize that one needs to employ various approaches to teaching and learning processes, contextually embedded nature of the research-education linkage. The literature shows rather consistently that disciplinary differences matter, for the ways in which teaching, and research are defined, and how the link has been conceptualized in various studies. While most of the literature, research-learning section focuses on undergraduate education, existing literature shows that in general this relationship is strongest at the PhD level and weakest at the bachelor level.

A number of studies indicate positive views from staff regarding the positive relationship, a number of authors highlight that current national and organizational frameworks can in fact push towards the somewhat normative stance that education and research should be linked closer together. Higher Education Institutions (HEIs) have multiple tasks and engage with society in various ways and the independence or interdependence of the main functions of universities has been an enduring debate in modern universities. As HEIs evolve, the increased complexity has also led them to have several layers of organization where the patterns for organizing education and research might differ from each other. Furthermore, recent changes in the higher education landscape can alter the underlying premises for whether and under what conditions such a link exists. Internationally, there is a trend towards higher concentration of research (for instance, the spread of research excellence initiatives), and withering out of institutional categories (i.e., abolishing earlier binary structures). This can mean both concentration of research activities, and in fact widening them to new institutions. National and International policies can facilitate the enhancement of such a link.

The indicators to measure the research-education relationships and its quality on higher education should be seen as "quasi-indicators" rather than full-scale performance indicators, due to the ambiguous nature of the link. Such indicators should use multiple sources of data and employ both qualitative and quantitative measures. For this purpose, three sets of indicators are proposed. They are input, process, and output parameters. The time evolution of these elements and recent advances that have taken place from the earlier decades-together experience gained by the Government-versus Stakeholder dialogues and the resultant innovative ideas and reformations in education and research are briefly discussed.

**Time evolution of Indian Education System**

Despite a considerable improvement in our education system, we are still far from meeting the defined targets like universal enrollment, inclusion, quality, and accessibility of education. Undoubtedly, the Kothari Commission, National Education Policy (NEP 1968, 1986); Plan of Action (POA), 1992; Right to Education (RTE). 2009; and National Curriculum Framework (NCF), 2005 have restructured our education system to a great extent. In recent times, the NEP underwent further developments during its journey though NEP 2020, 2022, 2023 and now 2024. Thus, the latest NEP 2024 is believed to facilitate a paradigm multi-dimensional structure, and trajectories in education, research, and policy systems.

Like any other education policies in India, its implementation and level of success also lies in the hands of the stakeholders. It calls for sincere efforts to inculcate life skills, promote critical thinking and foster problem-solving in students. But not all the teachers and related staff members are fully prepared to take up this demanding endeavor. The recent advances in technology and schooling alternatives like digital schooling platforms will simplify the innovative curriculum initiatives suggested in the NCF 2005. And if we succeed in bridging our digital divide, many Indian students will be able to thrive better with its visionary reforms.

**Framework and Highlights of NEP-2024: A Brief**

**(a)** Objectives of the NEP-2024 which geared the past policies:

- To elevate the standard of education in India to a global level, thereby enabling the country to emerge as a leader in knowledge-based industries. This objective is achieved through the universalization of education outlined in the earlier policies, and
- To enhance the quality of education and enable children to access good education.

**(b)** Salient Features:

- Holistic Approach: The new education Policy 2024 aims to foster over all cognitive, emotional, and societal development of students.
- ECCS Emphasis: Early Childhood Care and Education (ECCS) ensures strong foundational learning for every child.
- New Structure: A revamped 5+3+3+4 curriculum structure integrates experiential and skill-based learning.

- Vocational Push: By 2025, the goal is for 50% learners to have vocational education exposure.
- Regional Language Priority: NEP encourages instruction in regional or home languages up to Grade 5
- Digital Integration: Incorporating tech-driven platforms like DIKKSHA ensures accessible quality education.
- Teacher Training: Continuous professional development and training modules align educators with the new methodologies.
- Inclusivity and Equity: NEP 2024 commits to ensuing education for all, irrespective of socio-economic or physical barriers.

**(c)** Highlights and Benefits

- Multiple entry and exit points for higher education with appropriate certification.
- Undergraduate courses of 3 or 4 years with various exit options and certifications.
- Establish an academic bank of credit to store and transfer digital academic credits.
- National testing agency offering common entrance test for admission to higher education.
- Goal of building one multidisciplinary higher education institution in every district by 2030.
- Aim to make all higher education institutions multi-disciplinary by 2040.
- Higher education Commission of India as single body for entire higher education (except medical and legal education)
- Four verticals under Higher Education Commission of India: National Higher Education Regulatory Council, General Education Council, Higher Education Council, and National Accreditation
- Equal treatment for Government and Private education, with charges for education for the disabled.

As explained above, the framework of NEP-2024 brought some major improvements over the earlier Policies. This new policy is based on four main pillars, viz., access, equity, quality, and accountability. It involves the 5 + 3 + 3 + 4 structure which comprise 12 years of schooling and 3 years of Anganwadi / pre- schooling. Government of India desired to make Indian education system as a global knowledge superpower, and it will be only done by making changes in the education system for schooling, colleges, and Universities. Through this new education policy, the government desires to make the education system more flexible, holistic, and multi-disciplinary which will bring out their unique capabilities.

**(d)** Education Models for UG and PG Students, Leading to Research Prospects
It was imperative that a Model Curriculum be prepared by best experts from academia and industry, keeping in view the latest industry trends and market requirements and be made available to all universities / board of technical education and engineering institutions in the country. The All-India Council for Technical Education (AICTE) constituted a team of experts to prepare the Model Curriculum of UG and PG Degree Courses. For example, an UG course in Computer Science and Engineering (Artificial Intelligence and Data Science (AI&DS) etc. Similar exercise is done for other UG, Diploma and PG level in engineering, MBA, PGDM, Architecture, etc. It comprises of basic science and engineering courses, having focus on fundamentals, significant discipline level courses and ample electives both from the disciplines and cross disciplines including emerging areas all within a cumulative structure of 163 credits. Summer Internships have been embedded to make the student understand the industry requirements and have hands on experience.

Virtual Laboratories have been introduced for a few experiments. Also, most courses have been mapped to its equivalent SWAYAM/NPTEL Course to offer an alternative for learning that course online from SWAYAM. These features will allow students to develop a problem-solving approach to face the challenges in the future and develop an outcome-based learning approach. As a major initiative by AICTE, a three-week mandatory induction program for students has also been designed and has to be given at the beginning of the course. The idea behind this is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature. It is sure that this Model Curriculum will help to enhance not just the employability skills but will also enable youngsters to become job creators. So, it is strongly urged that the institutions / universities / boards of technical education in India to adopt this Model Curriculum at the earliest. This is a suggestive curriculum, The concerned university / institution / board should build on and exercise flexibility in readjustment of courses within the overall credits.

**Educational Research**

In general, research aims to expand our understanding of the world and to answer questions that are important to society. The objectives of the research are to identify new knowledge, establish facts, and test hypotheses, and to solve problems. Research is a way of knowing or understanding, just as an insight, divine inspiration, and acceptance of authoritative declarations can be ways of knowing is that research requires reporting. Educational research refers to the systematic collection and analysis of data related to the field of education. Research may involve a variety of methods and various aspects of education including student learning, interaction, teaching methods, teacher training, and classroom dynamics. The main purpose of educational research is to expand the existing body of knowledge by providing solutions to different problems pedagogy while improving teaching and learning practices. Educational research is basically divided in three types. They are (i) Descriptive or survey, (ii) Associational or Correlational and (iii) Intervention or experimental.

**Climate Education**

'Climate Education' is the need of the hour for Carbon Neutral Bharat. In India, The Policy Times Chamber of Commerce (PTCC) and Sustainovate has been organizing time-to-time webinars on "National Consultation on Climate Education (Virtual)" on various aspects related to sustainable Climate Actions. Recently, it organized an online webinar on at India International Centre (IIC), New Delhi on Thursday, 25 January 2024. The webinar commenced with an Inaugural Session on "India's Climate Trajectory and the Role of Education" followed by Panel Discussion covering 'Climate Education Financing, Industry Academia Linkage'. This webinar is unique in the sense that it is a long session wherein several National experts having world-wide experience spoke on Science, Education, Marketing and Policy.

The Patrons of the PTCC include (i) National Healthcare Committee, (ii) North Bengal Development Committee, (iii) National Education Committee, (iv) National Sustainability Committee and (v) Young Working Committee. In the recent past, the PTCC had organized several Workshops, Seminars and Meetings with themes ranging between Education Summit to Waste Management to Green and Sustainable Mobility Missions to Plastic Pollution to Circular Economy to Tyre & Rubber Recycling. All the speakers in the Webinar emphasized on various steps to be taken to encourage and adapt the SWAYAM portal at UG and PG levels at all School, Colleges, and Universities. In conclusion, the webinar covered a galaxy of topics ranged through Climate Sustainability, alternative methods utilizing the natural sources to improve the Gross Domestic Product (GDP) of India (presently at 5th place in the world), and development of methods to Mitigate the Climate Variability at regional through global level.

**Outreach Programs for Education and Research Connections**

Education, outreach, and training are often necessary components of successful research proposals. To assist researchers in identifying education, outreach, and training programs, the Office of Research staff have compiled a list of those programs of which we are aware. Outreach programmes create a partnership between communities and educational institutions. The mandatory outreach programmes of the Institution prepare students to be active citizens by engaging them in service activities and encourage them to work with society to help, uplift and support those in need.

Outreach activities are meant to engage a large audience and to bring knowledge and expertise on a particular topic to the general public. Outreach activities can take several forms, such as school presentations, workshops, public talks and lab visits etc. Outreach activities include visiting schools, giving talks at assemblies, discussions with students or participation in events such as career fairs and science and technology camps. Inviting groups of school students to our campus for lab visits and workshops. The main purpose is to help achieve a goal for the greater good. This is by choosing a specific group, analyzing their needs on certain issues, and therefore building a program to aid them in learning, recovering, or becoming self-sufficient.

**Internationalization of Education and Research: Influence of Population**

Internalization is defined as "the integration of international / inter-cultural dimensions to higher education purpose, functions, and or delivery. it involves a process of interchange of higher education between nations, between national systems of higher education, and between institutions of higher education. Internationalization of higher education in theory is " the process of integrating an international, intercultural or global dimensional into the purpose, functions or delivery of post-delivery education". Internationalization of higher education in practice is "the process of commercializing research and postsecondary. National Education Policy (NEP) 2020 stipulates various measures, which include facilitating research/teaching collaborations and faculty/student exchange with high-quality foreign higher educational institutions (HEI) and signing of relevant mutually beneficial MOUs with foreign countries.

In psychology and sociology, internalization involves the integration of attitudes, values, standards, and the opinions of others into once own identity or sense of self. People with internalizing behaviors have difficulty coping with negative emotions or stressful situations, so they direct their feelings inside. The two types of internalization are introjection, which entails taking in a value or regulatory process but not accepting it as one's own, and integration, through which the regulation is assimilated with one's core sense of self.

The term internalization is used in various disciplines, such as the social sciences, the humanities, and even biology and economics, to designate the process of transformation (reflection, transition) of external events, processes, and appearances into internal ones. The major strand of research on internationalization focuses on institutional strategies in support of internationalization, which themselves appear to have been developed principally in response to student-related concerns, including the growth of mass student mobility across borders (Ward, 2008) and new forms.

Overpopulation can have several negative impacts on the education of students, including, overcrowded classrooms. With an increasing population, schools may not have enough space to accommodate all students. The relationship between higher education institutions (HEIs) and local population and employment growth have been examined in New Zealand between 1986 and 2013. The results suggest a lagged growth plus a large set of other controls; and by including official demographic projections to account for growth-related factors, including university student numbers, which were projected by official statisticians but are otherwise unobservable to the econometrician.

Higher Education Institutions (HEIs), such as universities and polytechnics, affect economic outcomes in their hosting areas. This observation is very important for national policy makers considering strategies for promoting local development, and for local policy makers wishing to attract people and jobs to their local area. We provide new insights on this question by estimating the relationship between HEIs and local population and employment growth, using a sample of fifty-seven New Zealand territorial local authorities (TLAs) between 1986 and 2013.1 We pay particular attention to controlling for past and projected factors associated with local growth trajectories. We find, ceteris paribus, that TLAs with a higher ratio of university equivalent full-time students (EFTS) to working-age population experience faster population and employment growth. Consistent with a number of urban studies internationally, we estimate city growth using demographic rather than monetary variables, reflecting the idea that a well-performing area is one that is consistently able to attract and retain population and workers.

This relationship was rested by many authors in the literature using various specifications, including alternative samples, HEI variable definitions, and various estimation techniques including ordinary least squares (OLS), weighted least squares (WLS), and difference generalized method of moments (GMM). Within these specifications, we control for local time-invariant factors, national and local time-variant factors, and lagged growth, with the latter included to control for the possibility of reverse causality (i.e., growth leading to increased HEI activities).

**Policy Trajectory Analysis of Education and Research Relationships**

Education serves as a catalyst for personal, societal, and global development. A trajectory describes the course of a measured variable over age or time. Investigators in epidemiology and other fields are often interested not only in the trajectory of variables over time, but also in how covariates may affect their shape. Policy Learning Trajectories have three parts – a learning goal, a developmental path along which children develop to reach that goal. , and a set of activities matched to each of the levels of thinking in that path. Together, these help children develop to higher levels of mathematical thinking.

The Angle of Trajectory refers to the angle at which an object has been launched with respect to a horizontal plane. This angle allows for the calculation of determinations of a launched object, including the maximum height it attains in flight, the total distance it travels, and the total time of flight. A life trajectory is, first, the space-time path of a life, that is, the path through space and time that it traces as it proceeds. In this context, space means three-dimensional space, and the specific spaces involved are material ones, that is, occupied or defined by collections of material objects.

Trajectory is basically the path of the moving object, which the object follows when under some given forces. By calculating the effect of gravity and other forces, the trajectory of an object launched into space at a known speed can be computed precisely. It is a common term used in physics and engineering, but it also means 'a curve or to hurdle across' if used in a non- scientific manner. For example: the trajectory of a whole life may be set in a person's youth, or that a new book traces the long trajectory of the medieval period. In conclusion, integrated learning emerges as a valuable approach to education, providing students with numerous benefits. By combining multiple subjects, students not only deepen their understanding but also develop transferable skills, enhance motivation, and become better prepared for the real world.

So, education brings people closer to each other, helps them to understand each other better. To conclude, education has played a major role in modern life to all individuals in society, because it provides us with knowledge for the future, it paves the way for a good career, and it leads to enlightenment. The Education system in India faces many challenges, including unequal access to education, outdated curricula, and inadequate funding. Modern education is known to be the best transformation of the education system. It intentionally inclines towards bringing out the best potential of the students. This helps them do better in the future and handle challenges more sensibly. Thus, the importance of education in society cannot be overstated. It empowers individuals, drives economic growth, promotes social cohesion, improves health outcomes, and fosters knowledge and innovation.

## Concluding Remarks

The relationship between research and education has been a subject for debate in higher education research, with ambiguous and sometime contradictory empirical results. Some of the key arguments in existing studies by examining various types of linkages between education and research are presented in this Article. Education brings people closer to each other, helps them to understand each other better. To conclude, education has played a major role in modern life to all individuals in society, because it provides us with knowledge for the future, it paves the way for a good career, and it leads to enlightenment. Education brings maturity and teaches us to live in a society with a changing environment. The education system in India faces many challenges, including unequal access to education and outdated curricula and inadequate funding. In recent times, technology is emerging as a powerful catalyst for change. As we look ahead to the next 5 years, it is clear that technology will play a pivotal role in shaping the India education system. From modern classrooms to personalized learning, the impact of technology will reshape the education in India and aligns with the vision of NEP. Thus, integration of technology with NEP creates a learner-centric environment that promotes critical thinking, creativity, and problem-solving skills.

From the above discussion, it may be concluded that Research plays a crucial role in healthcare, education, technology, and social policy, among other fields. The research can be classified into seven types, they are (i) Empirical. Research, Logical. Research, (iii) Cyclical. Research, (iv) Analytical, (v) Critical, (vi) Methodical, and (vii) Replicability. Without research, we would not be able to make the significant advancements that have improved our lives and contributed to the betterment of society. Educational research studies can help improve education for all students by providing information about the diverse ways that people learn and process information. It helps improve teaching and learning methods: Educational research helps to evaluate existing teaching methods and find new ways of teaching and learning. Research may involve a variety of methods and various aspects of education including student learning, interaction, teaching methods, teacher training, and classroom dynamics. Educational researchers also seek answers to questions bothering learner motivation, development, and classroom management. Research may be conducted to (i) fill gaps in knowledge, (ii) evaluate if the methodologies employed in prior studies can be adapted to solve other problems, and (iii) determine if a similar study could be conducted in a different subject area or applied to different study sample.

The way forward to better understand and improve the affinity between Education and Research depends mainly on the effective outcome of 'The World Government Summits', which provides (i) a global platform dedicated to shaping the future of governments worldwide, (ii) next generation of governments with a focus on how they can harness innovation and technology to solve universal challenges facing humanity, (iii) information on the intersection of government, futurism, technology, and innovation, (iv) a leadership platform and networking hub for policymakers, experts and pioneers in human development, (v) a gateway to the future as it functions as the stage for analysis of future trends, concerns, and opportunities facing humanity, and (vi) an arena to showcase innovations, best practice, and smart solutions to inspire creativity to tackle the future challenges.

The four strategic priorities for governments to consider, that will help them respond effectively to make an impact on their human capital challenges could be (i) Identify and prioritize the skills gaps to close based on national priorities, (ii) Plan to manage a fragmented and fast changing educational delivery landscape as a result of evolving skills and emerging educational technology solutions, (iii) Regulate with agility based on sectoral needs, and apply the right level of governance, at the right level of delivery, and (iv) Design and manage a responsive and fit for purpose national qualifications framework that is aligned with a country's demographic profile. Moreover, the Skills Development Systems (SDS) that identify all the essential functions in education and training governance, also needs to be improved to meet these requirements.

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# 24
# ASSIMILATING CLIMATE CHANGE SCIENCE IN THE EDUCATIONAL SYSTEM

**Dr. Sushil Kumar Dash**

*This comprehensive text discusses the importance of climate education and its impact on society, focusing on formal, informal, and non-formal methods of education. It explores the need for climate education in light of advancing scientific knowledge and the escalating climate crisis. The text highlights the current inadequacies in climate education and offers suggestions for enlarging its scope through formal and non-formal channels. It emphasizes the role of teachers in disseminating climate-related knowledge and proposes strategies for enhancing climate literacy among students through participatory programs and short-term courses. Additionally, it underscores the significance of region-specific initiatives, disaster preparedness, and general awareness programs in addressing climate-related challenges. Overall, the text advocates for collaborative efforts to integrate climate education into mainstream education systems and empower individuals and communities to mitigate the impacts of climate change.*

***Keywords:*** *Climate change, Disaster Management, Literacy, Education, Greenhouse Gases*

## Introduction

Today, the issue of climate change is the most talked about topic in our day-to-day life. Every day in newspapers and TV channels, one comes across news items on any one or multiple issues such as the rise in earth's mean surface temperature, heat waves, cold waves, heavy rainfall, forest fire, sea level rise, snow/glacier melting, strong cyclonic systems, thunderstorms, lightning, and several other abnormal weather events which result in loss of life and property across the world (IPCC, 2021, 2022). Not only people read about these unusual weather events, but also, they experience the rise in temperature, the heat stress, their houses being flooded, roof tops being blown away and similar other devastations which affect their normal life to a large extent. These extreme weather events are often attributed to climate change arising out of manmade (anthropogenic) activities. Further, Urban Heat Island effects are felt increasingly all over the world along with the deadly problem of air pollution. It is said that 'change' is the constant. In every sphere, changes are inevitable. Hence climate change should have been accepted as a natural phenomenon. The cause of worry is not the changes occurring in the natural process, but those happening due to manmade activities. All the above weather and climate related issues are creating challenges for the survival of mankind in terms of loss of life and property.

It is observed that emissions of Greenhouse Gases (GHGs) such as Carbon Dioxide, Methane, Nitrous Oxide and CFCs have been increasing rapidly during the last hundred years or so and the mean surface air temperature has also been rising simultaneously. The final Synthesis Report of IPCC was released on 20 March 2023 under the United Nations Framework Convention on Climate Change. As per this report, human induced global warming of $1.1^{0}C$ has brought about changes to the Earth's climate that are unprecedented in recent human history (https://www.wri.org/insights/2023-ipcc-ar6-synthesis-report-climate-change-findings). Scientifically, the GHGs have the property of trapping the secondary radiation emitted from the surface of the earth and hence the increase in temperature of the atmosphere. Thus, global warming due to the use of fossil fuels and hence the emission of GHGs cannot be denied. Arresting the temperature rise is the major issue and that can be done only by reducing the emission of GHGs into the atmosphere due to manmade activities. It is commonly believed that growth of a country depends on its degree of industrialization which eventually is connected to the increasing use of fossil fuels and hence enhanced emissions of important GHGs. Since the economy of a nation is linked to its growth, climate change is a matter of geo-politics. Although the cause of climate change is the current type of human activities across the globe, its impact is local. People at the block and village levels bear the brunt which arises due to global human activities.

Weather and Climate science is interdisciplinary in nature which includes almost all-important branches of science such as Physics, Mathematics, Chemistry, Bi-sciences, Geo-sciences, Computer science and Engineering. In addition, rising temperature, extreme weather events, sea level rise, glacier and melting of glaciers and snow affect the socioeconomic conditions of the people. It is well known that climate changes have far more consequences in the fields of agriculture, human health, transport, tourism, availability of water, energy consumption etc. We are facing the climate emergency which needs to be tackled by all sections of the society in their own ways. Responsibility lies with everybody.

Sharing of knowledge and 'education for all' help in problem solving with a scientific approach. Awareness eases the use of science and technology for the societal good. This article discusses the need for education for all sections of the society in the emerging field of climate change science so that people can appreciate the uncertainties in the forecasted weather fields and climate projections and will have greater faith on the scientific approach of problem solving.

The contents of this article will include the progress made in weather and climate science, future projections of important climatic factors, impact of climate change on education system, need of climate education at all levels and some suggestions on taking climate science to the doorsteps of all sections of the society.

**Progress in Weather and Climate Science**

The climate science has shown its growth through the years due to the development of sophisticated earth observing systems, improved understanding of the physical processes, progress made in numerical weather forecasting and climate prediction models and finally due to the emergence of the state-of-the-art computing systems. From the societal perspective, climate science should be used to give the future states of the atmosphere and ocean at all time scales into the future so that we will be weather-ready and climate-smart which was the theme of the World Meteorological Day on 23 March 2018. Today, weather forecasting and climate predictions are primarily made using numerical models which depends on more dense and accurate initial weather parameters, improved understanding of the physical parameterization schemes and High Performance Computing.

The conventional weather instruments include Thermometer for measuring temperature, Barometer for measuring atmospheric pressure, Hygrometer for measuring humidity, Anemometer for measuring wind speed and Wind vane for measuring wind direction. These weather parameters in addition to some other weather conditions and surface features are needed as input data to any forecasting model. Through years, a whole range of weather instruments have been developed (WMO, 2018) to measure weather conditions at any time across the globe which include Pyranometer, Rain gauge, Doppler Radar, Radiosonde, Balloon, Satellite, Buoys, Wind profiler, Snow gauges, Lighting detector etc. These measuring instruments provide the 3-dimensional profile of the initial conditions of the atmosphere-ocean system for any mathematical model to solve a set of couple nonlinear equations which is mathematically an initial and boundary value problem. The nonlinear equations are simplified by various numerical techniques and the physical processes in the atmosphere such as evaporation, convection, radiation, planetary boundary processes etc are parameterized to the physical resolution of the model. There are inaccuracies in the measurements of the weather conditions and there are approximations made while numerically simplifying the equations and the physical parameterizations. While models are integrated into the future time, the errors at the initial stage grow and generate the uncertainties in the forecasts. The job of the scientists in the last century or more have been to understand various physical processes and develop new methods to reduce the errors in forecasts as best as possible and enhance the skill of the models. There has been tremendous success in this regard.

**Progress in Atmospheric Sciences**

The last hundred years of progress in forecasting (Benjamin, 2019) can be divided into four eras. The first 20yrs since 1919 was the era of empiricism where mostly the surface observations were used in weather forecasts essentially with the efforts of governmental operational agencies. In the next 15-16yrs, upper air measurements were made and 3-dimensional baroclinic structures were understood along with the emergence of sectors other than the government such as military, university and even private. After 1958, Numerical Weather Prediction (NWP) and weather satellite products began to be used in some way and the importance of mesoscale convective system dynamics and latent heating was realized. In 1959, Joseph Smagorinsky and his group at Princeton developed a nine-level primitive-equation General Circulation Model (GCM). The National Centre of Atmospheric Research (NCAR) was established in 1960 to provide University community with world-class facilities for research.

The European Centre for Medium Range Weather Forecast (ECMWF) supported by 35 European countries was created in 1975 to conduct research and disseminate numerical weather forecasts to member states. During this time, international meteorological community grew (such as GARP and WMO) for observations and forecasting. In the next phase, after 1985 the dependence on NWP enhanced and in parallel more and more satellite and Doppler Radar data were used in forecasting. There was increased understanding of small scale processes and cloud parameterization. Private sector entered in more effective way and there has been a sign of cooperation between Public, Private and Academic (PPA) organizations in the emergence of Global Weather Enterprise (GWE). The purpose is to apply numerical environmental and weather prediction in the larger forecasting community. Its success depends on the success in PPA mode of collaboration (Thorpe and Rogers, 2018). In June 2019, WMO has launched the Open Consultative Platform (OCP), for the Next Generation of Weather and Climate Intelligence, embracing a community-wide approach with participation of stakeholders from the public and private sectors, as well as academia and civil society.

It is hoped that in future, there will be integrated, cost-effective observations network which can lead to seamless weather/climate forecasting with the use of Numerical Earth-system and Weather-to-climate Prediction (NEWP). There will be increased understanding of local weather phenomena including multi-scale atmosphere-ocean interactions, moist and dry air interactions, and interaction between aerosol and cloud microphysics. In future NEWP will hopefully depend on mobile phone networks, internet, and social media. Further, AI tools and data mining will provide specific and actionable services to different public users for socioeconomic benefits.

**Climate Projections**

It is well known that climate change is a global problem and scientifically more than necessary GHGs emissions due to manmade activities is the major cause for global warming. The best solution is reduction of GHGs emission which is known as mitigation. However, this action is linked to industrialization and hence connected to economic growth. Hence solution of global warming is a matter of geopolitics and international treaties and understanding. While such actions are being framed and executed through holding of Conference Of Parties (COPs), the other choice is adaptation to various situations faced due to climate change events taking help of scientific approaches. Invention of more sources of renewable and green energy and their increasing use can make us less dependent on coal and hydrocarbons and hence less emissions. Geo-engineering techniques such as carbon dioxide removal (CDR) and the solar radiation management (SRM) are also being attempted. The other important challenge is to make ourselves resilient to extreme weather events and future changes in temperature, wind, rainfall etc. Essentially, we should be ready to face weather and climate related disasters. Thus, we need as accurate prediction of climatic parameters as possible and improved early warning systems. The pertinent issue is close to accurate prediction which can be best done by improvements in mathematical models.

The atmosphere lies between the space above and the land-vegetation and ocean below. In addition, this earth-atmosphere system undergoes through continuous physical, chemical, and biological processes. Realising these aspects, scientists have been working to model the earth-atmosphere system models based on well-known coupled and nonlinear mathematical equations. When one looks back, it notices that during the period 1960 to 1980, simple mathematical models were developed for the atmosphere alone. In the next decade, coupled atmosphere-ocean models came up. After 1990, more complex Earth System Models (ESMs) have been developed which incorporates more physical, chemical, and biological processes happening in the actual earth system. At each stage of model developments, improvements in model simulated climatic fields have been examined. The continuous efforts of the climate modelers in simulating future climatic conditions under different GHGs emission scenarios under the umbrella of IPCC are worth noting here.

Under IPCC, international coordinated model inter-comparison experiments have been conducted (so far five in number) which are known as Coupled Model Inter-comparison Project (CMIPs). The very first one CMIP1 began 1996 onwards and originally consisted of only one simple experiment, whereas CMIP2 (1997) included two experiments in which CO2 levels were theoretically increased by 1%. CMIP3 (2005-2006) was much broader whereas there was no CMIP4. The CMIP5 (2010-2011) has been very popular in which 110 experiments were conducted with the participation of 24 international centres and 45 distinct models. This culminated in AR5 which has projected the future climate of different regions in somewhat detail manner. These data have been extensively used in scientific research and projection of regional climate and policy formulation. CMIP6 is the most recent in this series which has given rise to the sixth Assessment Report (AR6). As per this report, extreme heat will be more frequent and intense, droughts will increase in some regions, heavy rain will be more frequent and intense, wildfires will be more frequent and oceans will become more warming, acidifying, and losing oxygen.

One of the most significant developments in the modelling era has been the development of Regional Climate Models (RCMs) whose output are very useful in application to Vulnerability, Impacts and Adaptation (VIA) studies (Giorgi, 2019). The outputs of GCMs are used to force RCMs and generate dynamically downscaled climate products at higher resolution than in GCMs. In this regard, the Coordinated Regional Downscaling Experiment (CORDEX) Phase I has served very useful purpose of readily available data sets at 50km resolutions over land areas in the world which have been used extensively by the impact and adaptation communities. The CORDEX Phase II has 14 geographical domains wherein climate projections are being available at 12km resolution.

If one analyses the present status of progress made in weather and climate science, one infers that the era of NWP has taken this emerging science to new heights. Further, people in general are appreciating some of the forecasts. This progress has been possible because of working together of scientists from operational agencies and institutes of higher learning which created close ties between research and development efforts of different organisations. Scientific breakthrough has come due to theoretical advances in predictability, fluid dynamics, and numerical methods; sub grid-scale physics parameterizations (cloud, mountain, etc.); assimilation of diverse observations from the surface and space; and high-performance computing (HPC) systems.

**Need of Climate Education**

As discussed above, the science of weather forecasting and climate prediction has come a long way. The scientific community is now in a position where we can have reasonably good idea of the type of atmospheric conditions in the future. Of course, the degree of probability of occurrence of a particular event will differ from time to time. The rate of progress in science and technology indicates that hopefully there will be more progress in near future so that we can get the climatic parameters with greater accuracy at any locality on the earth. Those values may help us in facing the challenges arising out of the climate related disasters effectively. However, for the effective use of the scientific results for the societal good, the people should be intrinsically involved. Participation of all stake holders in the problem solving is very important. Scientifically awareness of the actual problem, its cause and the methods of solution make the case easy. Simply gathering knowledge has no value unless it is shared with others. Education is the backbone of any society. Since climate emergency is knocking at our doorsteps, all sections of the population should be adequately informed about different dimensions of the real issue. It is the primary duty of the climate scientists to see that all the stake holders are adequately educated so that they can contribute to the problem solving to the best of their capabilities.

Education can be defined as a process of learning, acquiring knowledge, skill, values, and virtue. Taking a holistic view, one can say that education helps in building a better person. One can classify education into three types (https://www.cuemath.com/), formal, informal, and non-formal. The formal education is done in academic institutions and in this system, one passes one examination/degree and moves up in the ladder. Schools, colleges, Universities, and some other Institutions of Higher Education (IHE) basically impart formal education, and these are guided by government rules and regulations with specific syllabus etc. Informal education is that which is not done in formal institutions but primarily by parents, family, friends etc and through everyday experience. Non-formal education includes adult education, literacy programmes, skill development, community programmes etc. This type of education is highly flexible and can be undertaken by various NGOs, scientific societies, volunteer organizations etc on various platforms. Using this medium, one can educate much more people compared to the students in the formal education system.

When one analyses the Climate Education in particular, there are several IHE across the world including colleges and Universities where high level teaching and research are going on as a result of which progress has been made in weather forecasting and climate prediction. It should be noted here that for the purpose of our discussion, climate science includes subjects such as meteorology, atmospheric science, earth and atmospheric sciences and similar related names. Undergraduate courses in meteorology and in related subjects are available in limited number of countries. For example, in India although students can pursue their MSc, MTech and PhD degrees in some limited number of IHE and Universities, undergraduate courses are rare. Of late, climate science is being introduced at the undergraduate level in some form or the other as optional/elective.

Since climate science is interdisciplinary in nature and covers subjects like Meteorology, Physics, Chemistry, Mathematics, Environmental science, Geospatial science etc, getting admission into IHE for higher education in weather and climate related subjects not difficult. The National Meteorological and Hydrological Services (NMHSs) across the world educate and train their scientists regularly so that they can undertake the routine measurements and operational weather forecasting activities in proper manner. These courses are mostly meant for in house education and training under the standard protocol of WMO in order to maintain uniform standards across the countries. Some NMHSs collaborate with other universities and institutes and help them educating students also.
At school level, climate education is rare at the global level.

In very few countries it is taught as a separate subject. Mostly some aspects of climate are covered in the geography. Thus, in formal education system, climate education as a whole has inverse pyramid/cone structure. It is taught the least at the school level and as one moves up, it has formal syllabus degrees etc at the college and University sectors. Since climate is interdisciplinary in nature, knowledge acquired in basic and natural science subjects help the students to understand climate topics well and work in HEIs in state-of-the-art research topics. As per UNESCO (2021), nearly 47% of national curriculum frameworks of 100 countries reviewed had no reference to climate change while in rest of the schools, it was weakly referred to. Nearly 95% of teachers believed that it is important or very important to teach about the severity of climate change.

The present courses are inadequate to tackle climate (https://time.com/5953399/college-education-climate-change/). Almost 80% of the 110 students who responded to the U.K.'s Architects Climate Action Network survey felt their courses were not preparing them for future work in a world of climate breakdown. Presently, the effects of climate change have become more visible and hence climate education should become broader and include law, human health, literature, economics etc. Climate education should prepare students to face transformations in the job market. According to the Unity College, Indeed and Zip Recruiter (https://www.goingzerowaste.com/blog/environmentalist-jobs/) today some of the highest paying jobs are available for Environmental lawyers, Solar energy consultants, Environmental engineers, Hydrologists, Environmental managers, Geologists, Environmental scientists, Urban planners and Marine biologists. As per US Bureau of Labor (BLS) Statistics *(*https://www.bls.gov/ooh/life-physical-and-social-science/atmospheric-scientists-including-meteorologists.htm*)* atmospheric scientists can expect an employment growth of 4% from 2021 to 2031. It is further expected that there may be about 700 job openings for atmospheric scientists each year from 2021 to 2031 decade.

In the informal sector, climate education happens based on personal interest only. Students, teachers, and general public become aware of the climate change issues through news items, popular articles, social media, books, town hall meetings, learning from the parents, interaction amongst each other and similar such other activities. These are not structured ways of learning and their resultant effects on the depth of individual knowledge gathering might raise several questions. Nevertheless, these media are very effective and can reach large section of the society in disseminating adequate knowledge within short time, so as to make people understand the causes of human made changes and their responsibilities in arresting the adverse effects.

In the non-formal sector, climate education is mostly done by National Meteorological and Hydrological Societies (NMHSocs) through their annual activities such as special training programmes, regular and special purpose courses, workshops etc. Met societies such as American Meteorological Society (AMS) and Royal Meteorological Society (RMetS) have structured programmes for teachers and students at the school levels. Today several paid and free educational programmes, courses, webinars and lectures are available on the internet such as MetEd by the COMET Program of the University Corporation for Atmospheric Research's (UCAR's) Community Programs (UCP), the Virtual Laboratory for Training and Education in Satellite Meteorology (VLab) of WMO, GLOBE programme of NASA, UN CC: Learn, MetLink of RMetS, AMS Education Program and several others. The International Forum of Meteorological Societies (IFMS) (www.ifms.org) has been trying to build capacity by encouraging education and training programmes through NMHSocs. Such non-formal way of climate education is open to all and reaches several teachers, students and others interested in learning weather and climate. In several ways, such methods are very effective and can easily help educating the students at depth and complement the formal climate education system to a large extent. In today's world of virtual classrooms, non-formal climate education can certainly become successful when conducted by knowledgeable organisations in an organised manner

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**Impact of Climate Change on Education**

It is important to note that unusual weather events occurring on our earth due to climate change are affecting the education system in various ways. UNICEF has reported that half of the 2.2 billion children in the world are extremely at high risk due to climate change including its impact on education (https://www.unicef.org/press-releases/one-billion-children-extremely-high-risk-impacts-climate-crisis-unicef). Socio- economic burden on the parents in turn affect the children health and education to a large extent. Natural disasters disturb the daily lives of the downtrodden and thereby create a complicated societal situation which affects the education system tremendously. Such negative atmosphere also affects the teachers both physically and psychologically which ultimately deters the quality of teaching. Overall, the adverse effects of climate change create tremendous physical and psychological pressure on the parents, teachers and students which is detrimental to the whole education system.

Classrooms are usually built to make those suitable to the teachers and students under the present weather conditions at a place. With increasing temperature at most of the places, especially during summer, students feel uncomfortable to sit in the classroom or even to play outside most of the time. It is well known that heat waves affect human life and the working hours reduce during excessive hot/cold conditions. Classrooms in all schools do not have cooling/heating facilities. As per Randell and Gray (2019) in parts of the tropics, exposure to extreme temperature or rainfall in early life is associated with fewer years of schooling in later childhood. Further, higher-than-average rainfall is associated with less education in Central America and the Caribbean counties. When the children are not comfortable, the quality of education suffers. Another equally serious issue is the damage to school buildings due to high winds and weather events such as cyclones and related storm surge in the coastal areas. Floods equally damage the school buildings in the flood prone areas. School buildings which are not affected much are mostly used as shelters for the local people whose houses are usually destroyed. Schools remain closed for uncertain periods and that affects the educational calendar. The student drops our rate also increases due to related inconveniencies.

Natural disasters, especially in the rural area mostly faced by socially deprived people can seriously affect their livelihood creating difficulties in family income, food, and clean water. Such adverse situations affect the children in their early life leading to malnutrition, diarrhoea, and other health issues. This creates disadvantage situation in some regions as compared to children at other places. Thus, climate change can also enhance societal disparity. Some gender issues also arise, since girls are at more disadvantageous situation due to their increased engagement in domestic works such as collecting water from distance locations, cooking etc.

**Suggestions for Enlarging Scopes of Climate Education**

As discussed above, let us discuss here the scopes under the three methods of education.

***Formal and informal methods***

There are scopes of enraging the presently available climate education in all the three conventional sectors of the education system. While discussing the scope of climate education one should keep in mind that presently the health of the earth-atmosphere system is bad and further deteriorating day-by-day mostly because of human activities which are not sustainable. As per IPCC (2022), it is never too late and there are chances of getting out of this mess in times to come. Since climate science is interdisciplinary in nature and the changes occurring in weather and climate affect all sectors of the society, the participation of the entire population is very much essential to reduce the adverse effects. First of all, it should be noted that capacity development can best happen with spread of appropriate knowledge and adequate education. This section will dwell upon some important ideas which can help enlarging the scope of climate education and thereby involve all concerned.

Across the globe, education policies are formulated by the national governments to carry forward formal education in a systematic way. There are designated institutions/boards to formulate syllabus of what topics to be taught at what level. Mostly, it is a dynamic system with required incorporation of changes from time to time. There are various ways of modifying curriculum which vary from nation to nation. It is not easy to add climate science at different levels of education system in one attempt. Sometimes political will is required to introduce any new course depending on the necessity, demand, and importance after due consultations amongst the educationists. It is usually a slow process. Introducing a new subject especially at the school level enhances the load on the children which is not welcome. At college, university and HEIs, optional subjects can be introduced so that the students take their suitable decisions.

Scientific societies, mostly the NMHSs can take the issue up with the appropriate bodies and try to convince them on the importance of climate education and the benefits the society will gain thereby. NOGs can also influence the regulatory bodies in the higher education system including that of undergraduate degrees. Private institutions are probably the best ones to start the new courses which may be broad content wise covering different aspects of climate such as fundamentals of climate, mathematical modelling, observations, forecasts, future scenario, weather and climate disasters, renewable energy, impacts of climate change on agriculture, human health, water availability, power generation etc. In many countries across the world, such climate related courses are being successfully introduced in HEIs which eventually will enable students to appreciate the problems related to climate change and encourage them to find new ways out to counter the adverse effects of climate change.

It is true that introducing new climate related courses in formal educational institutions will take time because there are some standard procedures to follow. Nevertheless, it is possible to informally expose the students in schools and colleges through extracurricular programmes. The New Educational Policy (NEP) in India has flexibilities for award of grades through self-studies and interactive programmes. There are several ways to introduce climate topics in the formal educational institutions. However, in order to undertake those programmes, it is essential to train the teachers adequately. First of all, teachers trained properly can encourage students to take climate related topics for their self-study and hence evaluation. Secondly, while teaching the existing science topics, there are scopes for bringing into discussion several interesting weather and climate events in terms of examples. Thirdly, climate related seminars and interactions can be held in schools by inviting experts in the field. Fourthly, students can join participatory programmes of observations and thus learn about climate issues through the establishment of science/eco/weather clubs. More such methods can be thought about in order to encourage the students to know about the present climate issues. Once they are introduced to the subject informally in educational institutions, they themselves will enhance their knowledge through traditional informal ways of teaching. They will discuss amongst themselves, with their parents and relatives, try to read books and periodicals etc. This method will have multiple effects on them. Once they understand the real issues of climate change and their adverse impacts on our society, they will choose their career accordingly and in later life such informal education will help them in research, innovations, start-ups etc.

***Non-formal way of climate education***

The non-formal education can be best executed by the NMHSocs and similar associations and NGOs interested in climate issues. Members of NMHSocs include not only several existing employees of NHMSs but also scientists from academic's institutions and senior members who have long experience in the field and have potential to give popular talks, seminars, participate in hands-on training and teach designated courses to others. IFMS has been trying to build capacity (Dash et al. 2021) through educational and training programmes in climate. The following are some of the ways, which the interested organisations can approach for the success of the programmes. As discussed earlier, the scope of reaching large sections of the people via non-formal ways of education and spread of knowledge is vast compared to the formal ways of education, especially in today's world of internet, virtual meetings, and social media.

**Teachers training**

It is well known that teachers are the backbone of any society. Once a teacher is trained, it will have cascading effect and several others will be gradually trained by the teachers. It is like training the trainers. In several countries, there are very few colleges/universities/organisations where weather and climate related teaching and research have been going on. There is hardly any climate science course at the school level of several Asian and African countries. Geography is the only subject taught at schools which covers some aspects of the climate. Since, the science of weather and climate is interdisciplinary in nature and it covers all important science subjects such as physics, chemistry, mathematics and geography is schools, teachers, once exposed to the fundamentals of climate science can easily explain their students. However, well thought out specific course materials should be formulated for the teachers so that they will have good exposure to basics of weather and climate science, the observational set up, mathematical models, climate change, weather extremes, satellite observations, weather equipments, interpretation of weather forecasts, disaster management and related other issues. The duration of teachers training programme typically can be for one week since teachers are otherwise very busy in school activities. The most important aspect is periodic training to expose the trained teachers to the new aspects of climate science in the form of a series of short duration modules.

**Students participatory programmes**

Once teachers are trained, they can become the pivot for spreading the relevant climate information to the students easily. Even in the absence of formal courses of study in written examinations, students can be imparted adequate required climate education through their participation in specific climate and environment related projects in school campuses or outside. NMHSocs can extend their hands for the success of such programmes. There are several examples of such useful programmes across the world. Weather Labs can be set up in project modes where the students can learn the measurements of weather variables by their own participation in such programmes. Students can also save these time dependent parameters and then analyse those to understand their diurnal, monthly, seasonal, and annual variations due to the physical processes going on in the earth-atmosphere system.

When these data are saved for a large number of years, the relevance of climate change can be understood by the students easily. Just like in citizen science programmes, these school programmes can educate the students and simultaneously generate good quality weather data from the school premises which can be archived for their future use by the scientists. Several programmes involving teachers and students have yielded very good results. In one such programme in Africa named SANDWATCH (Cambers and Ghina, 2005) a strong field monitoring component made the whole programme interesting. Another weather related programme called Participation of Youth in Real-Time Observation to Benefit Education (PROBE) was successfully launched by the Department of Science and Technology (DST), Government of India https://dst.gov.in/inter-sectoral-science-technology-advisory-committee in the states of Uttarakhand, Tamil Nadu, National Capital Region of Delhi, Odisha and North-East to train students at school level (classes IX, X and XI) in taking meteorological observations for understanding day-to-day environment including weather. The data collected were assimilated into a weather model (Sahu et al. 2014) in order to examine the impact of additional data on weather simulation. IFMS is trying to initiate an interesting school and college level climate education programme through direct participation of teachers and students (Dash 2022) in nine countries in the Eastern Africa and Horn of Africa.

**Short term certificate courses**

As discussed earlier, climate change has impacts on several sectors of the society. The important stake holders of climate services include agriculture, human health, water availability, coastal ecosystem, forests, disaster management, NGOs, local administrators and overall the policy makers. Persons working in these sectors not necessarily have adequate knowledge and information about the basics of weather and climate science. Since climate services are going to be dominant in the days to come, the stake holders need to have reasonable training in the weather and climate science. It is the primary responsibility of Met Societies to keep the climate related stake holders well educated and informed about the present and future climates.

Every Met Society has experts and experienced scientists who can formulate short term courses of about two weeks each on specific sectors and also impart training in batches. In countries such as US and Europe, such courses exist and the society is getting benefitted. To add quality to such short term trainings, IFMS can award certificates to the participants. In due course, such training programmes will be welcomed by the people concern and some fees can also be charged from the participants. Thus, these short term certificate courses can be made self-sustained financially. In order to issue certificates at the end of such courses, the duration should be minimum for two weeks.

**Training on the use of climate data**

Today, weather and climate data are available from several sources freely online. These data are from the observed as well as model sources. Several weather and climate scientists are using such data in their R&D and publishing important results. Scientists in the impact sciences such as agriculture, human health, water availability and environmental sciences are eager to use climate data in order to examine the present and future relationships of important parameters in their sectors with the climate. However, many impact scientists are not well informed about the availability and use of climate data. Moreover, these climate data are archived on web sites in specific formats. In several platforms while discussing climate impact studies, it has been felt that there should be special training programmes organised for the scientists of non-climate science.

One week training programme in several countries will definitely help the scientists from no-climate background in using the relevant climate data in their R&D.

**Region specific programmes and thematic workshops**

World has several types of climates. In some large countries such as India, there are even six types of climates. Summer monsoon along with its cyclonic disturbances are dominant in the south of India while western disturbances are prevalent in the north. Every country has its own climate calamity peculiar to that region. Heat waves, Cold waves, Cloud bursts, Flash floods, Urban flooding, Landslides, Forest fires, Coastal inundation, Tropical cyclones, Typhoon, Tornadoes, sea level rise and several other weather phenomena are region specific and hence need focus in that region. Education and Training on these aspects when conducted in the concerned regions will be very effective and beneficial to the people. The education and training will be more effective when people relate their day-today experience with weather to the teaching materials. Therefore, there should be emphasis on the regional weather and climate and hence the same teaching material cannot be used in all parts of the world.

**Coping with disasters**

Disasters disturb the lives of the general mass brining about irreparable loss of life and property. These deserve special attention in the educational programme related to climate change. According to the WMO Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970 – 2019), there were more than 11 000 reported disasters attributed to these hazards globally, with just over 2 million deaths and US$ 3.64 trillion in losses. It is reported that the number of disasters has increased by a factor of five over the past 50 years. It is further estimated that improved early warnings and disaster management methods have helped reducing the number of deaths almost three-fold. It has been experienced that on several occasions people are unable to appreciate the seriousness of early warnings and in due course face dire consequences. Such unfortunate situations occur mostly during weather related disasters such as cyclone warnings, urban flooding, landslides, heat waves, thunderstorms, and lightning. Once the people become knowledgeable about these disasters and interpret the early warnings properly, they can save their lives and also help others doing so. Once people realize the consequences of other climate related disasters such as glacier melting, sea level rise, change in land use pattern etc, they may behave climate conscious and act in their daily life accordingly. Urban heat island effect, increase in air pollutants and their ill effect on the human health are other issues for the people to be educated about.

## General awareness programmes

Considering the complexity of the climate change, its origin, uncertainties, and tremendous adverse impacts on the society, it is of paramount importance that various facets of climate science and climate change reach the people of all sectors in the society. IFMS, Regional Met Societies and NMHSocs have a very responsible role to take science to the society by organising various types of events. There are several ways. Awareness about the extreme weather events and related safety issues can be explained to the people in batches. Human contribution to climate change can be explained to the people in simple local languages by organising town hall seminars and also in schools and colleges. World over, International Days are observed on important topics and issues. Mostly, the meteorological community is involved with World Meteorological Day, World Environmental Day, Ozone Day, Water Day, and Oceans Day. Several Met Societies across the world are observing these days to a limited extent. When specific funds are available to the Met Societies, they can involve more people and celebrate these important days by arranging invited talks that will educate the people. There can also be interactive sessions and specific field visits on these days. Such programmes will be mostly for very short durations, may be for a day or two.

## Concluding Remarks

Actions on climate change are being taken at all levels such as by international organisations, national governments, regional associations, and local governing bodies. Even an individual can help reducing global warming by changing his own style of living. Agreements at the international level are always difficult. Nevertheless, several successful international agreements have yielded good results. At national level, India as a country has been very active in taking positive steps concerning climate actions. All sections of the society have also their roles to play. Waiting for the national governments for every action may not help us to the extent we want.

Any step in the direction of saving our planet from climate crisis is well come, however small it may be. We should play our own part in this climate emergency facing the earth. All of us should be innovative in our contribution to the noble cause of arresting the global change. There are several ways of reducing our carbon foot prints as an individual. Optimizing the energy consumption and reducing the exploitation of natural resources are the least we can do.

Education and training help gathering knowledge and skill and thereby open the door for scientific approach of problem solving. Looking at the climate emergency faced by the society at large and the current education system, it seems that adequate education is not imparted in all the three sectors of education such as formal, informal, and non-formal. Children across the world are getting increasingly aware of the adverse effects of climate and are becoming ambassadors of campaigns to save the earth. It is true that students have very important roles to play in the society since they are the future of the country they belong to. It is the collective responsibility of all to see that the current disastrous climate situation is put before all strata in the society so that students, teachers, stake holders, administrators, policy makers, businessmen, administrators, academicians, scientists, impact scientists, politicians and citizens at large are involved in this education and learning process. Ultimately, it will be PPA mode of working together so as to integrate climate education in the day-to-day life. In this endeavour, one and all have responsibility and contribute to encounter the climate crisis. Citizen science will help to a great deal in marching forward. Maximum use of green energy, less consumption and sustainable lifestyle are keys to the survival of the healthy earth system.

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# 25
# GLOBAL HIGHER EDUCATION IN THE INDIAN CONTEXT

**Prof. Debabrata Banerjee and Prof. Raj K Tiwari**

*This article explores the concept of global education, its historical roots, and its evolution into the contemporary world. It examines the motivations and challenges faced by Indian students pursuing higher education abroad and highlights the strategies employed by foreign institutions to attract international students. Furthermore, the article discusses the potential for India to become a global higher education hub by improving infrastructure, safety, and academic practices to attract foreign students. The overall narrative underscores the need for Indian institutions to adopt a more proactive and competitive stance in the global education marketplace.*

**Keywords:** International Students, Historical Educational Exchanges, Ancient Universities, Study Abroad, Educational Mobility, Indian Higher Education, Knowledge Exchange, Multinational Employment, Cultural Adaptation, Global Higher Education Market, Economic Impact of International Students

## Introduction

### Global Education in the broader context

The concept of Global Education is not new. For centuries scholars have traveled long distances to both acquire and disseminate knowledge according to their particular area of interest or expertise. Historical documents are rife with examples of such scholars including Ibn Batuta, Marco Polo, Fa Hsien to name a few. A purview of ancient literature reveals that ancient universities, monasteries and religious institutions were also centers of learning and encouraged visiting scholars to spend time at these institutions to both teach and learn. Examples include Nalanda and Taxila Universities, several Buddhist monasteries all over Southeast Asia and several old Christian and Arab centers of learning and research (1-4). In the modern world, this tradition continues albeit with new variations. Scholars, students and others travel in great numbers to acquire and disseminate knowledge. This is greatly facilitated by increased access to air travel and the

World Wide Web. In the modern context, global education involves three main parts: a host institution in a foreign country, an area of mutual interest to the institution and the traveling student or scholar, and most mportantly the student or scholar. These three parts often come together as a result of information available to the parties by word of mouth, by means of educational fairs and via the internet.

Students who travel abroad do so with the goal of completing a degree in a subject that they feel will enhance their understanding and help them advance their career goals. Scholars traveling abroad do so to get involved in exchange of ideas and findings with collaborative colleagues and institutions in a mutually enriching atmosphere. In these instances, knowledge rises above the didactic and reaches a level of discourse supported by a divergent group of personalities, ideas and opinions that shape the course of the particular topic of interest. Knowledge in the purest sense is dynamic and ever evolving. While this is a rather lofty picture of global higher education, reality is often less rosy and more challenging. Issues of travel restrictions, time limits, financial burden of studying abroad, ever changing political landscape affecting foreign students and scholars as well as exclusion of foreign scholars and students from accessing sensitive applied technologies limits the scope and purpose of global education and free exchange of knowledge. Nonetheless, the lure of foreign exposure or degree is still a great motivator for scholars and students who travel great distances to achieve these goals. Primary and secondary education is still mostly local and regional while higher education, beyond the secondary level, is more suited to globalization. Despite several challenges, Indian students routinely travel abroad for higher education. This number of 1.2 million is likely to increase to 1.6 to 1.7 million students in 2025 as per projections.

**Indian students and higher education abroad**

Indian students who look for opportunities abroad are really trying to test themselves in a completely different environment, away from the comforts of home, away from family and in a situation where they have to manage not only their education but also their daily lives. Most of the students are careful enough to choose reasonably good schools and of course try to maximize the benefits in terms of scholarships or work on campus opportunities to defray costs. Despite careful scrutiny of schools and opportunities there are several instances of students from India falling prey to unscrupulous agents or brokers who take money to arrange admissions in non- accredited schools and are then left stranded when they try to renew their visas or temporary work permits.

The benefits of higher education abroad for Indian students are plenty. Firstly, they grow up to become independent and acquire life skills that they would not have if they had remained local students, in their familiar surroundings and familiar routines. Secondly, they get opportunities for higher studies including doctoral work based on their college degree and their familiarity with the graduate school admissions process. If they are completing their graduate studies abroad, then a post-doctoral fellowship of an industry job is much easier for them find. Moreover, it also makes them eligible for opportunities in Europe particularly in the pharmaceutical industry or research centers. Their knowledge of English as used abroad and their communication skills make them highly employable in comparison to students who have obtained all their education and training back home. There are always exceptions but the majority of students who go abroad for higher education generally benefit in the long term whether they look for faculty positions in Universities abroad or back home, research positions in institutes or start a biotech or consulting business on their own. Some have even prospered in financial institutions as analysts based on their knowledge of biotechnology, biomedical applications and biomedical engineering expertise.

Many Indian Institutions of higher education are among the best in the world, even though they may not all rank among the highest due to lack of certain parameters that are weighted heavily for the global rankings. Nonetheless, these institutions, as far as delivering a world class education is concerned, are not behind other institutions. They may lack great boarding facilities (although some of them have good hostel facilities), or gorgeous campuses, or affordable off campus housing, or in campus bus services but more than make up for it in didactic and practical training. When meritorious Indian students leave for higher education abroad, these fine institutions are deprived of some of the best and brightest our country offers up. One may argue that our higher education system gets plenty of really brilliant students based on extremely competitive entrance examinations; one still wonders whether these institutions would have benefited even more had these students opted to pursue higher studies in India. The dismissive argument has always been that these students could not face the rigor of the higher education system in India and therefore opted for an easier path.

Given the pool size of really brilliant students in India, it is hard to believe that the loss of good students to foreign institutions is likely to make an impact on the quality of admitted students in Indian Institutions. The quality of Indian physicians, administrative service officers and technical personnel such as engineers are probably the best in the world as far as knowledge base is concerned. These graduates go through some of the toughest screening in the world and still manage to come out on top, a testament to their brilliance. However, it is coming to light that these students are vastly underprepared for life. They appear to be one dimensional ie they know their subject very well but are not prepared in overall life skills. This is becoming apparent in interviews for lucrative positions with multinational companies that are looking to recruit bright young candidates in India. Comments such as “brilliant but lacks empathy” and “brilliant but cannot work in a team" are commonly heard. A prevalent tendency among students and institutions is one of regional preferences. Students prefer to study locally and institutes prefer to recruit faculty locally. While there are obvious advantages to this approach, there is a serious drawback, that of parochialism. As we all know, nature flourishes due to cross-pollination. This is also applicable for higher education anywhere and when practised, results in an amazing improvement in overall quality of higher education.

**How foreign institutions have positioned themselves to attract foreign students**

If we look at the distribution of the 1.3 million Indian students going overseas to pursue higher studies, a vast majority go to the US, Britain, Canada, Australia, the Middle Eastern countries including the UAE and Oman. One common factor among these countries is that the language of instruction is English with which all Indian students are very familiar. This, however, is not the whole story. The Governments, especially the Ministries or Department of Education, as well and their Colleges and Universities have worked together to attract foreign students to their shores (5-9). Most Colleges and Universities in these foreign countries have dedicated units that work constantly to reach out to prospective students and provide them information regarding the advantages of studying abroad and particularly at their institution. Staff from these offices, often called Global Education Offices or International Offices, regularly attend international education fairs and meet prospective students. They visit schools, Colleges and Universities in the target countries and maintain a reasonable presence in these countries either through the respective embassies or consulates or via offices on campuses of colleges and universities with whom they have an agreement to situate such a presence. The Colleges and Universities devote manpower and resources to make these offices serve as their ambassadors in the greater global education space.

Apart from going on recruitment drives these offices are also the main point of contact for all International students on their campuses. They serve to receive the foreign students (sometimes even arranging for pick up at the nearest airports), arrange for their accommodation, conduct orientation week to introduce all the facilities available to students, arrange for work permits to allow foreign students to work on campus to defray some of their living expenses, and arrange for social gatherings to keep the foreign students in good cheer at least during the first few months after arrival. When institutions close for spring break, thanksgiving break and winter holidays, foreign students usually return home to their loved ones. However this may not always be possible for foreign students and in this case the International office arranges for local families to host these students. This helps them to stay near the college or university campus while helping to introduce the foreign students to off campus life with the host families. These relationships, in most cases, last long after the foreign student graduates and leaves the institution. The International Offices also make sure to arrange for foreign students to visit nearby cities and towns and places of interest so that foreign students can also get exposed to the culture and sights and sounds of the new country. The international office will also arrange for tickets to sporting events, whether on or off campus so that foreign students can enjoy local sporting events. Colleges and Universities compete for foreign students by offering partial scholarships, greater opportunity for internships and possibly employment in areas of training that students have undergone in the host country. There were 1,057,188 foreign students studying in the US in the 2022 2023 academic year. This is an increase from 948,519 students in the previous academic year. India contributed about 268,923 students last year just behind China with 289,526 students.

The UK, Canada and Australia together attracted another 1.8 million foreign students in the past academic year. Why do Colleges and Universities go to all this length to attract foreign students? One big motivation is the economic impact of having foreign students. In the US alone, the foreign student economic impact was to the tune of 33 to 40 billion USD. The international students contribute not only through the tuition they pay, but they also spend money on transport, food, lodging and consumables during their tenure in the USA (8-12). The National Association of Foreign Student Advisors (NAFSA) organizes annual meetings in the USA and it is the most heavily attended international higher education meeting with 10,000 delegates of which about 4000 are foreign delegates. This is where US Colleges and Universities set up collaborations with foreign universities that are looking for partnerships in student exchange, research collaborations and student placement including recruitment.

These initial dialogs are then followed up with reciprocal visits to campuses and recruitment activities. Very few Indian Colleges and Universities attend such international education meetings. Last year, India hosted about 47,000 international students and mostly targets Asian and African students (data is publicly available from Ministry of Education, Govt of India https://www.mea.gov.in/Images/CPV/lu3820-1-mar-25-22.pdf). The plan is to expand this number to 200, 000 in the next five years. This will require a change in recruitment methods and improvement of infrastructure at Colleges and Universities in India. Investment in Global or International offices at the se Colleges and Universities and support from the ministry will be necessary to achieve this ambitious goal.

**India as a destination for Global Higher Education**

Quality of Indian institutions of higher education are acknowledged in India but has not been tested in an open market system. Meaning institutions of higher education in India seldom recruit students from abroad other than accepting inter government mediated exchange students from countries with strong cultural and political ties to India. On the other hand, foreign institutions hold educational fairs and actively recruit bright student from India even offering generous scholarships as enticement. One can argue that Indian institutions do not need foreign students as they get enough locally. But therein lies the problem, they are mostly local students who come to learn. Local students seldom question and almost never argue with their teachers, are very obedient and never contribute to an active discourse which is the very tenet of higher education. Indian institutions will be well advised to reach out and see how prospective students evaluate them and express their interest in coming to India for higher education.

In order for them to compete with global institutions of higher education there needs to be a concerted effort on behalf of the government, the local city authorities and the senior administration of the Central University authorities to ensure that the process is not unnecessarily burdensome. Foreign students, especially female students, should be assured that it will be safe for them to spend three to four years at Indian Universities and colleges. Indian universities and colleges will also have to come up with a fee structure that is attractive to foreign students so that they feel they are getting their money's worth. While this may not of prime importance, competitive fees will help attract a lot of foreign students. Fees paid by foreign students will bring in a lot of revenue for the colleges and universities and may in turn encourage them to make necessary infrastructural improvements to remain competitive internationally.

This entire process will take years to streamline but a few colleges and Universities can take the lead and guide other good colleges and Universities to join. The time has come for Indian Universities and Colleges as well other institutions of higher education to announce to the global community that they ready to compete with the best for foreign students. Universities and colleges that feel confident they can attract foreign students should organize themselves and share resources when they travel abroad to attend student fairs and educational events. For instance, they can choose to attend four fairs but send a limited number of representatives who can present on behalf of the colleges and universities in the pack. This way they can rent a single booth and represent a bunch of colleges and universities under a common banner.

Likewise they can jointly host foreign delegations from Colleges and Universities who are looking to place their graduates in the next level of higher education or looking for study abroad opportunities in Indian Colleges and Universities for their students. Locally they can develop a relationship with the education attachés at various foreign consulates in India and exchange information regarding opportunities. Such a proactive approach will enhance the global image of Indian Colleges and Universities and will bring name recognition to international students. India will once again become an education hub for the world. One can dig into history and find instances where priests from one part of India were delegated to perform rituals at temples in another part of the country. This was done with the idea that even though languages and cultures were vastly different, priests could officiate in Sanskrit and become integrated with the people and the culture in the new location. This kind of cross country arrangement between Universities and Colleges from different parts of the country coming together as a consortium and presenting a diversity that is unique to the Indian context. Arrangements can also be such that foreign students opting to study in one of Colleges or Universities within the consortium can take courses at the other Colleges or Universities. These administrative arrangements within consortia will attract many foreign students to Indian Universities and Colleges. Another important consideration for such arrangements will be to address the issue of meals available in cafeterias. Foreign students may not be used to strict regional fares available at cafeterias and may want a more continental variety. On the host side, there is considerable room for additional course work inside the class rooms. Besides teaching to complete syllabi for exams, teachers could incorporate critical thinking, in class presentations including team presentations to prepare students for life rather than just for board and entrance exams. This may require slight modification of course work and will need motivated teachers to conduct these courses.

Training of teacher, as well as recruitment and retention needs to be looked at from all the angles but most importantly from the angle that would be of greatest benefit for the students. In this regard, while the Indian colleges and universities do an outstanding job in preparing students for board and entrance exams, they can do better. One good option is to collaborate with outstanding foreign colleges and universities, particularly in countries from where they wish to recruit students, and introduce training modules for teachers so that potential host institutions in India are able to deliver courses and lectures that benefit local and foreign students equally. These are all simple modifications that can be easily performed. All stake holders, including administrators, teachers and students can come together and brainstorm to come up with desirable and acceptable modifications in course work, teaching methods and infrastructure that will make higher education in India very attractive to foreign students.

One has to be cognizant of fee structures such that foreign students do not feel that they are being charged enormous fees while local students can study the same courses and avail of the same opportunities at a fraction of what they are paying. This maybe a more difficult issue to tackle and may require input from the higher authorities such as the Ministry of Education at both the federal and the state levels. Most colleges and Universities opting to host foreign students should also keep in mind that these students may need dedicated support for personal banking and mobile telephone services. The overall package should take into consideration the educational needs, the room and board needs, as well as the daily practical needs of these incoming foreign students on Indian campuses. Appointing student and teacher facilitators or chaperones for groups of foreign students may also be very helpful to make the transition from one country/life style/campus to a very different one. Indian colleges and universities have a lot to offer in terms of culture and entertainment and very active exchange between local and foreign students will foster a lively and enriching atmosphere outside of the class rooms. If Indian colleges and universities are serious about competing in the global higher education space then it is time to think seriously about making the suggested changes.

**Concluding Remarks**

Global education, characterized by the exchange of knowledge across borders, has a rich history, dating back to ancient times with scholars like Ibn Batuta and Marco Polo. Ancient universities and monasteries, such as Nalanda and Taxila, were early examples of centers fostering such exchange. In modern times, global education has been facilitated by advancements in air travel and the internet. Contemporary global education typically involves a host institution, an area of mutual academic interest, and the traveling scholar or student, with information about opportunities often disseminated through educational fairs and online platforms.

Indian students, numbering around 1.2 million and projected to rise to 1.6-1.7 million by 2025, frequently seek higher education abroad to gain independence, life skills, and enhanced career opportunities. However, they often face challenges, including financial burdens, travel restrictions, and sometimes exploitation by unscrupulous agents. Despite these challenges, the benefits of studying abroad, such as improved employability and broader academic prospects, remain significant.

Foreign institutions actively attract Indian students through dedicated international offices and recruitment efforts, leveraging their English-language instruction and offering various support services. This influx of international students provides substantial economic benefits to host countries. For example, the US alone hosted over a million foreign students in the 2022-2023 academic year, contributing significantly to its economy.

Conversely, Indian institutions have not extensively pursued international students, largely relying on local enrollment. To compete globally, Indian colleges and universities need to enhance their appeal by improving infrastructure, ensuring safety, offering competitive fees, and fostering an inclusive academic environment. Establishing consortia among Indian institutions can also facilitate cross-cultural academic exchanges and attract a diverse student body.

In summary, while Indian higher education institutions possess strong academic capabilities, they must adopt strategic initiatives to enhance their global competitiveness. This includes participating in international education fairs, establishing robust international offices, and creating a supportive environment for foreign students. By doing so, India can reclaim its historical position as a global education hub and significantly contribute to the global academic landscape.

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# 26
# ROLE OF FUTURE EDUCATION IN PEACE HARMONY & DEVELOPMENT WITH SPIRITUALITY

**Dr. S P Kaushik**

*Education plays a pivotal role in shaping individuals and societies, fostering peace, harmony, development, and spirituality. This article explores the transformative power of education in promoting peace and harmony, highlighting the importance of values-based education and critical peace education. It delves into the interplay between spirituality and education, emphasizing the role of spiritual awakening in holistic development. The article also discusses the philosophy of education and its integration into educational practices, drawing on a case study approach to exemplify its transformative potential. Through an examination of these themes, the article offers insights into the role of education in shaping a more peaceful, harmonious, and spiritually enriched world.*

***Keywords:*** *Education for Peace, Spirituality in Education, Peace Education, Democratic Education, Social Responsibility, Personal Growth, Societal Well-being*

## Introduction

The transformative role of education in fosteripreng peace, harmony, and development through the integration of spirituality is the prime focus of this article. It highlights education's pivotal role in human capital formation and societal advancement, underscoring its potential to nurture global citizens committed to universal human values. By examining various educational approaches, including peace education, conflict resolution, democratic and justice education, and human rights education, the article emphasizes the need for a unified peace education theory that addresses all dimensions of peace. The discussion extends to the interplay of spirituality and education, advocating for the inclusion of spiritual values such as compassion, empathy, and ethical integrity in educational curricula. This integration promotes inner peace, resilience, and social responsibility, contributing to harmonious societal development. The article also explores the potential positive impact of spirituality on academic performance and the importance of training faculty to incorporate spiritual elements in teaching.

Finally, the article would investigates into the philosophy of education, emphasizing its role in shaping the beliefs, values, and practices of educational institutions. Through a case study approach, the transformative impact of integrating philosophy and spirituality into education is illustrated, highlighting the holistic development and spiritual growth of students as essential for thriving in an ever-changing world. By merging traditional educational goals with spiritual insights, this article proposes a comprehensive framework for future education that promotes peace, harmony, and development, ultimately contributing to a more cohesive and sustainable global society.

## Role of Education in Peace, Harmony, Development, and Spirituality

### The Transformative Power of Education

Education stands as a foundational pillar for human capital formation, acting as a catalyst for societal progress and individual development. Its impact transcends mere knowledge acquisition, driving productivity, prosperity, and the enrichment of human capital. Through education, societies advance holistically, fostering environments where individuals can thrive and contribute meaningfully.

**(a) Education as a Catalyst for Peace and Harmony**

Historically, education has championed universal human values, including peace and harmony. In our increasingly globalized world, education's role is more crucial than ever in nurturing global citizens dedicated to fostering peace and harmony. It equips individuals with the tools to navigate and appreciate diverse perspectives, promoting a culture of understanding and unity.

**(b) Peace Education: An Integrated Approach**

Peace education integrates values, knowledge, and skills that promote harmony within oneself, with others, and with the environment. It draws upon various ethical frameworks and emphasizes nonviolent conflict management, critical analysis of societal structures, and the cultivation of a peaceful mindset.

**(c) Critical Peace Education and Conflict Resolution**

Critical Peace Education moves beyond traditional paradigms by incorporating local narratives and practices aimed at transformative change. Conflict Resolution Training is a key component, providing individuals with the skills to manage disputes effectively. This training encourages peaceful resolutions and a deeper understanding of diverse perspectives, essential for a harmonious society.

**(d) Democratic and Justice Education**

Democratic education fosters critical thinking, debate, and coalition-building, instilling values like freedom of speech and tolerance. Justice education underscores the rule of law, teaching principles of crime prevention and community engagement, thus nurturing a sense of fairness and accountability in society.

**(e) Human Rights Education**

Human Rights Education is pivotal in raising awareness about global peace policies. It familiarizes participants with international agreements and promotes core values such as tolerance, solidarity, and respect for human rights, contributing to a more just and equitable world.

**(f) The Quest for Unified Peace Education**

Despite its fragmented nature, peace education aspires to develop a unified theory that addresses various dimensions of peace, from individual to international levels. This unified approach seeks to harmonize the diverse strands of peace education into a coherent and impactful practice.

**Transforming Worldviews through Education**

Education has the profound ability to transform conflict-based worldviews into unity-based perspectives, enhancing human capacity to mitigate conflict and foster sustainable peace.

**(a) Spirituality in Education: An Introduction**
Spirituality in education goes beyond religious beliefs, encompassing universal values such as compassion, empathy, and ethical integrity. It seeks to nurture the inner dimensions of individuals, fostering a sense of purpose and interconnectedness.

**(b) The Interplay of Spirituality and Education**
Both spirituality and education aim for personal and societal transformation. While education provides knowledge and skills, spirituality offers deeper insights into life's purpose and meaning, guiding individuals towards a more holistic and fulfilling existence.

**(c) The Relevance and Merits of Spiritual Education**
In today's materialistic world, spiritual education plays a critical role in promoting inner peace, resilience, and social responsibility. It fosters a sense of

interconnectedness, essential for building harmonious societies where individuals feel a deeper connection to one another and to the world around them.

**(d) Spiritual Awakening and Holistic Development**

Cultivating spiritual awakening through practices such as introspection and mindfulness helps students understand themselves and their place in the universe. This self-awareness enhances their overall well-being, leading to more balanced and meaningful lives.

**(e) The Future of Education: Spirituality as a Compass**

Amid unprecedented global challenges, spirituality serves as a guiding compass, steering education towards holistic development and societal well-being. It encourages a balanced approach to life, integrating personal growth with collective progress.

**(f) The Impact of Spirituality on Academic Performance**

The role of spirituality in academic success varies, with some studies indicating a positive correlation between spiritual practices and academic achievement. Spirituality can enhance focus, reduce stress, and foster a conducive learning environment, ultimately benefiting students' academic performance.

**(g) Incorporating Spirituality in Teaching**

Incorporating spirituality into teaching involves training faculty in aspects such as self-disclosure and the development of intellectual and interpersonal connections. This approach can improve teaching quality and enhance students' perceptions of spirituality, creating a more supportive and engaging learning environment.

## Philosophy of Education

The philosophy of education serves as a guiding principle that shapes the beliefs, values, and practices of educational institutions. It encompasses the study of nature, reality, and existence, addressing fundamental questions about the purpose and aims of education.

### (a) Integrating Philosophy into Education: A Case Study Approach

The School of Thought Educational Institute exemplifies the transformative power of integrating philosophy into education. By prioritizing holistic development and spiritual growth, the institute ensures that students not only acquire knowledge but also develop the skills, values, and mindset needed to thrive in an ever-changing world. This integrated approach prepares students to navigate life's complexities with wisdom and integrity, fostering a more enlightened and compassionate society.

## Concluding Remarks

To summarize, the future of education lies in its ability to integrate peace, harmony, and spirituality into its core framework. By fostering a holistic approach that emphasizes personal growth, societal well-being, and global citizenship, education can transform individuals and communities. The incorporation of spiritual and philosophical dimensions into educational practices holds the promise of nurturing a generation equipped to meet the challenges of the 21st century with resilience, empathy, and a deep sense of interconnectedness. As we move forward, may we embrace the transformative power of education in building a world where peace, harmony, and development are not just ideals but lived realities. Imparting spirituality in education is essential for nurturing well-rounded individuals who are compassionate, ethically responsible, and spiritually aware. By integrating mindfulness, character education, service learning, and holistic curricula, educational institutions can support the inner development of students. The benefits extend beyond individual well-being, contributing to a more just, compassionate, and harmonious society. As we look towards the future, it is imperative that education systems prioritize the spiritual development of students to foster a sustainable and fulfilling world.

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# 27

# REDESIGNING INNOVATIONS IN HEALTH EDUCATION WITH SPECIAL FOCUS ON MILLETS

**Dr. Luxita Sharma**

*Health education plays a vital role in informing people about behaviors and lifestyle factors that contribute to various health-related diseases. Millets, as a nutritious source of food, offer numerous health benefits such as reducing the risk of chronic disorders, improving cardiovascular health, enhancing the digestive and immune systems, and protecting against diabetes and degenerative diseases. They also hold socio-economic significance by promoting food sovereignty and creating job opportunities. Government policies and initiatives are crucial in promoting millet cultivation and consumption to address nutrition and food security concerns. Innovative approaches in breeding practices, genetic research, and food processing are essential to ensure the sustainability and nutritional value of millets.*

***Keywords:*** *Health education, millet, disability, health benefits, sustainable agriculture, food security, culinary innovations, millet programs.*

Health is closely associated with healthy behavior and dependent on a healthy existence which is affected by smoking, physical exercise, and the type of diet or dietary habits. Nutrition is a very essential factor that plays a crucial role in people's lives and is responsible for influencing mental and physical health and development in the early stages of life. Early food habits during infancy can influence the choices or preferences we make in later life by tracking habits of eating from childhood to the stage of adolescence (Amadou et al., 2013). Health education's motive is to aware people of the negative consequences that are associated with health along with its behaviour (Hall et al., 2016). The focus is always on the people and their behavior or habits such as smoking and eating patterns.

Health services should also be included with rehabilitation in which asses should be there for community-based health care services on the primary level, special attention for the people who are at risk or underserved like handicapped and elderly people, degenerative and chronic diseases intervention on early stage to prevent and improve the quality of healthcare services by making them cost-effective along with equitable provision (Hall et al., 2016).

**Innovations in Health and Food Education**

Innovation in health and food education is leading to sophisticated scientific knowledge and technological advancement in the food processing sector. Various novel technologies include high-pressure processing, nanoencapsulation, pulse electric field, 3 D printing in combination with novel technologies along with ancient or traditional techniques like UV light in combination with high-pressure processing applied to reduce the salt in products of fish that have been adopted to improve the food quality so that their bioactive compounds control will release and their bioaccessibility will be favored. Innovative companies along with agents of innovation and innovation financiers are working together with the institutions to provide the basis for feasible innovations in the field of food and health education. Recently technologies such as nanotechnology have been found to have potential applications in the field of functional foods which is opening research scope due to engineering biological molecules as they have functions in developing new research (Hsieh & Ofori 2007).

Various innovations are happening in the field of gene science that is allowing the exact identification or accurate gene that are producing the individual nutrient, natural toxic plant compounds, and flavors, that is responsible for changing the unique components that are present in the natural materials of food from the origin or animal or plant (Saleh et al., 2019). Many genetically modified foods help enhance the health status of individuals such as peanuts with the proper balance of protein in it, lycopene is a natural antioxidant found in tomatoes in higher content, soybean with a high amount of oleic acid provides stability during frying, and improved taste, and for lowering cholesterol garlic and clove that contains allicin and strawberries with ellagic acid for fighting cancer. Fat-modified foods are the term that contains various foods that are modified versions of full-fat content either by removing the content of fat or by replacing some of the fat with ingredients that are non-fat or has less amount of fat such as baking the products instead of frying them is known to be the fat modified food. It is useful in providing fat-free foods to consumers or low-fat foods by retaining its attributes and sensory qualities (Hsieh & Ofori 2007).

**Types of Millet and their Nutritional Configuration**

Understanding the different types of millet (e.g., sorghum, pearl millet, finger millet, foxtail millet) and their nutrient content. The pearl millet is significantly considered to be the best source of dietary fiber (soluble as well as insoluble), resistant starch, antioxidants, and minerals. The dry matter present is 92.5%, ash is around 2.1%, crude fiber is almost 2.8%, crude protein is about 13.6%, crude fat is around 7.8% and starch is around 63.2% (Saleh et al., 2019).

In foxtail millet, it is found that the concentration of protein shows that it is a potential ingredient of functional food along with the essential amino acids that can be used for the supplementary source of protein as it is a good source of lysine which is lacking in cereals.

The finger millet is known for its beneficial functions in improving health and well-being as it is a rich source of polyphenols. The finger millet which is a small seed contains a high amount of calcium, which is very beneficial for bone health in children and prevents osteoporosis in adults along with various disorders of bone. As it is also rich in iron, so, it also helps to protect people from anemia (Saleh et al., 2019).

In comparison with cereals kodo millets and little millets contain a high amount of dietary fiber that is 37% to 38% respectively, along with a higher percentage of fat which is polyunsaturated fatty acid (Amadou et al., 2013). The proso millet is also a great source of nutrients, it is rich in protein and contains essential amino acids such as leucine, methionine, and isoleucine in high amounts and the amount of protein is about 11.6% dry weight of protein that is more than the protein present in wheat. (Saleh et al., 2019).

**Health Benefits of Millets**

Millets have various health-related benefits as they are a rich source of nutrients and protect the body from various chronic disorders millets help to reduce the risk of cardiovascular disorders, lower the risk of developing cancer, help to improve the digestive system, improve the immunity system, helps to protect from diabetes, energy levels also increased by millet consumption, helps to detoxify the body, and also helps in protecting from various types of degenerative diseases like Parkinson’s disorder along with metabolic syndrome. (Saleh et al., 2019).

- **Cardiovascular Disorders**

It is known that millet contains a high amount of magnesium that helps to reduce the risk of blood pressure along with other heart-related diseases such as atherosclerosis or risk of heart stroke (Amadou et al., 2013). Due to the presence of potassium content in the millet, it helps to maintain blood pressure by keeping it low as it acts as a vasodilator which is useful in reducing the risk of heart disease. Millets such as finger millets and proso millets are clearly shown that they effectively lower the serum triglycerides concentrations as compared to white rice. It is also shown in studies that sorghum millet-based food products can be used to control the levels of cholesterol in people (Saleh et al., 2019).

**Diabetes mellitus (DM)**

DM is a condition of chronic metabolic disorder that is characterized by the presence of hyperglycemia in which modifications are required in diet such as carbohydrates in the form of complex carbs, protein, and metabolism of lipids to control the level of insulin as DM is a disorder of endocrine due to insufficient insulin production in type 1 diabetes and in type 2 diabetes it is the insulin resistivity and the secretory response of insulin. Magnesium content in millets helps to control diabetes (Amadou et al., 2013). Diets that are finger millet-based contain high fiber have a low glycemic index and contain polyphenols that are antidiabetic and contain a high amount of antioxidant content. Proso millet is also a rich source of nutrients shows anti-hyperglycemic activity and helps to maintain blood glucose levels in diabetic patients by improving glycemic response. Barnyard millet is also effective in controlling diabetes due to its high nutrient content. So, grains of millet have a significant role in controlling diseases like diabetes effectively (Amadou et al., 2013).

- **Gastrointestinal Disorders**

Digestive processes are regulated which increases the retention of some nutrients along with reducing the gastrointestinal conditions that are more serious such as colon cancer or gastric ulcers.Millets are a rich source of fiber that helps to prevent disorders such as bloating, cramps, constipation, and excess gas. Celiac diseases are the immune-mediated response due to the ingestion of gluten present in cereals like wheat in this case individuals are not able to eat wheat, barley, and rye-based food products. So, they require a gluten-free diet that can be achieved by replacing these cereals with millets such as sorghum, amaranth, quinoa, rice, millet, and corn as they are gluten-free cereals. Millets are good sources of nutrients as they are gluten-free so these are suitable for people who are suffering from diseases like celiac disease who will freely consume millets (Amadou et al., 2013).

- **Cancer**

As the grains of millets are rich in phytates, phenolic acids, and tannins that are useful in preventing and reducing the risk for certain cancers like breast and colon cancer in animals. It is estimated that sorghum and millets are a good source of fiber that helps to lower the risk of oesophageal cancer in the population that is consuming millets instead of wheat and maize. Studies have also proven that millets contain a high amount of fiber that helps protect women from the onset of breast cancer and the risk can be lowered to 50% by the consumption of fiber more than 30g every day also the anti-carcinogenic properties of the sorghum millet are well explained by the researches. According to in vitro and vivo is it clearly shown that sorghum millet consumption has various health benefits and protection against cancer (Amadou et al., 2013).

## Millets in Sustainable Agriculture and Smart Agricultural Practices

Various innovations are coming in the food and nutrition security that are responsible for increment in agricultural production of crops such as promoting the agricultural sector and its sustainability along with farmer's skill improvement, production of crops to generate income out of it, and making the farmers empowered with the help of collective actions that suggests the importance of production of agricultural increment and emphasis in developing policies for future science in the agriculture and food and nutrition security. Millets are crops that are known for their tolerance to a bad environment or harsh conditions they have a rich history as they require low inputs for cultivation and provide a high amount of nutritional content as they are a rich source of health-benefiting nutrients (Amadou et al., 2013).

As the population size is increasing day by day proportionally the demand for food is also growing. due to the staple crops like wheat, maize, and rice being in demand has led to lag behind the millet crops along with orphan crops. Crop improvement is not high in major staple crops production as it has less possibility of improvement and because of this reason world is facing problems or challenges like degradation of soil, expansion of drylands, and the scarcity of groundwater. In India, almost half land of irrigated total land is still unirrigated even after using the whole and maximum potential of irrigation which indicates that there is an urgent requirement for alternative crops of cereals. In these situations, millet crops can be the better option for solving the problem of irrigation and can be cultivated on low-fertility soil. These millets can easily help to replace major crops such as wheat and rice as they are rich in nutrients (Singh et al., 2022).

## Millets - Dietary Diversity and Food Security

- **Dietary Diversity**

Millets, a group of small-seeded, drought-tolerant grains, have played an essential role in global food security for thousands of years. These versatile crops, comprising species like sorghum, pearl millet, finger millet, and foxtail millet, thrive in diverse agro-climatic conditions, making them a vital resource for regions susceptible to climate variability (Singh et al., 2022). Their significance in ensuring food security stems from their impressive nutritional profile, adaptability, and sustainable farming practices.

Millets are a remarkable crop with numerous advantages. They use 70 percent less water than rice, grow in half the time of wheat, and require 40 percent less energy in processing. These qualities make them a crucial solution amidst climate change, water scarcity, and drought conditions, offering sustainable food security. Additionally, diets with low environmental impact, like those incorporating millets, protect biodiversity and ecosystems, ensuring access to nutritious food. Moreover, millets enable crop diversification without compromising nutritional value, resulting in increased food production, reduced greenhouse gas emissions, and enhanced climate resilience. They have been identified as a viable option for ensuring food security and environmental resilience, particularly in the face of changing monsoon cereal production in India. Millets' adaptability to extreme conditions, such as high temperatures and drought, allows them to thrive in harsh, arid regions. They have a diverse genetic makeup and require minimal cultivation inputs. Furthermore, millets offer higher nutrient density compared to traditional grains (Singh et al., 2022).

- **Food Security**

Millets are nutritional powerhouses, boasting high levels of protein, dietary fiber, and a range of essential micronutrients. For instance, pearl millet is rich in iron and calcium, crucial for combating anemia and promoting bone health. Finger millet, on the other hand, is a standout source of dietary fiber and calcium, making it an excellent choice for maintaining digestive health and combating osteoporosis (Shobana et al., 2013). One of the most compelling attributes of millets is their adaptability to harsh environmental conditions. These crops are naturally drought-tolerant, requiring significantly less water compared to traditional cereals like rice and wheat (Srinivasarao et al., 2018). Millet cultivation promotes sustainable farming practices due to their low input requirements. These crops are generally less reliant on synthetic fertilizers and pesticides, reducing the environmental footprint of agriculture (Bhale et al., 2018).

Millets have the potential to be a vital safeguard in the era of climate change. They play a crucial role in efficient farming, particularly for small and marginal rain-fed farmers, offering stability in food and livelihood. Millets have been rightfully hailed as 'nutri-cereals' or 'smart foods'. In regions struggling with hunger, small millets exhibit nutritional characteristics that make them an ideal staple crop. Ultimately, millets have the potential to be a transformative crop, supporting sustainable food systems in the face of climate change, nutrition insecurity, and environmental degradation (Singh et al., 2022).

**Promoting Millets in School Nutrition Programs**

Integrating millet into school meal programs presents a valuable opportunity to enhance the nutritional quality of children's diets while promoting sustainable agriculture. One effective strategy is to collaborate with local farmers and suppliers to source millet grains, thereby supporting the local economy and ensuring a fresh and reliable supply chain (FAO, 2020). Additionally, providing training and capacity-building programs for school cooks and staff on millet-based meal preparation can help overcome potential barriers related to unfamiliarity with these grains. Incorporating millet into familiar and culturally appropriate recipes, such as porridge, bread, or pancakes, can make them more appealing to students (Sharma et al., 2020). Furthermore, conducting nutrition education campaigns can raise awareness about the health benefits of millet among students, parents, and community members (Shukla et al., 2018).

Educational campaigns play a pivotal role in raising awareness about the benefits of millets among students, parents, and educators. These campaigns serve as a powerful tool to disseminate information and foster positive attitudes towards millets. Targeted workshops and seminars in schools can provide students with hands-on experiences, imparting knowledge about the nutritional value and versatility of millets. In parallel, engaging parents through informative sessions or printed materials can extend the impact of the campaign beyond the school setting, encouraging the incorporation of millet into home-cooked meals (Shukla et al., 2018). These campaigns can also emphasize the environmental benefits of millet cultivation, promoting sustainable agricultural practices.

**Entrepreneurship and Millet-Based Products**

Millet-based products have a great deal of opportunity for the agribusiness and food manufacturing sectors because of their nutritional value, environmental sustainability, and rising consumer desire for alternative grains. Small-seeded grasses known as millets have been farmed for hundreds of thousands of years and are a valuable source of vitamins, minerals, and fiber. Their excellent nutritional value—which contains a high amount of protein, dietary fiber, B vitamins, and micronutrients like iron, calcium, and magnesium—makes them a superfood. Millets can therefore be extremely important in combating malnutrition and fostering improved health. They provide health advantages including better digestion and a lower chance of developing chronic illnesses.

Millet-based goods are seeing growth in the market as more people adopt gluten-free diets. Millets are inherently gluten-free, meeting the increasing demand from customers with celiac disorder or gluten sensitivity for gluten-free goods (Saleh et al., 2019). The millet industry has had a notable upsurge in entrepreneurial energy in recent times, resulting in an upsurge of creativity and environmentally friendly practices in the agricultural scene. This comeback has been led by start-up businesses, who are changing the story about these ancient grains. In addition to producing excellent millets, their dedication to sustainable agriculture has helped advance the adoption of environmentally friendly farming practices (Saleh et al., 2019).

**Policy and Advocacy for Millets**

Governmental policies and programs are essential for encouraging the production, processing, and eating of millet. This is due to their importance in solving issues with nutrition and food security. The Indian government has taken several actions to increase millet output. The National Food Security Mission (NFSM) for Millets, for example, was established by the Ministry of Agriculture and Farmers Welfare to raise millet farmers' incomes and increase millet output. Additionally, money is set aside under the Rashtriya Krishi Vikas Yojana (RKVY) to support millet planting through initiatives including training courses and the distribution of seeds. To promote millet planting and processing, the Millets Development Program in Karnataka, India, also offers farmers financial assistance and technical support. Globally, agencies such as the United Nations Food and Agriculture Organization (FAO) have promoted millets as components of sustainable food systems, highlighting their ability to improve food security and their resistance to climate change (FAO, 2023). The inclusion of millet in school meal programs and public distribution programs promotes their consumption, which in turn spreads the word about their nutritional advantages to a larger audience (Food Corporation of India, 2021). The Food and Agriculture Organization (FAO) and other international agencies have been leading the charge in promoting millet. Given that millet has the potential to enhance livelihoods, nutrition, and environmental sustainability, the FAO's "Global Year of Millets" in 2023 aims to galvanize international efforts to support millet cultivation and consumption (FAO, 2023).

**Research and Innovation in Millets**

The emphasis on Millet's research and innovation has grown in the last few years. These ancient crops have the potential to address worldwide food security and nutrition issues since they can withstand drought. Sorghum, finger millet, pearl millet, and foxtail millet are examples of millets that are rich in vital nutrients and resistant to harsh weather conditions. For this reason, they are important staples in areas where the climate is unpredictable. Furthermore, millets are a good fit for sustainable agriculture since they need less water and inputs than wheat and rice. The variety of genes, breeding approaches, and agronomic techniques that can improve millet yield and nutritional value have all been the subject of recent research. For instance, important genes linked to disease resistance and drought tolerance in millets have been found thanks to genomic research. To hasten the production of better millet varieties with desired features, novel breeding strategies are being used, such as genomic selection and marker-assisted selection. Moreover, the complete nutritional worth of millets is being unlocked by developments in value-added procedures and post-harvest technology (Saleh et al., 2019).

**Culinary Innovations with Millets**

Millets have been a mainstay in many societies for ages because they can withstand a wide range of conditions, according to evidence from the National Institute of Nutrition. The age-old wisdom of using millets in South Indian foods like idlis, dosas, and porridges is demonstrated in traditional recipes. Global food security and nutrition are significantly impacted by the dynamic and diversified area of ongoing study in millet-based nutrition and agriculture. Research focuses on several aspects of millet production, handling, and eating to realize the entire potential of these hardy grains. Nutrition research explores the diverse makeup of millets, highlighting their high fiber content, high protein content, and high micronutrient density. Studies highlight how millet might help prevent non-communicable illnesses linked to food and malnutrition, particularly in more susceptible communities (Hithamani et al., 2020).

To increase the number of culinary uses for millets, improvements in millet processing and value addition are essential. Improvements in technology include dehulling, milling, extrusion, and fortification procedures, which guarantee that goods made from millet are not only nutrient-dense but also tasty and user-friendly. Innovative storage and packaging techniques also help millet-based goods last longer on the shelf, increasing their accessibility to a larger market (Adeoti et al., 2018; Bharti et al., 2020).

**Monitoring and Evaluation of Millet Programs**

Initiatives to promote millet intake for better nutrition and well-being must be evaluated based on metrics that measure the efficacy of millet-focused initiatives on health outcomes. Measures of anthropometric results, such as variations in height for age, weight for age, and a person's body mass index (BMI), are important indicators because they shed light on the state of nutrition generally. Specific information on micronutrient adequacy can be obtained via biomarkers of nutritional status, such as blood or urine samples' levels of iron, and zinc, as well as vital vitamins and minerals. Millet addition can increase the overall quality of a diet according to dietary diversity scores, which represent the range of food categories ingested. Furthermore, monitoring shifts in the incidence of non-communicable illnesses associated with food, such as diabetes and cardiovascular disorders, might demonstrate the long-term effects of millet-focused interventions. The cost and availability of millet-based diets may also be assessed using economic measures, such as family income and food expenditure (Adeoti et al., 2018; Bharti et al., 2020).

Using the best standards in data gathering and program assessment is essential to guaranteeing the impact and efficacy of millet initiatives. The first and most important step is to set quantifiable, explicit goals. These goals have to be SMART—specific, measurable, attainable, relevant, and time-bound. This would provide assessment professionals with a clear path forward. Using a mixed-methods strategy that combines both quantitative and qualitative information-collecting techniques is essential. This enables a thorough comprehension of program results by gathering participants' qualitative perceptions in addition to numerical indicators. Furthermore, the accuracy and reliability of the data acquired are improved by using rigorous sampling strategies and verified measuring instruments. Throughout the program, routine monitoring and recurring assessments enable prompt modifications and enhancements, optimizing the program's overall impact (Adeoti et al., 2018; Bharti et al., 2020).

## Conclusion

To sum up, it can be stated that along with being abundant in vital nutrients, millet is also very important in avoiding several chronic illnesses. Millets have demonstrated encouraging outcomes in terms of diabetes control and cardiovascular health. Their high magnesium content lowers the risk of heart-related illnesses and helps to regulate blood pressure. Their high fiber content and low glycemic index also make them useful partners in the management of diabetes. Similarly, millets have shown promise in improving gastrointestinal health by reducing symptoms like constipation and bloating. For those who have celiac disease, they also provide a safe and nourishing gluten-free substitute. Millets are a promising tool in the fight against cancer, especially in the areas of breast and colon cancer prevention. Their abundance of antioxidants aids in detoxification, assisting the body in getting rid of dangerous pollutants and enhancing general health. Including millets in our meals and encouraging their growth can enhance public health outcomes and help create a more resilient and sustainable agriculture system. As the cornerstone of a nutritious and sustainable food future, millets require our continued investigation and investment.

The promotion of millet in school nutrition programs holds immense potential to improve the nutritional quality of children's diets while supporting local economies. Collaboration with local farmers and suppliers, along with training programs for school staff, can help integrate millets into school meal menus. Additionally, educational campaigns and hands-on experiences for students can raise awareness about the health benefits of millet. Entrepreneurship in millet-based products has witnessed a surge, driven by their nutritional value, environmental sustainability, and increasing consumer demand for alternative grains. Governmental policies and programs play a pivotal role in promoting millet production, processing, and consumption.

Initiatives like the National Food Security Mission for Millets in India and the Global Year of Millets by the FAO highlight the significance of millets in ensuring food and nutritional security. Furthermore, advocacy efforts at both local and international levels are crucial in raising awareness about the benefits of millets and driving their resurgence as a sustainable food source. Research and innovation in millets have seen significant advancements, focusing on breeding techniques, agronomic practices, and value addition to enhance yield, nutritional content, and culinary versatility. Culinary innovations with millets offer a pathway to broaden their appeal and integration into modern diets. Through concerted efforts in promotion, research, policy, and culinary creativity, millets can play a transformative role in shaping resilient and sustainable food systems for generations to come. Their resurgence not only offers a practical solution to current agricultural and environmental challenges but also celebrates the rich heritage and nutritional value of these ancient grains.

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# 28

# A DREAM UNIVERSITY TO REALIZE THE VISION OF DEVELOPED INDIA: BRIDGING THE GAP THROUGH INCLUSIVE ACCESS, INNOVATION, AND SUSTAINABLE DEVELOPMENT

**Prof. Neelam Sahu**

*In the pursuit of India's vision for becoming a developed nation, the establishment of a dream university that embodies principles of inclusivity, innovation, and sustainable development is paramount. This article explores the role of such a university in driving societal progress, addressing challenges, and fostering holistic development. By examining case studies, policy frameworks, and best practices, this article offers insights into the potential impact of a dream university on India's journey towards development.*

**Keywords:** *Inclusive Access, Innovation, Sustainable Development, Higher Education, Policy Implications, Developed India Vision*

## Introduction

India's aspiration to become a developed nation hinges on its ability to transform its higher education landscape. A dream university that embodies the values of inclusivity, innovation, and sustainable development can serve as a catalyst for societal progress. This article aims to explore the concept of such a university and its potential to realize the vision of a developed India.

India's journey towards becoming a developed nation necessitates transformative measures in its higher education sector. A dream university, conceptualized as an institution embodying inclusivity, innovation, and sustainable development, emerges as a cornerstone in this pursuit. Such a university envisions a holistic approach to education, aiming not only to impart knowledge but also to nurture critical thinking, creativity, and social responsibility among its students. By prioritizing inclusivity, innovation, and sustainability, a dream university aspires to address the multifaceted challenges hindering

India's progress towards development. Through this article, we delve into the foundational principles and practical implications of establishing such a university, exploring its potential to drive societal change and shape India's future.

The concept of a dream university aligns with India's broader vision for the future, encapsulating aspirations of growth, progress, and global leadership. As the nation strives to overcome socio-economic disparities and transition towards a knowledge-based economy, the role of higher education becomes increasingly pivotal. By fostering an environment conducive to learning, research, and innovation, a dream university aims to empower individuals from diverse backgrounds to contribute meaningfully to India's development trajectory. Moreover, the establishment of such an institution signifies a paradigm shift in educational paradigms, moving away from traditional models towards more dynamic and inclusive approaches. Through collaborative efforts between policymakers, educators, and industry stakeholders, the realization of a dream university holds the promise of reshaping India's higher education landscape and steering the nation towards prosperity.

**Inclusive Access**

Ensuring inclusive access to higher education is critical for bridging socio-economic disparities and fostering equitable development. This section examines the barriers faced by marginalized communities in accessing higher education and explores strategies for promoting inclusivity through affirmative action policies, scholarships, and community outreach programs.

Ensuring inclusive access to higher education is imperative for promoting social mobility and fostering a more equitable society. Marginalized communities, including those from rural areas, low-income households, and underrepresented groups, often face formidable barriers in accessing quality education. Financial constraints, lack of educational infrastructure, and cultural biases exacerbate these challenges, perpetuating socio-economic disparities. Initiatives aimed at promoting inclusive access, such as affirmative action policies and scholarship programs, play a crucial role in mitigating these barriers and expanding educational opportunities for disadvantaged populations. Additionally, community-based outreach efforts and awareness campaigns are instrumental in addressing cultural stigmas and promoting a culture of education within marginalized communities.

The transformative power of education extends beyond individual advancement to encompass broader societal benefits. By ensuring equitable access to higher education, a dream university not only empowers individuals but also fosters social cohesion and economic development. Moreover, diversity and inclusivity within educational institutions enrich the learning environment, fostering cross-cultural dialogue, and understanding. Through targeted interventions and strategic partnerships, stakeholders can collaborate to dismantle barriers to access and create a more inclusive educational ecosystem. By prioritizing inclusivity as a foundational principle, a dream university sets a precedent for other institutions to emulate, catalyzing systemic change and advancing India's agenda for social justice and equality.

**Innovation and Entrepreneurship**

Innovation and entrepreneurship are key drivers of economic growth and development. A dream university must cultivate an ecosystem that fosters creativity, critical thinking, and problem-solving skills among its students. This section explores the role of innovation hubs, incubators, and industry partnerships in nurturing an entrepreneurial mindset and driving innovation-led growth.

Innovation and entrepreneurship are indispensable drivers of economic growth and societal advancement. A dream university serves as a catalyst for cultivating an ecosystem that fosters creativity, critical thinking, and entrepreneurial spirit among its students. By integrating innovation and entrepreneurship into its curriculum and extracurricular activities, the university empowers students to become agents of change and catalysts for innovation-led development. Through experiential learning opportunities, such as internships, hackathons, and startup incubators, students gain practical skills and real-world experience in ideation, prototyping, and business development. Moreover, industry partnerships and mentorship programs connect students with seasoned professionals and entrepreneurs, providing invaluable guidance and support as they navigate the entrepreneurial landscape.

The impact of innovation and entrepreneurship extends beyond the university campus to catalyze broader economic transformation and job creation. By nurturing a culture of innovation and entrepreneurship, a dream university contributes to the development of a vibrant startup ecosystem, attracting investment and talent to the region. Moreover, entrepreneurial ventures founded by alumni and faculty members serve as engines of innovation, driving technological advancements and market disruptions. Through collaborative research initiatives and technology transfer programs, the university bridges the gap between academia and industry, facilitating the commercialization of cutting-edge research and innovations. Ultimately, by fostering a spirit of innovation and entrepreneurship, a dream university plays a pivotal role in shaping the future of India's economy and society, positioning the nation as a global leader in innovation and entrepreneurship.

**Sustainable Development:**

Sustainable development lies at the heart of India's vision for the future. A dream university must prioritize environmental sustainability, social responsibility, and ethical leadership. This section examines initiatives for promoting sustainability on campus, integrating sustainability into the curriculum, and fostering research and innovation for sustainable development.

Sustainable development lies at the intersection of economic prosperity, environmental stewardship, and social equity. A dream university embodies these principles by integrating sustainability into its core mission, operations, and curriculum. Through campus-wide sustainability initiatives, such as energy conservation, waste reduction, and green building practices, the university demonstrates its commitment to environmental responsibility. Additionally, sustainability-focused research centers and interdisciplinary programs equip students with the knowledge and skills to address pressing environmental challenges, such as climate change, resource depletion, and ecosystem degradation. By fostering a culture of sustainability, the university instills in its students a sense of environmental stewardship and social responsibility, preparing them to become leaders in sustainable development.

Furthermore, a dream university leverages its expertise and resources to drive sustainable development initiatives at the local, national, and global levels. Through community engagement projects and outreach programs, the university partners with local communities to address environmental issues, promote sustainable livelihoods, and enhance resilience to climate change. Moreover, collaborations with government agencies, non-profit organizations, and industry stakeholders enable the university to develop innovative solutions to sustainability challenges and advocate for policy reforms that advance the sustainability agenda. By integrating sustainability principles into its teaching, research, and outreach activities, a dream university not only contributes to the achievement of sustainable development goals but also inspires future generations of leaders to create a more sustainable and equitable world.

**Case Studies and Best Practices**

Drawing on international and national examples, this section presents case studies of universities that have successfully embodied the principles of inclusivity, innovation, and sustainable development. Best practices and lessons learned from these institutions offer valuable insights for the design and implementation of a dream university in India.
Examining case studies and best practices from both national and international contexts provides valuable insights into the implementation and impact of sustainable

development initiatives within higher education institutions. For instance, the University of California, Berkeley's Sustainable Berkeley Lab serves as a pioneering example of how universities can integrate sustainability into their campus operations and academic programs. Through initiatives such as zero waste goals, energy efficiency measures, and interdisciplinary research projects, the university has demonstrated a comprehensive approach to sustainability that extends beyond environmental conservation to encompass social equity and economic resilience. By leveraging its academic expertise and institutional resources, Berkeley has not only reduced its environmental footprint but also contributed to the advancement of sustainable development goals at the local and global levels.

Similarly, the Indian Institute of Technology (IIT) Madras's Rural Technology Action Group (RuTAG) exemplifies how universities can engage with local communities to address pressing socio-economic challenges through technological innovation. By collaborating with rural artisans and entrepreneurs, RuTAG has developed low-cost, sustainable technologies that enhance livelihoods, improve access to essential services, and promote environmental conservation. Through participatory approaches and knowledge exchange, RuTAG has empowered rural communities to become active participants in their own development, fostering self-reliance and community resilience. These case studies highlight the transformative potential of universities as drivers of sustainable development, demonstrating the importance of interdisciplinary collaboration, community engagement, and innovative solutions in addressing complex socio-environmental challenges.

Moreover, best practices such as the implementation of sustainability-focused curriculum reforms, establishment of interdisciplinary research centers, and adoption of green campus policies offer valuable lessons for universities seeking to integrate sustainability into their institutional culture and practices. By sharing experiences, successes, and lessons learned, universities can inspire and support each other in their journey towards sustainability, contributing to a more resilient, equitable, and sustainable future for all.

**Policy Implications**

Effective policies and regulatory frameworks are essential for the establishment and operation of a dream university. This section discusses policy recommendations for government agencies, educational institutions, and other stakeholders to support the development of such universities and ensure their long-term sustainability and impact.
Effective policy frameworks are essential for supporting the integration of sustainability into higher education institutions and promoting sustainable development at the national level. Governments play a crucial role in setting regulatory standards, providing financial

incentives, and facilitating collaboration between academia, industry, and civil society. For instance, policies mandating the inclusion of sustainability education in school curricula and university programs can help mainstream sustainability principles and foster a culture of environmental stewardship from an early age. Similarly, financial incentives such as grants, tax incentives, and funding opportunities for sustainability research and innovation can encourage universities to invest in sustainable infrastructure, initiatives, and partnerships. Moreover, regulatory frameworks that prioritize environmental protection, social equity, and economic resilience can provide a supportive environment for universities to develop and implement sustainability strategies that align with national development priorities.

Furthermore, policy coherence and coordination across different government departments and agencies are essential for ensuring the effective implementation of sustainability policies and initiatives. Inter-ministerial task forces, national sustainability councils, and multi-stakeholder platforms can facilitate dialogue, collaboration, and knowledge-sharing among relevant stakeholders, including policymakers, academics, industry representatives, and civil society organizations. Additionally, policy mechanisms such as sustainability reporting requirements, performance indicators, and accountability mechanisms can help monitor progress, track impact, and hold institutions accountable for their sustainability commitments. By adopting a multi-level governance approach that engages stakeholders at the local, regional, and national levels, policymakers can create an enabling environment for universities to contribute meaningfully to sustainable development goals and promote a more sustainable and inclusive future for all.

**Concluding Remarks**

In conclusion, the establishment of a dream university that embodies the principles of inclusivity, innovation, and sustainable development holds immense potential for realizing the vision of a developed India. By providing equitable access to quality education, fostering innovation and entrepreneurship, and promoting sustainable practices, such a university can contribute significantly to India's socio-economic development and global competitiveness.

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# 29
# INDIAN CENTRES OF EXCELLENCE IN HISTORICAL PERSPECTIVE

**Prof. Dr. Shashibala**

*The world seeks peace and sustainable development, with education as a key driver. The Indian philosophy of education, with its unique aims, objectives, and dissemination methods, contrasts significantly with Western approaches. In India, rishis, acharyas, and socially inclined individuals educated and inspired holistic development in ashramas, gurukulas, and temples. Renowned universities like Odantapuri, Takshashila, and Vikramashila produced philosophers, scientists, and strategists. This education emphasized the harmony of science and spirituality, fostering moral, social, and global values through the guru-shishya tradition. Students chanted mantras like shanti-patha and vasudhaiva kutumbakam, promoting harmony and progress. Education was accessible to all capable individuals, with no focus on patents or copyrights. India's educational traditions significantly influenced distant lands. Today, global education should revisit these ancient traditions to address contemporary problems and crises, emphasizing sustainable and holistic development over mere modernity.*

***Keywords:*** *Gurukulas, Ashramas, Takshashila, Nalanda, Vikramasila, Jagaddala, Somapura, Vallabhi, Kautilya's Educational Steps, Vedic Education, Holistic Development, Cultural Heritage*
*Global Educational Influence, Spiritual Advancement, Higher Learning Centers*

## Introduction

Higher education is the main pillar of any society at any time. Centres of excellence for higher education have been termed differently in different countries and traditions. In Indian they are called Gurukulas, Ashramas, Viharas, Mathas, temples. They gave foundation to states through educating the youth. The Greeks called them academies, the Europeans named them as *studium*, Chinese named them as centres, Indonesians founded mandalas.

Holistic development of an individual was the aim of education from the Vedic times. Innovation in various fields of knowledge resulted in composing more than eighty thousand works. There is no compendium so far to give a fixed number as given the Chinese Tripitaka, Tibetan and Mongolian Kanjur and Tanjur that contain translation of Sanskrit texts. History to arts, law to medicine, science and technology to profound philosophy. Husbandry to astronomy, enriching the outer and the inner dimensions of an individual.

From Kashmir to Kanyakumari great centres of excellence scattered all over India were world famous. They were extensively contributing to only Indian cultural and civilizational development but of all the countries around it. The fact is confirmed by historians, pilgrims and men of learning in China, Cambodia, Greece, Iran and Tibet etc. Alberuni has written that Kashmir was the most important centre of scholarship. Scholars from even Kashi used to go to Kashmir to study at the massive universities like that of Shrinagar. Indian heritage echoed in the mountain ranges of Kashmir.

Kautilya enumerates the steps of studies in ancient Indian educational system as—

- Sushrushu
- Shravanam
- Grahanam
- Dharanam
- Uhapoha
- Vijnana
- Tattvabhinivesha

**The term University**

According to Encyclopaedia Britannica (Vol. 22, pg 862) The term university comes from medieval Latin term universitas which denoted community or corporation. Magistrorum et scholarium was added to be used in the modern sense of a body devoted to learning and education. Ancient and customary designation of such communities in medieval times regarded as places of instruction was studium. As a scholastic guild it sprang by 13$^{th}$ 14$^{th}$ century in most of European centres.

By 6$^{th}$ century the secular Pagan schools of the Roman empire were swept away. Salerne became known as the first school of medicine in 9$^{th}$ century. and monastic schools replaced them by 12$^{th}$ century for educating the monks and priests. Legal studies began in Bologna by AD 1000. Commencement of University of Paris goes back to 12$^{th}$ century to study logic emerging out of the belief that intelligent appreciation of spiritual truth depended upon correct use prescribed methods of argument. Dialect is was looked upon as science of science. Prague existed as a studium in 13th century. The University of Heidelberg received it charter as stadium generale on Oct 23, 1385. Cologne, Leipzig, Freiburg, Louvain and Budapest are some of the names of famous Universities in Europe that were established during this period. Dharma-sutras carry on the Vedic tradition and practices of education and codify them into regular systems. Education had its own aim and character for self-fulfilment and educing the personality, for growth, as a process of life controlled in totality.

From biological parents' home to a spiritual parent called gurus a shishya was to undergo the upanayana ceremony marking a turning point in his life. Manu (2.146,148) calls it brahmajanma. Now as a brahmacahri he had to live a strictly disciplined life. Living in gurukula one who was passionate could study day and night. Pupils sometimes went from one teacher to another for seeking in-depth knowledge. Sudhana's way to enlightenment is a grand narrative of visiting 51 best teachers of the time to get enlightened. The gurus to whom students used to come from distance of hundreds of miles are called Yaujakasantikas by Patanjali (5.1.74.2). Manu (2.140,141, 246, 3.156, 4.102) mentions classes of teachers and the dakshina to be presented to them at the end of studies.

**Ashramas in ancient times**

Indian education system was highly developed which created the brightest minds who contributed immensely to its glorious past. Teacher-student relationship was of utmost importance. The normal routine was very strictly followed. The ashramas created the best strategists and rulers like Krishna and Rama. Krishna with Balarama and Sudama had studied at the ashrama of Guru Sandipani, a great tapasvi, well versed in 18 types of fields of knowledge. Sage Vashistha as described in the Ramayana had a large ashram. King Dilip went to perform austerities there. Lord Rama was also educated in the same ashram of Rishi Vashistha. Another famous ashrama was of rishi Vishwamitra but he himself had attained brahmata in Vashistha's ashram. The ashrama of Bharadwaja Muni in Prayag was another famous ashram of that age.

**Gurukulas**

A gurukula is a residential centre of education where students spend their time living twenty-four hours near their acharyas or gurus imparting knowledge and life skills. Acharyas cull out the essence of the sacred texts. They follow them themselves and also persuade their disciples to do that. Their curricula was developed innovatively catering to the needs of the royalty to masses. Those who achieved higher levels were called paramacharyas. The approach was student centric not teacher centric. Learning was practical application based. Academic studies aimed at preparing students to be participants in community services through imparting knowledge in variety of areas like mathematics and science, astronomy and ayurveda, vedas, Vedangs, Yoga, and so on. But some gurukulas focused more on Sanskrit to give a solid foundation to all the branches of knowledge. Moreover, there were tapahsthalis for big gatherings for sitting together to get in-depth knowledge.

**Subjects studied**

The focus in Gurukulas and ashrams was on the holistic development of a child. The system of education was comprehensive and all encompassing. The subjects included mathematics, fundamentals of astronomy, science, languages, medicinal theories, along with Vedas, Upanishads, Brahmanas, Dharmasutras etc. Works of renowned scholars like Aryabhatt and Patanjali were also taught. The students learnt Yogic sciences, science and techniques of war, martial arts and even sports. After Gurukulas emerged huge universities all over India.

**Takshashila as a great centre for education**

Takshashila was called Taxila by the Greeks. It was the capital of Gandhara in Punjab province, now in Pakistan. Takshashila was a centre for Hindu and Buddhist studies both. 1st to the 5th century CE is the time when it flourished. It flourished as a centre of trans-continental trade and as a famous centre for Buddhist studies. The city is mentioned in the Jatakas but not in Pali sutras. It is presumed that the physician of the Buddha had studied there. It was famous for Sarvastivada school of Buddhism. Hsuan Tsang and Faxian both have described this university. Ashoka had built a Dharmarajika stupa and a monastery there. It was enlarged when the city was rebuilt after Scythian invasions. (Princeton Dictionary of Buddhism 892)

**Nalanda**

Nalanda, now in Bihar the most famous university in India was constructed by King Shakraditya according to a seal discovered from the site. It was planned to be a centre of excellence when Taxila University was destroyed by Hunas. A few interpretations are given by scholars over centuries about the name of Nalanda. One of them is that it comes from nālā meaning "lotus stalks". It was visited by Lord Buddha with his residence at Pravarikamravana. Emperor Ashoka had built a stupa there in honour of Sariputra and consecrated it with imperial offerings. Nalanda became a great religious and educational centre in those days and in the times of Nagarjuna, 2nd century AD. Students from far and near came to Nalanda to study at the feet of the great masters. The number is said to be 10,000. According to Hsuan Tsang the university had students from all over the Buddhist world- Sri Lanka, Tibet, Nepal, China, Mongolia, Turkistan, Japan, Korea, Indonesia, Central Asia, Vietnam, and even from Persia, Greece and Turkey. (Embree & Wilhelm 1976:149) . Masters who came to Nalanda or went from there inspired translated great works in Chinese, Tibetan and other languages of Asia. Services by Asanga and Vausbandhu made the university famous.

According to Hsuan Tsang there were six or eight colleges at Nalanda and viharas for each one of them were built by the kings from Kumaragupta I to Harsa. Another Chinese pilgrim Itsing had visited Nalanda. He has mentioned that there were eight colleges with 300m rooms. A great number of Indonesians used to visit sacred places and study under Indian teachers. Nalanda acquired the patronage of Pala kings and also from a king from Suvarnadvipa. For a time, it was the largest and most important Buddhist centre of the Mahayana school. The Buddhist masters came in search of sacred manuscripts, relics and images. The number of Indonesians was so big that a monastery was founded for them and a famous inscription there dating from about AD 860, known as 'Balaputra's charter' that records the donation of villages for its upkeep by a Pala king.

**Vikramasila Mahavihara**

Excavations of the ruined university of Vikramasila in the village Antichak, in district Bhagalpur, Bihar, bring to light that it was founded by Pala king Dharmapala in late 8th or early 9th Century A.D. It prospered for about four centuries before it collapsed in the beginning of 13th Century A.D. It is known to us mainly through Tibetan sources specially the writings of Taranath, the Tibetan monk historian of 16th-17th Century A.D. As one of the largest Buddhist universities had more than hundred teachers and about one thousand students. It produced eminent scholars who were often invited by foreign countries to spread Buddhist learning, culture and religion. The most distinguished and eminent among all were Atisa Shri Dipankarajnana, Nagarjuna, Ratnavajra, Acharya Jetari, and Ratna Kirt. Subjects like theology, philosophy, grammar, metaphysics, logic etc. were taught here but the most important branch of learning was tantrism.

The excavations revealed a huge square monastery with a cruciform stupa in its centre, a library building and cluster of votive stupas. To the north of monastery, a number of scattered structures including a Tibetan and a Hindu temple have been found. The entire spread is over an area of more than hundred acres. The monastery, or residence for the Buddhist monks, is a huge square structure, each side measuring 330 metres having a series of 208 cells, 52 on each of the four sides opening into a common verandah. A few brick-arched underground chambers beneath some of the cells have also been noticed which were probably meant for confined meditation by the monks.

There was a library building, air-conditioned by cooled water of the adjoining reservoir through a range of vents in the back wall. The system was perhaps meant for preserving delicate manuscripts. A large number of antiquities of terracotta, stone, iron copper, gold, silver, bronze, ivory, bone and shell have yielded in course of excavations. A large number of sculptures of Buddha, Bodhisattva, Maitreya, Manjusri, Marichi, Mahakala, Tara, Jambhala, Aparajita, Sadakshari Avalokiteshwara, Mahachanda Rosana, Navagraha, Vishnu, Siva, Uma-Maheshwara, Surya, Mahisasurmardini, Kaumari, Chamunda etc. in stone and Buddha, Maitrya, Vajrapani, Avalokiteshwara, Lokeshwara etc. in bronze are noteworthy.

**Odantapuri University**

According to Tibetan sources, five great Mahaviharas stood out in Magadh. Vikramashila was the premier university of the era. Others were Nalanda, Somapura Mahavihara, Odantapuri, and Jaggadala. These five Monasteries formed a network under state supervision and there was a system of co-ordination among all of them. Odantapuri University, also called Odantapura or Uddandapura, was a Buddhist Vihara in what is now Bihar, situated at Hiranya Prabhat Mountainand, the bank of River Panchanan. It flourished as the second oldest of ancient Indian universities. Nalanda was just six miles from there. Great acharyas of the time had studied there like Acharya Sri Ganga of Vikramashila. King Gopala (660-705) supported to establish it. Tibetan are the most valuable sources to know about the university. According to them, there were about 12,000 students at Odantapuri. Unfortunately, the way the University was destroyed, we do not get much information about it. King Dharmapala of Pala dynasty in the 8th century was instrumental in establishing it. In a Tibetan history of the Kalachakra Tantra it is mentioned that Odantapuri was administered by "Sendhapas," the Tibetan referent for Sri Lankan Theravadins.

**Jagaddala University**

Jagaddala was an important Buddhist monastery located in Naogaon district of modern Bangladesh. It was founded on the banks of river Ganga, and Karatoya river in northern Bengal. By King Ramapala (AD 1077–1129). This was a centre for the study and dissemination of Tantric Buddhism. It followed the methods, practices, and traditions of Nalanda. Reports from the early 13$^{th}$ century indicate that the monastery continued to flourish after the destruction of Odantapuri and Vikramashila, serving as a refuge for such renowned acharyas as Abhayakaragupta nd Subhakaragupta. Vidyakara, the author of Subhashita-ratna-kosha, a famous enthology of aphorisms, had served as an abbot at Jagaddala. In the year 1027 AD Muslim invaders destroyed the university. Robert E. Bruswell and Donald S. Lopez, The Princeton Dictionary of Buddhism 2014:376).

**Somapura University**

Somapura in Bengal, now in Bangladesh in Ompur town, a large Buddhist monastery, covering an area of one sqare kilometer, was built in early nineth century by King Devapala (810-815), the son of Dharmapala who had built Vikaramashila. The mahavihara, under royal supervision was also know as Dharmapala Mahavihara of Somapura. 177 monks' cells were organised on four floors around a courtyard, built in a unique architectural style. Housing around 800 monks during the apex of its influence verifies it as one of the largest monasteries of the time. The Paharpur temple at the monastery constructed with architecturally significant elements which are not found in any other temple, either Hindu or Buddhist. Its base is cruciform, a terraced structure with inset chambers and a pyramid form which reminds us of similar Buddhist temple in Burma, Java and Cambodia. This leads to a discussion about Somapura vihara serving as a model for Southeast Asian temples. According to the biography of Atisha Shri Dipankarajnana, he had stopped at Somapura vihar on his way to Tibet. Translation of Madhyamakararatnapradipa from Sanskrit into Tibetan was done by him during his stay there. It must have been possible with the help of his Tibetan disciples who were accompanying him. It was raised to ground by Muslim invaders. (Princetone dictionary 839).

**Vallabhi University**

As a Buddhist university, Vallabhi (Valabhi), near Wala in Kathiawar in western India played the same important role that Nalanda did in the east. Its development was due to the munificent grant of the Maitraka Kings. It had about 6000 monks. It specialised in the study of the Shravakayana with each of the mainstream Buddhist schools. Mahayana was also taught there along-with Hindu and secular subjects like eighteen Shilaps or industrial and technical arts and crafts as mentioned with regard to the schools at Takshasila—Vocal music, Instrumental music, Dance, Painting, Mathematics, Accountancy, Engineering, Sculpture, Cattle breeding, Commerce, Medicine, Agriculture, Conveyancing and law, Administrative training, Archery and military arts, Magic, Snake charming, Art of finding hidden treasures. For technical education in the above-mentioned arts and crafts an apprentice system was developed. It is reported that essential details are given in the Naradasmriti. Two famous masters of Yogachara school— Gunamati and Sthiramati held prominent positions before they left for Nalanda. When Chinese monk Hsuan Tsang visited, there were six thousand monks residing in around a hundred buildings. (Princeton pg. 958) It flourished from 475 to 1200 AD almost as a rival of Nalanda.

**Great Acharyas**

A number of great acharyas of India studied at ashramas and gurukulas. Their contribution to humanity is immense. In ancient times Kanchipuram was an internationally famous centre for education. It received a number of students and sent Acharyas abroad. Seekers of knwoeldge travelled from one university to another to study under eminent acharyas. Bodhidharma carried the knowledge of Dhyana yoga, martial arts and Marma therapy to China and later they were developed in their own way in all the east Asian countries – China, Korea and Japan. The ancient Tamil rulers and aristocrats were keenly devoted to education. They took it as their duty to develop it and help people to remove the darkness of ignorance. This resulted in high standards of literacy. Hindu, Buddhist and Jain centres had huge libraries. Pallavas patronised both Sanskrit and Pali at the institutions. Buddhism was disseminated to several countries. Great epics like Shilpadikaram and Manimekhalai were composed by them.

**Shankaracharya** was a Namabudari brahmana, from Kaladi in Kerala. He travelled far and wide in search of a worthy guru. Finally, he reached the Ashrama of Govinda Bhagavatpada and studied the Prasthana trayee. During his stay there he wrote commentaries on Badarayana's Brahma Sutras, the various Upanisads and the Bhagavad Gita, commented upon the various other texts including the Vyasa's bhasya to Patanjali's yoga Sutras. His school of thought is called 'Advaita' –that which is non dual.

**Ramanujacharya** is the formulator of Vishishtadvaita school. He, born in 1011 C.E. at Sriperumbudu, went to Kanchipuram for education under Guru Yadava Prakasha who had propounded his own school of Advaita known as Yadavadvaita. But the thirst for knowledge of Ramanujacharya forced him to move on. So, he gained the entire fundamentals and rudiments of the thoughts of Sri Yamunacarya. At the age of sixty Ramanuja started writing the commentary on the Brahma Sutras under the title `Saririka Mimamsa Bhashya'. He travelled all over the country and visited almost all the famous places of pilgrim. He was instrumental in establishing the five famous Narayana temples in Karnataka with the assistance of the Hoysala King Visnuvardhana. He wrote nine works— 1.Vedartha samgrahah, 2.Saririka Mimamsa Bhasyam or Sribhasyam, 3.Gitabhasyam, 4.Vedantadipah 5.Vedantasarah, 6.Saranagati gadyam.7.Vaikuntha gadyam 8.Sriranga gadyam 9.Nityagranthah.

**Srimad Anandatirtha** also known as **Madhvacarya** is the founder of Dvaita Vedanta. He was born in a village called Pajaka ksetra, about eight miles southeast of Udupi in

Karnataka; became a Sannyasin when he was only sixteen years old. After studying the Vedas, Shastras and Advaita classics like Ishtasiddhi from a guru Acyutapreksa, he realized that he was not satisfied with the existing interpretations of the Brahma Sutras, Upanisads and the Gita. So, he studied the entire sacred literature independently including Itihasa and Purana. He traveled all over India, and visited famous centres of learning, went to Badarikasrama to present his Gitabhashya to the sage Vedavyasa and received his blessings. He established temple at Udupi. His wrote commentaries on Brahma Sutras- Brahmasutra Bhasya, the ten principal Upanisads, Bhagavad Gita, on the first forty hymns of Rg Veda, ten prakaranas, a book on meditation and worship, some stotras, commentary on Brahma Sutras viz. Anuvyakhyana in two thousand verses.

**Spread of Indian Education System Abroad**
**Indonesia**

Like India the purpose of education in Indonesia spiritual advancement. Prominent intellectual figure in Indonesia lived in sacred places and villages. They studied Vedas, Upanishads, philosophy, life cycles at macro and micro levels. Tantra was taught to explain tattwa, Mantra, moksha. In order to understand the mysteries of creation of nature, surrendering the self out of devotion, becoming one with the absolute, becoming energised, and empowered. They were taught jnana, bhakti and karma marga. There were rishis and their shishyas who studied under maharshis called mahagurus in mandalas. The education given by the rishis reached from palaces to the common man and eventually was used as the basic curriculum. It included sacrificial acts, Vedas, philosophy of creation, knowledge about the highest to unite the jiva with paramatma, various areas of skills, ceremonies, mantras, chants, prayers for sick, beating spirits, giants and desires etc.

Formal and informal education as an institution for cultural development could be both individual and community levels (Hariani Santiko 1990:156-171). Purpose of education was the purpose of society which included spiritual humanism dharma, arts, literature, ritual, administration, governance etc. Gurus used to live alone in forests or on mountains. Ashramas and mandalas are found on Gunung Penanggungan and vihara existed since 7$^{th}$ century at temples like Sari and Plaosan. They were like retreats classified by the number of people and type of community called rsi, Saiva, Sugata, bhairava, tyaga, kasturi etc. Apart from composing literary texts they wrote tuturs and carved reliefs to instruct. Mandalas had their board of education. Poets and doctoral candidates used to go from one mandala to another for shatrartha. Rishis used to travel far and wide. People in search of knowledge went as pilgrims to discuss with the enlightened ones. These places were ideal for samadhi as described by literary sources called kakawins – wanashramas, patapan, paajaran, parhyangan etc. 8$^{th}$-9$^{th}$ century ruins of viharas indicate presence of various kinds of educational intitutions. Even King Airlangga had quitted his throne and to become a retreater, as a sanyasi. Depending on their areas of expertise they were artists, academicians, acharyas and counsellors. Pamget and samget were the terms used for graduation and post graduation. During Majapahit times janggan meant a doctoral student. They could opt for further as professional called Mpu. Atisha was a great master; he had studied under several gurus but still he travelled to Sumatra to study under Guru Dharmakirti. Itsing, a Chinese pilgrim on his way to India had stayed for six months in Java to study Sanskrit grammar. According to an inscription Shivasoma, the guru of King Indravarman (AD 878-887) of Cambodia, came to study shastras in India under Bhagavat Shankara (Adi Shankara). The inscription was erected on the occasion of installing a statue of Lord Bhadreshvara. Ashramas were built attached to temples there for training and educating as centres for meditation and discussions for betterment of society. They resounded with the chants of akahnda patha of Ramayana, Mahabharata and Puranas. They used to offer prayers even to great authors like Jaimini. Following Indian regulations, inside the ashramas violence, using ceremonial umbrellas, or entry of pets was prohibited. Wise and famous brahmanas held high positions but were leading life like sages and ascetics.

Royal families in **Thailand** were responsible for education in a traditional style. One of the earliest forms of education began when King Ram Khamhaeng who had invented the Thai alphabet in 1283 basing on Southern Indian scripts. Stone inscriptions from 1292 depict moral, intellectual and cultural aspects. During AD 1238-1378 education was dispensed by the Royal Institution of Instruction (Rajabundit=Rajapandita) to members of the royal family and the nobility, while commoners were taught by Buddhist monks. From 1350 to 1767 during the reign of King Narai the Great (1656-1688), the prosody of Thai language and official forms of correspondence was written by a monk, Pra Horatibodi. Narai was a poet, and his court became the centre where poets congregated to compose verses and poems. The Buddhist Sangha, during the reign of King Rama I (1782-1809), worked for the development of public education.

India acknowledged as cultural leader of the world was famous for its centres of higher learning disseminating all kinds of knowledge depending on the ability and capacity of those who were hungry for knowledge. Students and scholars used to throng from several countries. There is information about Buddhist universities but the systems and history of education system developed at ashramas and mathas needs further research. Their contribution to other countries is another field of research. Universities outside India used to develop their curricula following the patterns of Indian Universities. There is a lot of scattered information in Greek, Chinese, Tibetan and other historical chronicles.

## Concluding Remarks

The article delves into the rich history of ancient Indian universities, highlighting renowned centers of learning such as Nalanda, Vikramashila, and Takshashila. It explores lesser-known institutions like Jagaddala, Somapura, and Vallabhi, which played pivotal roles in fostering intellectual exchange and preserving cultural heritage. The contributions of eminent acharyas like Bodhidharma, Shankaracharya, Ramanujacharya, and Madhvacarya are celebrated for their profound impact on philosophy and spirituality. Additionally, the article examines the spread of Indian educational principles to countries like Indonesia, Thailand, and Cambodia, underscoring India's enduring influence as a cultural and educational powerhouse. Overall, it calls for further research into ancient educational systems and their global ramifications, reaffirming India's status as a beacon of knowledge and wisdom throughout history.

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# 30

# RE-IMAGINING TECH-POWERED HIGHER LEARNING IN INDIA: WAKING TO WISDOM

**Dr. Payel Sen**

*While NEP 2020 has been a strong advocate for tech-enabled learning methods to enhance the quality and accessibility of education, digitization of higher education in India actually presents a dual narrative of challenges and opportunities amidst the country's rapid technological advancements. Besides shedding light on the key challenges such as infrastructural gaps, unequal access, institutional/faculty resistance, digital divide, data security, etc, the article also celebrates the promise of technology to revolutionize learning paradigms, democratize educational access and drive socio-economic development in the current age. The insights offered therein will serve as pertinent resources for shaping discussions, informing strategies, and driving initiatives aimed at advancing digital transformation in Indian higher education within the framework of NEP 2020.*

***Key Words:*** *Digitization, NEP 2020, Higher Education, Sustainability, Inclusivity*

## Introduction

The rapidly transforming world is radically reshaping the face of higher education in profound ways. Universities, once bastions of knowledge dissemination, are now viewed as dynamic and adaptive ecosystems with contours stretching beyond the realm of academia to engage with the broader community and industry. In navigating the currents of globalization, technological advancements and shifting societal expectations, it is imperative that universities today reinvent themselves to emerge as catalysts for innovation, incubators of change and drivers of global connectivity. Transcendence of geographical boundaries besides prompting international collaborations and cultural diversity, is also intensifying the need to prioritize vocational and experiential dimensions of learning to cater to the rising demand for practical skills, industry readiness. In the wake of the ongoing digital revolution one witnesses a steady expansion of educational access mediated through online learning, personalized content and adaptive technologies, a process sped up significantly by the COVID 19 pandemic (Joshi: 2021). Being exposed to an unmatched amount of tech-driven devices such as smartphones, social media and internet in everyday life, there is a rising interest among youth in using technology as a tool to assist learning (Bharucha: 2018).

Against this general backdrop of these global influences, the paper, divided into four parts, delves into the contemporary shifts in the nature and role of Indian universities amidst digital disruptions in the post Pandemic era. Sections 1 and 2 of the article sheds considerable light on the evolving Indian higher education landscape, its changing direction and priorities, with special reference to the NEP 2020 reforms imperatives. Subsequently, drawing attention to the key challenges confronting Indian higher education, Section 3 unlocks the transformative potential of digital technology to navigate them. Finally, Section 4 analyzes the major impediments to the seamless integration of technology in Indian higher educational institutions urging the need for a holistic approach and a firm commitment to creating a technologically adept and resilient higher education ecosystem as a tool for empowerment and inclusivity.

**The Changing Face of Indian Higher Education**

India's evocative response to the global educational transformations finds its most expressive articulation in recent times in the announcement of India's National Educational Policy (NEP) 2020. Guided by a firm intent to reconfigure the education system in India, the spirit of NEP 2020 also conforms to the national commitment to further UN Sustainable Development Goals (SDGs), particularly, Goal 4 (SDG4) which focuses on equitable access to inclusive and quality education and promotion of life-long learning opportunities. It gives a clarion call to align teaching and research with SDGs. The aspirational document seeks to reposition the country's education system by making it resilient, adaptive, globally competitive, and reflective of contemporary educational philosophies. India's active engagement with the G20 member nations along with the valuable insights drawn from global educational practices, emerging technologies and evolving pedagogical approaches, have contributed greatly to enriching the vision of NEP 2020. Inspired by the global influences, NEP 2020 envisions an educational system that promotes inclusivity, autonomy and innovation- the principles championed by the G20 forum. It emphasizes on the adoption of a multidisciplinary and flexible approach in alignment with educational practices in countries like Finland, Singapore and Canada that recognize the interconnectedness of knowledge domains. The policy prescriptions also effectively address the demands of a rapidly changing global economy, with an increased focus on skill development and vocational education. Sharing of global perspective resonates deeply with the encouragement of internationalization, collaborations and establishment of foreign campuses to foster a more interconnected educational landscape. In cognizance of the potential of technology in addressing myriad societal challenges, the

Policy envisages establishment of the National Educational Technology Forum (NETF), to operate as a platform for free exchange of ideas on the use of technology to enhance learning, assessment planning and administration for higher education. The creation of the Academic Bank of Credit (ABC) enabling digital storage of academic credits earned from various HEIs to facilitate the grant of degrees based on credits earned over a period of time, is also a progressive step in this direction. There is a clear focus on utilizing technology to ensure efficiency and transparency of regulatory bodies such as the Higher Education Commission of India as well as its four verticals (National Higher Education Regulatory Council, National Accreditation Council, Higher Education Grants Council and the General Education Council).

In alignment with the global educational trends and the enlightened NEP 2020 vision, the Indian higher education landscape is undergoing significant transformations in recent times, marked by a steady shift towards digitization, increased emphasis on skill-based learning along with a growing focus on research and innovation. Increasing global interconnectedness is greatly influencing our educational practices and standards. The constantly rising demand for a skilled, adaptable and agile workforce in the global market urges Indian institutions to align their curricula with international standards. Within the highly competitive global knowledge economy, there is an increasing pressure on Indian universities to remain relevant, competitive and attract international students. Advances in digital technology coupled with proliferation of online learning platforms are enabling seamless exchange of knowledge across borders, fostering a more collaborative and accessible learning environment. There is also a growing incline towards international collaborations between Indian and foreign universities towards promotion of cross-cultural learning experiences and research partnerships. Moreover, in cognizance of the value of vocational and industry-relevant skills, one witnesses strengthening of collaborative engagements between academia and businesses.

With the fast-paced digital transformation sweeping the nation, the concept of a digital university is gradually gaining in prominence as a pivotal higher education innovation. Driven by the power of technology, digital universities transcend traditional barriers to offer accessible, flexible and life-long learning opportunities to a diverse array of students. This model, by fostering a culture of continuous skill development, and innovation, aligns with the country's vision of becoming a global knowledge hub. Moreover, in the context of G20, where education stands crucial to promoting economic growth, stability, global cooperation and sustainable development, the role of digital universities further expands in its scope especially in view of the contribution they can make towards the development of skills and entrepreneurship, strengthening India's position as a knowledge economy powerhouse within the G20 community.

## Major Government Initiatives Toward Digitization of Higher Education

The Indian government, in tandem with the international benchmarks and imperatives, has launched a series of strategic initiatives to propel the digital agenda forward. The National Mission on Education through Information and Communication Technology (NMEICT) stands as a pivotal initiative aiming at technological empowerment. NMEICT seeks to bridge the digital divide in education and enhance the quality of learning experiences across the country. NMEICT envisions creation of a networked and knowledge-rich society, fostering research and innovation in the educational realm. This comprehensive mission encompasses a spectrum of projects and sub-missions that include the establishment of virtual classrooms, e-content development, and the provision of high-speed connectivity to educational institutions. Under NMEICT, SWAYAM, the country's national Massive Open Online Course (MOOC) platform was created in 2003 to offer free online high-quality courses across various disciplines and degrees from Indian institutions. The digital repository hosts video lectures, interactive quizzes/assignments, self-paced learning materials and other multimedia resources, providing students with greater flexibility, accessibility and expanded learning opportunities. The SWAYAM educational platform currently has the largest enrolment base, with the total enrollment rising steadily from 31 lakh in 2017 to more than 72 lakh by the end of 2023.

Since 2021 the University Grants Commission (UGC) allows universities to offer to students nearly 40 percent of courses per semester online via the SWAYAM platform. More recently, in February 2024 the Swayam Plus platform was launched to offer a range of employability and professional development-focused programmes in sectors including manufacturing, energy, computer science and engineering, IT or ITES, management studies, healthcare, hospitality, tourism besides Indian knowledge systems. These courses collaboratively developed with leading industry players (that include L&T, Microsoft and CISCO) seek to enhance students' employability and lifelong learning opportunities. The establishment of Swayam Plus weaves an inspiring tale of industry-academia partnership, showcasing a rich blend of academic rigour and real-world relevance. Multilingual content, AI-enabled chatbot to assist the students and credit recognition are some of the highlighting features of the SWAYAM Plus platform.

Complementing Swayam, Swayam Prabha exemplifies the government's commitment to democratizing education, breaking geographical barriers and nurturing a culture of lifelong learning. Swayam Prabha leverages Direct-to-Home (DTH) television channels to broadcast educational content, ensuring that students with limited internet access can benefit from the courses. The National Digital Library of India is another initiative launched by the government, which provides students and educators with access to a vast collection of digital resources, including books, journals, and research papers. In 2015, the e-PG Pathshala portal was launched to host high quality curriculum based interactive e-contents in Indian languages such as Hindi, English, Sanskrit and Urdu. M VIDWAN is a premier database portal of profiles of scientists and faculty members working at leading academic institutions and R&D organizations. By sharing their address, experience, publications, achievements etc, VIDWAN database helps identify resource persons, experts or research collaborators in respective fields.

Synergizing with the aforementioned endeavours, the Academic Bank of Credits (ABC) has been conceptualized and established under the NEP 2020 as a digital repository of academic credits earned by the students across various courses and institutions. This innovative mechanism, besides promoting a flexible and learner-centric approach, also facilitates seamless credit transfer and accumulation. ABC as a digitized credit system aligns with the broader digitization agenda, fostering interoperability and transparency in academic transactions. The empowering initiative enables students to access their academic records online, providing them with a greater control over their educational journey.

In addition, the government has also launched several initiatives to bridge the digital divide and improve internet connectivity in the country. The Digital India program, for example, aims to provide high-speed internet connectivity to every citizen of India. Also, several initiatives have been launched to provide digital devices to students from underprivileged backgrounds, ensuring that they have access to the necessary hardware and software to participate in digital learning. The government, under the Rashtriya Uchchatar Shiksha Abhiyan (RUSA) initiative, extends financial support to educational institutions for upgradation of their infrastructure and technology capabilities, including digital infrastructure.

Regulatory bodies such as NAAC are increasingly encouraging better digitalisation and technological adaptation in universities and colleges. The recent NAAC accreditation reforms have attempted to digitize the entire assessment and accreditation process to bring in more objectivity, making it mandatory for the Universities to go for e-documentation to comply with requirements of the NAAC assessment and accreditation (Rana S. and Kaur, D. 2023).

**Revisiting Contemporary Challenges and Key Concerns**

The fast-paced changes triggered by global influences on the Indian higher education system unravel a multitude of challenges spanning across various dimensions. With the vastness of size and diverse population, our country is struggling hard to offer quality education to all. First, in attempts to align with the global educational standards, the institutions of higher learning are constantly at a risk of dilution of traditional knowledge systems along with a neglect for the value of local context in curriculum design. The drive towards internationalization of higher education is impregnated with the hovering threat of cultural imperialism, especially with respect to the overshadowing effects of the dominant Western educational paradigms over diverse local knowledge systems as it may lead to a lack of diversity in perspectives and approaches, potentially limiting creativity and innovation in academic research and teaching. To avoid homogenization of academic content and experiences, there is an urgent need to strike a right balance between incorporation of global best practices and preservation of the country's rich cultural heritage of education.

Another significant concern stems from the rapid integration of technology. While technological advancements offer opportunities for innovation and access to a wealth of information, they also go on to widen and deepen the existing disparities. Rural areas often lack necessary infrastructural and resource support for seamless integration, leading to a yawning digital divide between urban and rural students The Inequality in access can hinder the educational progress of students from marginalized categories exacerbating socio-economic disparities. Access to quality online resources and infrastructure also remains a critical bottleneck, hindering the equitable distribution of educational opportunities.

Pursuit of global competitiveness coupled with mounting pressures to conform to global rankings skew institutional priorities thereby posing serious financial constraints. As academic institutions work with an aim to enhance their global standing, they exhibit a tendency to prioritize areas and activities that enhance their global ranking such as infrastructure development, research facilities/outputs and foreign faculty recruitment to meet international benchmarks. This shift in focus can impact the overall educational experience for students and the responsiveness of higher education to domestic challenges. As participation in global networks and meeting international standards often require substantial investments, this often comes at the expense of imparting quality teaching. The consequent hike in tuition fees can make quality education financially inaccessible to a chunk of the country's population. The ongoing commercialization of education, if left unchecked, may eventually lead to a scenario wherein education becomes a privilege rather than a right, with only a select few retaining power to afford the best education.

Quality assurance complexities set forth a critical barrier. While international collaborations can enrich academic environments, ensuring consistent quality across diverse partnerships is complex. Also, concerted efforts towards harmonizing academic standards, accreditation, assessment methods, grading systems, evaluation criteria and faculty qualifications across highly differentiated cultural and institutional contexts becomes essential to maintain the integrity of degrees and certifications, preventing a situation where the perceived value of Indian degrees varies widely on the global stage.

**Technology as a Transformative Force in Managing Indian Higher Education Challenges**

In essence, as the institutions of higher learning in India metamorphose to meet the challenges of contemporary times, technology emerges as a linchpin in this transformative journey. Leveraging technology opens up a range of possibilities that may significantly contribute to mitigating the challenges discussed in the preceding section. By embracing the power of technology, universities can not only adapt to change but also lead the way in reshaping the future of education, research, and societal impact. The range of tech-driven innovative solutions can go a long way in making learning dynamic, accessible and finely attuned to the demands of the contemporary world (Alenezi: 2021).
One key strength lies in the increased accessibility facilitated by online learning platforms. Technology, in this regard, offers a scalable solution, allowing Universities to offer a variety of courses to a larger constituent of students besides providing them with a level of support that may not be possible with in-class teaching within brick-and-mortar institutions (Papachashvili: 2021).

The traditional barriers of geography and infrastructure can be largely overcome with students accessing educational resources from anywhere with an internet connection (Bharucha: 2018). This is particularly relevant in a land of sheer size like ours, where remote and far flung areas may lack educational infrastructures. Online courses and digital resources will go a long way to ensure that knowledge is disseminated widely, reaching out to students who may otherwise possess limited educational opportunities. Greater access is also facilitated by democratization of information and knowledge dissemination. Open Educational Resources (OER) and Massive Open Online Courses (MOOCs) by offering free or affordable access to high quality educational content narrows the digital divide and ensures that a broader spectrum of the population, including those with limited financial resources, can benefit from the educational opportunities Bordoloi and Das: 2020, .

Digital technologies can also circumvent systemic challenges particularly, with respect to the dearth of teachers. The Indian Universities currently struggling with faculty shortage may embrace online learning wherein one quality teacher can reach out to many students at a time. Technology also aids in resource optimization, reducing costs associated with conventional educational delivery. Setting up Virtual classrooms requires relatively lower investment as compared to establishing physical campuses. E-books, e-journals and digital libraries minimize the need for physical learning resources, making education more sustainable and cost-effective. Cloud-based solutions offer scalable infrastructure for educational institutions. This adaptability allows Universities to efficiently manage varying workloads, handle increased data storage needs, and deploy applications without significant upfront investments in hardware.

Furthermore, technology enables enriched and personalized learning experiences through adaptive learning systems. These systems use relevant data and algorithms to tailor educational content to individual students, addressing their specific needs and learning styles. Adaptive technologies in the form of virtual labs, interactive multimedia content and simulations help ensure that students receive a customized learning experience, fostering better understanding and retention of the material. Additionally, incorporation of gamified elements in educational platforms make learning both enjoyable and engaging. Bringing in game-like features such as quizzes, challenges and rewards keeps students motivated and elevates their overall learning experience that complement the traditional classroom instruction.

Also, online platforms and modular courses offer flexibility in learning paths allowing students to choose courses based on their inclination and career goals. Adaptability caters to diverse learning preferences and supports non-traditional students such as working professionals aspiring for further education. Virtual classrooms allow flexibility in schedule lectures and access course materials at their convenience, thus enabling learners to pursue higher education while balancing other obligations. Advanced analytics tools track individual student progress and map learning patterns and engagement metrics. Educators can use these insights to tailor teaching methods, identify areas of improvement and offer targeted support to students, contributing to a more personalized and effective learning experience.

Technology also plays a vital role in fostering a culture of innovation within the higher education institutions. Virtual Reality (VR) and Augmented Reality (AR) applications create richer and more immersive field-specific learning experiences, especially in the domains of sciences, engineering, medicine, archeology and architecture. These technologies enhance practical skills and provide a simulated environment for students to apply theoretical knowledge, preparing them for real-world challenges.

Collaboration is another area wherein technology has the potential to drive excellence. Within the virtual classrooms, discussion forums and interactive tools can break-down physical barriers to promote interaction among students and educators. It is of immense use in large-sized classes, as it encourages the exchange of fresh ideas and sharing of diverse perspectives. Collaborative and social learning platforms enable students to interact with peers, share knowledge and participate in group discussions. These collaborative technologies inculcate a strong sense of community among students which not only enhances their learning experience but also prepares them for a globalized world where effective communication and team playing abilities are essential skills.

While efficient administration stands critical to effective management of higher education institutions, technology helps streamline various administrative processes. Automated systems for admissions, registration and grading besides reducing manual overload, also minimizes arrows and saves time. By streamlining the application and disbursement processes for scholarships and financial aid, digital platforms ensure that deserving students receive timely support and assistance, addressing financial barriers to education. AI-powered chatbots and automated support systems assist students with queries related to admissions, course selection, and administrative processes. Implementing blockchain technology ensures the security and authenticity of academic credentials. By simplifying the verification process for employers and other institutions, this innovation reduces the scope of fraudulent practices, enhancing the authenticity of degrees and certifications. This efficiency is crucial for handling the administrative complexities of a large and diverse education system, allowing institutions to focus more on improving the quality of education, communication mechanisms and levels of student satisfaction.

E-assessment tools and online examination systems streamline the assessment process. These platforms not only reduce administrative burdens but also enhance the integrity of assessments through features like remote proctoring and plagiarism detection. Adaptive testing methods, by allowing for adjustments of the difficulty-level of the questions based on the student's performance, ensures a fair and transparent evaluation process by reflecting a more accurate assessment of a student's abilities and reinforces the credibility of the education system. Technology enables instant feedback on assignments and assessments, fostering a dynamic learning environment. Real-time feedback loop helps students understand their strengths and weaknesses, promoting continuous improvement and a more personalized educational experience.

Furthermore, technology strengthens research capabilities in higher education. Increased access to online databases, research tools and collaborative platforms facilitates research collaborations among institutions and scholars. This not only contributes to achieving the country's academic development but also positions Indian higher education as a key player in the global research community. Technology accelerates the pace of research and innovation, enabling researchers to stay abreast of the latest advancements in their fields. This apart, virtual collaboration tools facilitate international collaborations among faculty, students and researchers. Global perspective and connectivity give a boost to the quality of education imparted by exposing students to diverse perspectives, research methodologies and cultural insights, preparing them for a connected and globalized workforce.

Skill enhancement aligned with industry needs is a pressing requirement for higher education in India. Technology plays a pivotal role in offering courses and training programmes that are relevant to the demands of the job market. Online platforms, virtual labs and simulations provide students with practical experience, bridging the gap between academic learning and its real-world applications. Industry exposure is also facilitated through virtual internships which successfully connects students with industry professionals and workplaces remotely. The alignment with industry needs, by making rendering students more employable, addresses the twin challenges of unemployment and underemployment. In times of crises, such as pandemics or natural disasters, tech-mediated virtual classrooms and Universities can ensure learning continuity and resilience by allowing higher education institutions to quickly transition to online learning.

Continuous professional development of educators is also facilitated through technology. Online workshops, targeted training programmes, webinars and collaborative platforms enable educators to stay abreast of the latest pedagogical innovations and domain developments. Regular and ongoing training efforts ensure that educators are well-equipped to deliver high-quality and up-to-date content to their students, contributing to the overall improvement of the education system.

Going beyond the digital realm, technology supports eco-friendly practices. Higher education institutions can adopt virtual classrooms, reduce paper usage through digital assignments, and implement energy-efficient systems, advancing sustainability efforts in higher education.

Also, with new players making their way into the online space to compete with the renewed digital initiatives of more traditional institutions, the disruptive effects of new technologies are increasingly felt on the learning structures, processes and practices worldwide. While a wide range of higher education offerings, both online and offline, unpack an expanded set of choices and new learning opportunities, it also unravels complex decision processes especially in terms of intelligently choosing between online and offline programmes. The rapid pace of technological advancements poses a grave challenge in ensuring that academic curricula remain relevant and up-to-date. This apart, balancing the integration of technology with preservation of essential aspects of a comprehensive education remains an ongoing struggle.

**Barriers to Seamless Integration of Technology in Indian Higher Education**

While technology has great potential to revolutionize higher education in India, it also presents a myriad of challenges that merit careful consideration. Following are some of the key factors that impede the seamless integration of technology in Indian higher education:

**Socio-Economic Factors**

**(a) Availability & Access:** Digital divide remains a teething problem. India's vast and variegated landscape is mirrored in regional variations in educational infrastructure and access to technology. While urban areas boast robust technological infrastructure, rural regions often lack necessary internet connectivity, access to bandwidth and devices. Many educational institutions, especially those in the rural areas, lack the necessary infrastructure and resources to support advanced technology. Insufficient funding, outdated facilities and lack of technical support often dampen the efforts to implement tech-driven initiatives. This creates a stark imbalance, hindering students in remote areas from availing the benefits accruing from online educational platforms. The disparity exacerbates existing opportunities in educational opportunities, raising serious concerns on the 'inclusivity' of tech-driven education initiatives.

**(b) Affordability:** The issue of affordability of technology remains a significant hurdle as the socio-economic divide exacerbates the digital divide, hindering access to technology for economically disadvantaged students.. A large number of students from underprivileged backgrounds with limited financial means struggle to purchase devices or afford high-speed internet connections or data plans. This economic barrier can impede their participation in online classes, hindering their access to educational resources and along with their academic progress.

**(c) Quality Concerns:** While the recent rise in online degrees and courses are providing learners with enhanced flexibility and access, this runs the risk of diluting their quality and credibility. It is, therefore, essential that online courses and degrees meet the same standards as traditional educational institutions and are recognized by employers and universities.

**(d) Employability Divide:** Given the yawning socio-economic disparities in the students' exposure to technology and digital skills, those from more affluent backgrounds may have better access to supplementary technology courses and resources, giving them a competitive edge in the job market. Contrarily, lack of exposure to such tools may constrict the ability in students to compete in industries with evolving technological requirements.

**Cultural Factors**

(a) **Resistance to Change:** Adaptability of educators to technology remains a major cause of concern that impedes the widespread acceptance and seamless integration of technology in classrooms and online learning environments, impacting the overall quality of education. While younger generations may be tech-savvy, many educators, particularly in older age groups, may struggle with incorporating technology effectively into their teaching methods. Besides the digital literacy gap among educators, cultural norms and traditional educational values may also resist the rapid adoption of technology.

(b) **Linguistic Divergence:** India's linguistic diversity adds another layer of complexity with respect to the integration of technology. As many online educational resources are primarily available in English, this potentially excludes those who are more comfortable with regional languages/vernaculars. Also, most technological tools and educational platforms being often designed in English, can hinder effective communication and comprehension, limiting the reach of technology-driven educational initiatives and solutions.

(c) **Gender Disparities:** Gender biases and cultural taboos may have a bearing on the equitable distribution of technological resources. In some cases, girls may face societal expectations that prioritize their roles in the hitherto traditional domains, potentially limiting their access to and participation in technology-driven education.

(d) **Parental influence:** A student's educational choices may often be conditioned by parental expectations and preferences resisting the shift towards technology-driven learning. Overcoming such cultural expectations requires a shift in perception and awareness of the benefits of digital education.

**Institutional Factors**

(a) **Status-quoist culture:** Institutional cultures often resist change, and the integration of technology requires a significant shift in mindset. Faculty and administrative staff may be resistant to embracing new teaching methods or administrative systems, posing a challenge to the successful implementation of technology in academic processes.

(b) **Training and Development:** While creation of adequate training and professional development opportunities for educators is critical, institutions may face challenges in organizing effective training programmes to enhance digital literacy among faculty members, making it difficult for them to fully utilize tech tools in their teaching practices.

(c) **Standardization and Compatibility:** The lack of standardized technology platforms and compatibility issues among different systems can create obstacles. Therefore, institutions often struggle to establish a cohesive technological framework that aligns with curriculum requirements and facilitates seamless communication among various departments.

(d) **Budgetary Constraints:** Financial constraints can limit the capacity of educational institutions to invest in the latest technologies. The cost of acquiring and maintaining cutting-edge hardware, software and infrastructure may strain institutional budgets, impacting ability to provide a technologically enriched learning environment.

(e) **Data security and privacy:** Safeguarding sensitive student and institutional data is of paramount concern. This necessitates educational institutions to implement robust cybersecurity measures to protect against data breaches and ensure the privacy of students and staff. Establishing and maintaining these security protocols may pose a complex challenge.

(f) **Scalability:** As institutions grow, implementing technology solutions that can adapt to the increasing number of students, faculty and administrative staff without compromising on the efficiency and performance is a vital consideration for sustainable technological integration.

(g) **Assessment and Evaluation:** The institutions often face the challenge of developing fair and effective evaluation systems that accurately gauge students' understanding and skills in a digitally-driven learning environment.

## Concluding Remarks

In the labyrinth of Indian higher education, the transformative potential of technology is undeniable. The transformative power of education, amplified by technology, has the potential to bridge socio-economic gaps and empower individuals across diverse cultural landscapes. As Arthur C. Clarke aptly noted, "any sufficiently advanced technology is indistinguishable from magic." Indeed, the magic lies in the promise of revolutionizing education, breaking barriers and democratizing knowledge. Technology upholds the promise of an experiential revolution that transcends traditional boundaries. Digitization aligns with NEP 2020 mission to foster holistic learning environments, empowering learners to shape a brighter future.

However, the fusion of technology and Indian higher education is an achievement still waiting to unfold as this journey towards innovation is not without its share of challenges. A number of socio-economic, cultural and institutional hurdles stand as formidable gatekeepers. The challenges being as real as aspirations, surmounting the odds calls for a collective commitment and a concerted effort towards inclusivity- i.e, ensuring the last mile delivery.

The potential exclusionary effects notwithstanding, embracing diversity, fostering a culture of adaptability and prioritizing inclusivity are the cornerstones of successful transition to a technologically enriched education system. Therefore, in navigating the intersection of promise and impediment, the Indian higher education institutions must re-emerge as leaders in innovation, thoughtfully adapting their practices to the evolving technological landscape. This requires concerted efforts encompassing several key strategies. Investment in necessary infrastructure and technology upgrades is essential to ensure reliable internet connectivity and access to digital devices for both faculty and students.

Collaborating with industry partners can help align curriculum with evolving job market needs and foster the development of relevant digital skills among students. Furthermore, incentivizing research and innovation in educational technology can drive the creation of indigenous solutions tailored to the unique needs and contexts of the Indian higher education landscape.

To leverage the potential of technology in education a harmonious fusion of technological innovation, cultural sensitivity, and institutional adaptability is necessitated. Merely incorporating gadgets into classrooms will bear no fruits unless there is a fundamental transformation in the way knowledge is imparted and acquired. Thus, the need for robust cybersecurity measures and a balanced blend of traditional and online pedagogies cannot be overstated.

Creation of a conducive digital learning ecosystem within Indian higher education calls for nurturing a culture of adaptability and continuous improvement within institutions to facilitate the agile adoption of digital tools and strategies to meet the evolving stakeholder needs. Comprehensive faculty training and professional development initiatives are critical to empowering educators with the necessary skills and knowledge to effectively integrate technology in the teaching-learning process. Through ongoing training and support, faculty members can enhance their digital literacy, pedagogical practices and instructional design capabilities, thus driving attainment of superior learning outcomes and improved educational experience for their students. Curated faculty development programmes foster a culture of collaboration and continuous improvement, enabling educators to collectively explore and adopt best practices in digital teaching methodologies, curriculum design, assessment strategies, and student engagement techniques tailored to the unique needs of Indian higher education settings. Thus, by investing in faculty development, institutions can ensure that educators are well-equipped with relevant tech tools and resources to navigate the challenges and opportunities of the digital age.

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# 31

# INDUSTRY DRIVEN EDUCATION AND SKILLING - MODEL FOR EMPLOYABILITY AND PRODUCTIVITY

**Dr. Sunil Abrol**

**Abstract**

*The current higher education , skilling and hiring model is not working satisfactorily to make students professionally competent , employable and proficient to become entrepreneurs. HEI's are producing large number of unemployable degree holders as the education is lacks outcome focus. There is need to change the current policy to an employer/ market driven education model leading to integration of education, skills, jobs and entrepreneurship. Degree Apprenticeship is a well tested and practiced model in developing nations to achieve the objective. Implementation of Degree Apprenticeship model would lead to happier and economically vibrant society with youth becoming professionally competent, employable and productive to take up professional careers and entrepreneurship and employers saving hugely on hiring, training and availability of job ready workforce. The model envisages greater engagement of employers and society for which policies to incentivize them would be needed.*

**Keywords:** Higher Education, Employability, Industry engagement, Degree Apprenticeship, Entrepreneurship, Productivity, Practice School, Formative-Summative Assessment, Skills and Competencies, On the job Learning, Learning outcomes, Application of learning.

The current Education, Skilling and Hiring Model is not working enough to make students professionally competent , employable and proficient to become Entrepreneurs. The new education policy NEP2020 has identified several reasons for current state of Higher education in India and one of them is ' Less emphasis on the development of cognitive skills and learning outcomes'. Higher education in India is more input focused and hardly output/ outcome based. Students get strong conceptual knowledge but lack skills and application orientation.

Higher education plays an important role in human and societal development leading to sustainable livelihood and economic development. With India aiming to become a 50 Trillion economy and number one in the World by 2047 , role of Higher education becomes very critical to achieve that goal. The contribution of Higher education needs to be oriented to prepare well rounded professionals having, knowledge, skills, attitude and values to contribute to the Society and National economy.

**The Employability Gap**

Currently, University/ Institutions are producing a large nunber of unemployable degree/ diploma holders annually across disciplines leading to doubt about the relevance of Higher education. Students and parents spend huge money and time to acquire qualifications from HEI's which have no demand with employer. Mismatch between qualifications offered by HEI's and industry requirements is leading to frustration and social unrest. Skill certification which is linked to job role is not in demand as skilling is considered to be relevant for blue collar jobs and not prestigious in Society .

Employers do not get trained and skilled candidates against their requirements , leading to gap in demand and supply. Employers end up making huge investments of time, effort and money in selection and induction training to get job ready employees. Various studies including Mercer Mettl's India Graduate Skill Index 2023 , consistently reveal that only 45-50 % of Indian fresh graduates are deemed employable by industry standards.

**Connect Higher Education with Industry and Community**

The HEIs should reach out to industries and community to build connectivity between higher education, employability, employment and entrepreneurship as also to make higher education relevant. There is a need to match supply with demand and prepare the entire supply chain end to end. Higher education institutes need to reorient themselves to focus on industry and society's needs. Courses and curriculum need to be designed and developed in consultation with various stakeholders in society including Industry, policy makers and Society. The faculty would need to be trained to deliver teaching and learning accordingly. Getting industry and subject Matter experts from the stakeholders to teach and take courses or modules of courses would add value to students and get them to learn from real life experiences and challenges. This way the students would not only gain conceptual knowledge which is necessary to build foundation and logic but would also get exposure to expectations of the employers and acquire skills prerequisite to get hired.

**Practice Schools to promote Employability Skills**

Some of this is already happening in few universities and institutions leading to higher level of placement and branding for the institutes. A classical example of this is 'Practice School' model introduced by BITS ( Pilani ) in its degree courses where students spend 6-12 months with industry working on a project identified by employer. Students are mentored and monitored during the project execution both by BITS faculty and employer manager. This has lead to student placement mostly in organizations they go for Practice School projects. There are few examples of industry initiatives to meet their captive manpower requirements, by setting up labs in HEI's by employers eg. Intel, AMD, Microsoft etc. However, it is not enough to reach results that can be achieved by a fully academia- industry integration model of education. There is need to change current Higher Education and Skilling Policy to make Education and skilling industry driven.

**Industry Internships are a way out**

Consequent to NEP2020 , UGC has issued guidelines to Higher Education Institutes, to offer Degree Apprenticeship/ Internship embedded programs. These guidelines emphasize on the placement of students with industry during learning as part of the course and award credits for the on-the-job training and industry attachment. However, in the absence of a detailed implementation model, the concept of Degree Apprenticeship/ Internship has remained on paper and very few HEI's have actually put the policy and guidelines on ground.

Ministry of Skills Development and Entrepreneurship ( MSDE ) in order to encourage employability of skilled workers ( primarily blue collar ) has come out with National Apprenticeship Promotion Scheme (NAPS). The modified Apprenticeship Act and NAPS expect employers to engage 2.5% of their workforce as Apprentices. The scheme envisages payment of stipend to students during Apprenticeship by the employer and 25% of the stipend is proposed to be reimbursed to the employer by MSDE. The employer is expected to bear 75 % of the stipend and OJT related costs during Apprenticeship. This has not worked. The model is not attractive enough to the employers as they perceive this as both financial and effort burden on them with no advantage.

**Map Best Practices in Leading HEIs**

There is need for India to look at models for Higher Education and Degree/ Diploma/ Certificate Apprenticeship that have successfully worked in developing nations like UK, USA, Germany, Singapore, South Africa etc. Models in these countries rely greatly on industry commitment and involvement. Industry is involved in every step beginning admission to course to industry placement/ employment/ entrepreneurship. In some of these countries eg. UK, the student does not seek admission in the HEI , but seeks to register for Degree Apprenticeship with employer . Once employer accepts the student for Degree Apprenticeship, employer facilitates registration of student with appropriate HEI for Degree/ Diploma course. Thus the burden of getting admission in an HEI also shifts from student to employer. It is truly an employer driven model of higher education, skilling and employment.

The objective of Degree/ Diploma/ Certificate Apprenticeship should be to :

- Develop courses as per market needs
- Develop content and structure of courses to develop demand based skills
- Train/ engage faculty to deliver application oriented knowledge and skills
- Get industry subject matter experts to deliver classroom and OJT
- Design and develop tools for formative and summative assessment
- Give students exposure to real life experience / exposure
- Engage industry/ employers/ stakeholders at every step of education value chain
- Dynamic changes to cope with market expectations
- Continuous academia- industry exchange programs
- Industry driven research, education and employment

Industry/ Employers to see following advantages of Degree Apprenticeship :

- Testing / observing future employees during Apprenticeship to avoid misfit hiring.
- Training candidates to match industry / job specific skills
- Getting productive and job ready candidates for hiring
- Reduced induction training , time and cost
- Higher productivity for the organization
- Higher retention/ low attrition
- Greater employee engagement and commitment
- Availability of trained manpower on demand
- Better Return on Investment
- No liability whatsoever for hiring

**Degree Apprenticeship Model**

In order to overcome the employability barriers including employer acceptability of graduates passing out of universities and HEI's a model of Degree Apprenticeship is proposed. The model envisages following activities:

- Design and development of course ( including duration of classroom and on the job training ) in active consultation with prospective employers and industry experts.
- Design and development of Learning outcomes ( skills ) during On the job training/ Apprenticeship , in consultation with prospective employers/ industry experts .
- Design and development of tools and methods for Formative and Summative Assessment of learning during On the job training/ Apprenticeship.
- Design and Develop ' Train The Trainer / Assessor " course for training of On the job Trainers / Mentors/ Industry Supervisors on 'How to deliver OJT' and ' How to Assess Skills Acquired' during Apprenticeship through tools for Formative and Summative Assessment.
- Design and Develop End Point Assessment ( comprehensive test of having achieved standards for qualification )
- Development of Project Management System for execution of Degree Apprenticeship.
- Develop system for issue of Degree Apprenticeship Certificate and Skill Passport for employment.

**Design and Development of Course**

The universities and HEI's would need to develop mechanism for extensive industry involvement in deciding the courses to be offered and curriculum for the courses. This would mean course development committees to have higher representation of industry experts and employers. Have experts who are familiar with the job roles and competencies required to perform the tasks expected from the employee when hired. This strategy would achieve the objective of curriculum becoming market driven .The committee of experts would be in a better position to advise on the subjects that students need to learn and duration of on the job learning necessary to build skills and competencies.

**Developing learning outcomes of Apprenticeship**

The current Apprenticeship model is highly unstructured. The trainees get attached to industry for Summer Training/ Apprenticeship for 4-24 weeks without specific objective and plan. For Degree Apprenticeship to be successful, on the job training/ Apprenticeship will need to be highly structured and outcome driven. For that to happen, HEI's would need to consult Industry experts to detail out what the student is expected to learn during industry attachment. The industry experts need to define skills and competencies that the student is expected to acquire in order to become employable. The specific skills and competencies required to become employable will then go into the curriculum for on the job training/ Apprenticeship, distributed over the time that is available to student to learn during Apprenticeship to ensure adherence to industry expectations and requirements.

**Design and Development of Tools and Methods for Assessment**

For Degree Apprenticeship to be successful, it is necessary to ensure that the learning and acquisition of skills and competencies is happening during Apprenticeship as planned. For that industry experts would need to help in designing and developing Tools and Methods that will later be used by Employer Trainers/ Mentors/ Supervisors responsible for imparting on the job training to carry out both Formative and Summative Assessment of learning. The focus will be to assess skills and competencies expected to have been acquired during Apprenticeship.

**Designing and Development of Training of Trainer/ Assessor Module**

To ensure that the industry trainers/ managers/ mentors follow the curriculum and guide students to learn appropriate skills and competencies as per curriculum planned during Apprenticeship a structured 'Trainer Manual ' would need to be prepared and prospective industry trainers/ mentors / managers would need to undergo training before students are attached with them for Apprenticeship. The industry trainers/ mentors/ managers would also need to carry out Formative and Summative assessment for which they would need to be trained on various tools and methods to used for the purpose to ensure objectivity, consistency and transparency.

**End Point Assessment**

The objective of End Point Assessment is to do a comprehensive sample test of both Knowledge and Skills for quality assurance. Tools and methods for the same would need to be developed as per international standards and practices.

**Project Management**

To ensure smooth operation and ensuring timely completion of all activities during Apprenticeship an online project monitoring and management system would need to be in place so that timely course correction could happen if required and Management Information System available for generating reports.

**Certification and Skill Passport**

For students to establish authentically the competencies and skills they have acquired during Apprenticeship for seeking employment and career progression, students would need to get a certificate (digital/ physical). Additional option would be to give students a Smart Skills Card (Skills Passport) that would be handy, portable and reliable repository of student profile .The Skills Passport issued by IHE is a smart card that carries authenticated profile (photograph, name, date of birth, Identity ( Aadhaar ) , certificates of qualifications and skills ) that can be accessed by prospective employer through any smart phone anywhere. It has multiple advantages including identity, repository of qualifications, skills, experience etc.

The above model of Degree Apprenticeship would achieve high level of employability and entrepreneurship as the students would have acquired requisite skills and competencies for them to succeed in whatever career path they decide to choose commensurate with the skills and competencies achieved.

**Industry / Employer Commitment**

While the model above looks very attractive and ideal to meet the challenge of employability of Indian graduates, the key factor in the entire model is the engagement and commitment of employers/ industry experts for its success. They have a major role in the entire value chain. The NAPS model of skilling has not done enough primarily because the employers neither have trust in NSDC certification because of absence of their involvement, nor are they willing to spend time and energy to train students who they may not hire at the end of the day without any incentive.

Globally different models of getting employer commitment to Apprenticeship have been used. UK uses Education/ Skill levy , collected in advance from employer to be used to recoup stipend and cost of on the job training by the employer. Some other countries use Skill coupons (subsidy by Govt. ) to employers against expenditure on Apprenticeship stipend and training cost.

India currently does not have any such scheme. The Apprenticeship Act provides for 2.5% of work force to be engaged as Apprentices. The implementation of the Act is weak leading to not even 20% of the students getting engaged as apprentices. There is a need for Govt. to come out with policy that would incentivize employers to get their commitment to above model. The options are either to use existing Govt. Tax laws such as CSR Fund, Education Cess, Labour Cess to be used to cover Apprenticeship stipend and on the job training or to come out with a new policy specifically for Skilling including Apprenticeship on the lines of policies and practices in developing nations like UK, Germany ,Canada and Singapore .

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# 32

# UNIVERSITY EDUCATION FOR FUTURISTIC DEFENCE SCIENCE AND TECHNOLOGY

**Rear Admiral Kishan K Pandey, AVSM, VSM (Retd.)**

**Abstract**

*This Article deals with the role of India's higher Education through University/ Institute for contributing towards the futuristic Indian Defence Science and Technology. The Indigenous Technologies driven by ISRO and DRDO in the context of University Education have also been dwelt upon in this article. Integration of AI, ML, Quantum Computing, Cyber Security and other advanced communication technologies in the curriculum of higher education are of paramount importance. The Article also focuses on the application of modern techniques and digitalization to address the NEP 2020 Implementation, such as skill-oriented education, innovation driven research, economically viable technologies for future robust defense . The Article focusses on the overall development of sustainable ecosystem for strengthening India's strategic domains.*

**Keywords:** *University Education, Defense Science and Technology, Digitalization, Entrepreneurship*

**1.Introduction :** Strong and developing nation like India, must have robust Defence Strategy for deterrence and safeguarding our soil. In today's day and age almost all aspects of warfare are driven by Science and Technology, which are ever evolving and dynamically changing with the passage of time. Hence, Research for Development plays an absolutely important role. Further to this, research and innovation must be carried out in a timebound manner. Because the chain of activities from Research to Prototype to Administrative / Financial approval to Manufacturing to Acceptance Trials and finally Induction is extremely long winding and prolonged procedure. Hence, at each of the stages of execution, there is a need for multiple agencies to work on a given task, on a fast-track basis. For e.g. Research / Innovation work should not only be undertaken by agencies like DRDO or ISRO or R&D verticals of manufacturing units. This task should be spread across higher education organizations for timely results. Similarly, manufacturing should be spread across public and private sectors, with level playing measures.

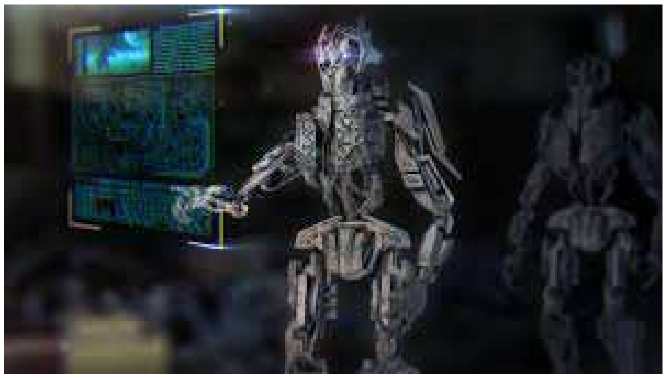
2. University education can play a pivotal role in preparing for futuristic defense science and technology requirements through a multi-faceted approach. A few of the key areas are appended in the succeeding paragraphs.

3. **Specialized Curriculum Advanced Courses**: Universities can offer specialized courses in emerging technologies such as Artificial Intelligence, Machine Learning, Space Applications, Networking Solutions, Cybersecurity, Quantum Computing, Electronic Support Systems Robotics, Missiles and Radar Technologies, Underwater Technologies, and Autonomous Systems. Further, Interdisciplinary Programs are equally important. Creating interdisciplinary programs that combine engineering, computer science, and military studies to provide a comprehensive education that addresses complex defense ever evolving challenges.

4. **Research and Development Research Centers**: Establishing dedicated research centers focused on defense technologies, fostering innovation and advanced research in every University would go a long way. Further, collaboration with Defense Agencies and Partnering with defense organizations for joint Academia-DRDO research projects, would surely be a step in right direction. Further young minds may be exploited for out-of-box solutions. Providing students with real-world problems and practical solutions would ensure concurrent and timely desired results.

5. **Skill Development Practical Training**: Offering hands-on training through labs, workshops, and simulation exercises to build tech-savvy Human Resource at the Undergraduate (UG) level itself, this would ensure practical skills, Internships and Co-ops for building skill-based manpower, which can be exploited towards research for development. This coincides with the NEP2020. Facilitating internships and cooperative

education programs with defense contractors and military organizations is yet another way forward for speeding-up the discoveries and innovations.



6. **Innovation and Entrepreneurship Incubators and Accelerators:** Setting up incubators and accelerators to support startups and innovative projects in Defense Technology at University Level would go a long way and play a catalyst role. Organizing competitions and hackathons to encourage creative solutions to defense-related problems would play a pivotal role in finding solutions in the rapidly changing technological environment.

7. **Policy and Ethical Training Defense Policy Studies:** Including courses on defense policy, international relations, and strategic studies in University curriculums would be a step in right direction. This would definitely provide a broader context to technological advancements. Teaching the ethical implications of defense technologies and responsible innovations/ patents is considered equally important for inculcating right mind-set towards Science and Technology.

8. **Continuous Learning and Professional Development Online Courses and MOOCs:** Offering online courses and Massive Open Online Courses (MOOCs) for continuous learning can yield desired results in niche Technology. Universities can also run an Executive Education Programs for updating and upscaling Defence Personal at mid level of their careers. Executive Education Providing specialized executive education programs for defense professionals to stay updated with the latest technologies and strategies.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9**. Implementation Steps Curriculum Development**: Universities can work with defense experts to develop and regularly update curricula to reflect the latest technological advancements and strategic needs. Concomitantly, Academia - Industry Partnerships shall play a central role for updates and upgrades of software solutions, in-order to keep the technologies of the day, current and updated. Building strong partnerships with defense industries and agencies for collaborative projects, internships, and funding for research is yet another important facet towards collaborative advancements in critical technologies. Funding and Resources is the backbone of any developmental efforts. Securing funding from government grants, defense agencies, and private sector to support research, labs, and educational programs by the Universities should be accorded priority. Recruiting Defence Experts is going to play a pivotal role towards Research for Development. Hiring faculty with experience in defense technology and policy, and engaging industry professionals as adjunct professors or guest lecturers may be adopted by the Universities. We often under-estimate the students. However, Student Engagement should be given its due impetus. Encouraging student participation in defense-related projects, providing scholarships and incentives for students pursuing careers in defense technology should be considered favorably. Many universities collaborate with the Defense Advanced Research Projects Agency (DARPA) on cutting-edge defense technology projects. Such collaborative approach should be encouraged by the Universities. By integrating these strategies, University Education can significantly contribute to meeting the futuristic defense Science and Technology requirements, ensuring a well-prepared workforce and innovative solutions for National Security.

**Conclusion :** The challenges being faced in modernizing Indian Defense Science and Technology Enterprise have been decades in the making. To mitigate these challenges, University Education for futuristic Defence Science and Technology is the need of the hour. A vibrant innovation ecosystem depends upon clear communication to ensure partners have accurate information and can build complementary processes to enable effective collaboration. True innovation requires novel approaches to challenging problems that often emerge in unexpected circumstances. Fostering a vibrant ecosystem that includes numerous partners and encourages cross-collaboration amongst Academia – Defence Forces – Defence Research Organizations- Defence Production Agencies; will create more opportunities for insights to emerge. There are a lot of different ways to anticipate the future, ranging from the basic question if it is worth the challenge, to the more proactive attitude of building it, through collaborative engagement between Academia and Defence Forces.

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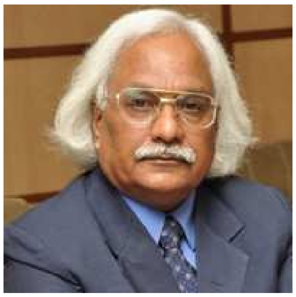
# Brief Profile of Contributors



**Prof. P B Sharma** is an eminent academician, founder Vice Chancellor of Delhi Technological University, DTU and RGPV and past President of the Association of Indian Universities, AIU. A renowned thought leader and an institution builder Prof. Sharma has been an eminent member of CABE and also Chairman of Central Counselling Board of Ministry of Education, Govt of India and currently is Vice Chancellor of Amity University Gurugram. A passionate researcher, innovator and a champion of quality and relevance of higher education and research, Prof. Sharma during his 55 years of academic and research career has made a profound contribution to policies and programs of higher education. An Ambassador of Peace of Universal Peace Federation, Prof. Sharma is a Fellow of World Academy of Productivity Sciences, Fellow of IE(I), Fellow of AeSI and currently is the Sr Vice Chairman of WCPS India.

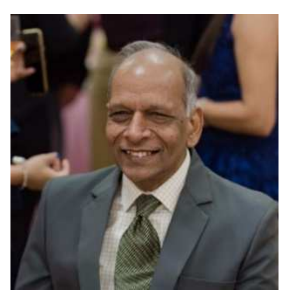
**Prof. J S Rajput** is eminent educationist, a highly renowned writer, and an institution builder who during his long illustrious career has immensely contributed to major reforms and policy formulation in school as well as higher education. Prof. Rajput is a former Director of NCERT and founder Chairman of the National Council for Teacher Education (NCTE) has also been the Joint Adviser on Education to the Ministry of Human Resource Development. Rajput has published several articles and books that include Encyclopedia of Indian Education. A strong advocate of education quality and service with sacrifice, Prof. Rajput has authored several impactful treatises that include Education in a Changing World: fallacies and forces, Contemporary Concerns in Education and Universalization of Elementary Education. UNESCO honored Prof. Rajput with Jan Amos Comenius Medal in 2004 for his contributions to educational reforms in India. The Government of India awarded him the fourth highest civilian honour of the Padma Shri, in 2015, for his outstanding contributions to literature and education.

**Prof. Prem Vrat** is a distinguished academician and currently is the Chairman of the Board of Governors at the Indian Institute of Technology (ISM) Dhanbad. A distinguished Alumni of IIT Kharagpur, Prof. Prem Vrat has the distinction of being the longest serving professor of IIT Delhi, Founder Director of IIT Roorkee and Vice chancellor of UPTU Lucknow. Prof. Vrat holds honorary positions at IIT Delhi and AIT Bangkok and has served on the boards of multiple educational institutions and editorial boards of various reputed journals. Prof. Prem Vrat is a Fellow of several prestigious academies, including the Indian National Academy of Engineering, the National Academy of Sciences and also World Academy of Productivity Sciences. A crusader for quality and productivity in higher education, a distinguished chair professor of AICTE, Prof. Prem Vrat has been listed in the 100 Great IITians dedicated to the service of the Nation.

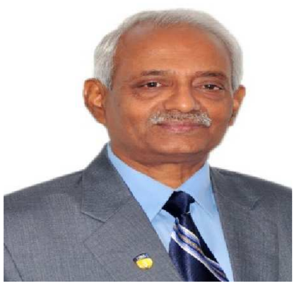
**Prof. Seyed E. Hasnain** is a world-renowned scientist, currently holding the coveted honour of being the National Science Chair of India at IIT Delhi. A highly acclaimed educationist, and institution builder, Prof. Hasnain is the former Vice Chancellor of University of Hyderabad and Jamia Hamdard University. His influential roles include membership on the Science and Engineering Research Board, the Indian Council of Medical Research, and the Science Advisory Council to the Prime Minister of India (2004-2014). He has also been involved with prestigious institutions like AIIMS, ILBS, PGIMER, and IISc. As a Section Editor of PLoS ONE and an editor for multiple journals, Hasnain has significantly contributed to scientific research in the areas of life sciences and immunology. He has received Germany's highest civilian award Das Verdienstkreuz and has been conferred with the honour of Padma Shri by the Govt of India.

**Dr. (Mrs.) Pankaj Mittal**, Secretary General, Association of Indian Universities, is a Fulbright Scholar and has the distinction of being the Founder Vice Chancellor of Bhagat Phool Singh Mahila Vishwavidyalaya, the first rural women university of North India. Dr Mittal has three decades of experience of Policy Planning & Management of Higher Education. Dr has visited a number of countries on various higher education missions that include USA, UK, Australia, Canada, South Korea, Spain, Germany, South Africa, Hong Kong, Thailand, Mauritius, Mexico and Philippines. She has received several awards and recognitions President Award for Digital Initiatives in Higher Education, Qimpro Gold Standard Award for HE and Subhashini Devi Award for Community Engagement.

**Dr. Onkar Singh** is a Professor of Mechanical Engineering at Harcourt Butler Technical University Kanpur, founding Vice-Chancellor of Madan Mohan Malaviya University of Technology, Gorakhpur and currently is the Vice Chancellor of Uttarakhand Technical University. An accomplished author, Dr Singh has published several books, authored 233 research papers, and holds 3 patents. His contributions to engineering education have earned him numerous awards, including the AICTE Young Teacher Career Award. Dr Singh is a Fellow of several prestigious engineering societies and has served on the boards of IIT Kanpur, IIT Roorkee, and IIT BHU, among others.



**Prof. Vijay Kant Verma** is a distinguished electronics and communication engineer. Prof. Verma currently serves as the Chancellor of Dr. C.V. Raman University, Vaishali, Patna, Bihar, and the Director of the Core Research Group (CRIG) of six universities under the AISECT Group. In addition to his administrative role, he is the Editor-in-Chief of two esteemed bi-annual research journals, Anusandhan and Shodhaytan, a position he has held for the past twelve years. His extensive experience and contributions to the field of electronics and communication, along with his dedication to academic excellence, have made him a prominent figure in the realm of higher education and research.



**Dr. W Selvamurthy** currently is the President of Amity Science, Technology and Innovation Foundation, Director General for Amity Directorate of Science and Innovation, and Chancellor of Amity University, Chhattisgarh. A renowned defense scientist Dr. Selvamurthy has served in the Defense Research and Development Organization (DRDO) for 40 years, in various capacity where he rose to the coveted position of Chief Controller of R&D. Dr. Selvamurthy is a member of the Scientific Advisory Committee to the Cabinet (SAC-C), and Chairman of various committees including the Technology Commercialization Committee of ICMR. Dr. Selvamurthy has epresented India at international forums, and received numerous awards, including the CSIR "National Award for S&T Innovations" and the DRDO "Technology Leadership Award." As the President of ASTIF, Dr Selvamurthy had built a great reservoir of talent, technology innovations and has earned Amity University the repute of being a front runner as research and innovation driven university deeply engaged in cutting edge science and technology research and its translation into innovative product and technology development.

**Dr. Kamal Kant Dwivedi** is a distinguished scientist, researcher, educator, diplomat and science communicator. Dr. Dwivedi has served in various capacities in India and abroad for over 38 years in government and currently is the Sr Vice President of Amity education Group. Dr. Dwivedi has been the Vice-Chancellor of Arunachal University, Adviser and Director in the Ministry of Science and Technology, Govt. of India, and Counsellor at the Embassy of India in Washington DC. Dr. Dwivedi has also served as President of the International Nuclear Track Society and received numerous accolades, including the India 2000 Millennium Award and fellowships from various prestigious institutions. Dr. Dwivedi is the Founder President of World Academy of Doctorates.

**Dr. Yugal Kishore Mishra** is a world renowned heart surgeon, currently is the Chief of Clinical Services and Chief Cardiovascular Surgeon at Manipal Hospitals, Delhi. The field of expertise of Dr. Mishra includes Minimally Invasive Cardiac Surgery, Robotic Cardiac Surgery, Redo Valve and Coronary Surgeries, Surgery of ascending aortic aneurysms and dissections, Valve repair and replacement, Surgery for heart failure including heart transplantation. A highly reputed medical practitioner, Dr. Mishra has a highly compassionate heart for the humanity at large and has performed so far over 50,000 operations successfully. In recognition of his eminence Dr. Mishra has been awarded Rastriya Rattan Award by International Study Circle, Life Time Achievement Award by World Congress on Clinical and Preventive Cardiology in 2006.

**Prof. Tendai Padenga**, is the Founder Chancellor of Afrisol Technological University, Deemed University. A reputed computer science professional, Dr Padenga is an aluminous of Jamia Millia Islamia, Gujarat Technological University, and Jamia Hamdard Universities. He is an alumnus of the Commonwealth Register of Fellows and also a Distinguished Aluminous Fellow of Indian Council for Cultural Relations conferred upon him in 2019 making him the first Zimbabwean and the third African to be conferred with this coveted honour by the Government India. He was the founding executive Dean for the School of Information Sciences and Technology at the Harare Institute of Technology, Zimbabwe.

**Dr. Alok Mishra** is a prominent figure in the Healthcare and Medical Technology Industry, currently serving as the CEO of Value Addition, where he aids MedTech companies in building strategy and marketing capabilities. Dr. Mishra recently retired from Johnson & Johnson MedTech Asia Pacific as Vice President, Strategic Capabilities, after a distinguished 20-year career. At Johnson & Johnson, Dr. Mishra had held various key positions, including area Vice President for the South Asia Region and Managing Director for Singapore and India. Dr. Mishra is a member of MENSA and serves as an adjunct faculty member at Singapore Management University. Dr. Mishra has been recognized as the "Most Valued Industry Mentor" by the Singapore Stanford Bio-design Program.

**Dr. UN Singh** is an expert in Linguistics and Culture and is currently Chair-Professor at Amity University Haryana. Previously, Prof. Singh served as the Director of CIIL, Mysore, and Pro-Vice-Chancellor of Visva-Bharati, Santiniketan. Prof. Singh teaching career spans prestigious institutions like the Universities of Hyderabad, Delhi, South Gujarat, and MSU-Baroda. Prof. Singh is a prolific writer, with seven collections of poems, six books of essays, twelve plays, and over 250 research papers to his name. Additionally, he has produced 545 documentary films.

**Dr. Rajesh Pankaj** with over 20 years of rich professional experience has demonstrated a strong history of working across higher education, skill development, and edtech sectors. Currently Dr. Pankaj is serving as Director of FICCI. Rajesh has successfully led various key initiatives, driving the education reforms agenda forward. Dr. Pankaj's expertise includes interfacing with senior leadership in government, regulatory bodies, national and international academic institutions, industry, and global development agencies on education policies, studies, program launches, and effective program development and management. Dr. Pankaj has been deeply involved in leading projects related to industry-academia engagements, capacity-building programs, topical master classes, and organizing global higher education summits and thought leadership forums. Dr. Pankaj's contributions have significantly impacted the advancement of education reforms and the promotion of international academic cooperation.

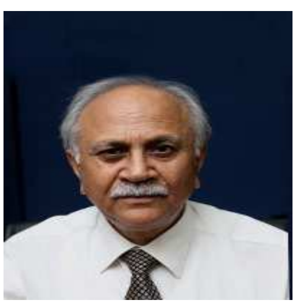
**Prof. Priyaranjan Trivedi** is a world-renowned environmental scientist, institution builder and a charismatic leader with more than 47 years of teaching and training experience in different areas of ecology, environment, disaster management, sustainable development, peace studies, conflict resolution, human rights, intellectual property rights, ecological tourism, geriatric care, and institution building strategies. Prof. Trivedi is the Founder Chancellor of The Global Open University Nagaland and Indira Gandhi Technological and Medical Sciences University, Aruanchal Pradesh. Prof. Trivedi has authored the World Encyclopaedias on the emerging subjects like environmental sciences, remote sensing, health care, global peace and security, production and operations management, materials management, bioinformatics, green business management, geriatric care, habitat and population studies, blue economy etc.

**Dr. M P Gupta** is a renowned figure in e-governance, dedicating significant resources to developing cases, tools, and frameworks to advance e-governance research in India. Dr. Gupta co-authored the book "Government Online" and edited "Towards E-government" and "Promise of E-governance,". Dr. Gupta has guided the production of 14 edited volumes through the International Conference on E-governance (ICEG) since 2003. Dr. Gupta leads the EU-funded project "EU-India Cooperation Platform in Future Internet and Electronic Media," fostering partnerships and introducing the FIWARE platform in India. Dr. Gupta has received the Humanities & Social Sciences fellowship from the Shastri Indo-Canadian Institute and was a Visiting Fellow at the University of Manitoba.

**Prof. Dr Sanjna Vij** is a renowned academician with over 24 years of experience in academia and administration. Currently a Professor at Amity School of Liberal Arts, she holds key leadership roles, including Dy Director at Amity Academic Staff College, Head of the Centre of Excellence for Innovation in Education at Amity University Haryana. Prof. Vij has authored numerous scholarly articles, book articles, and three books. With a Ph.D. in Education, she combines deep academic knowledge with extensive teaching and administrative experience. Beyond the classroom, Prof. Vij contributes to various professional activities and educational content creation, including video lectures for SWAYAMPRABHA. Prof. Vij's work positions make her as a transformative leader dedicated to educational excellence and innovation.

**Dr. Markandey Rai**, has been the Senior Advisor of the Human Settlements Program after his retirement as the Chief of the United Nations Inter-Agency Coordination besides the Global Parliaments as well as Trade Unions Program of UN-HABITAT based in Nairobi, Kenya. Dr. Rai was the pioneer for establishing Global Urban Observations and Publications of the Compendium of Human Settlement Statistics and Atlas periodically. Dr. Rai has been the Chairperson of the Joint Advisory Committee (JAC) at Nairobi to advise the heads of the UN offices Nairobi on the matters of the Staff Administration and Welfare. Dr. Rai has widely travelled and attended several conferences of scientific as well of political nature. Dr. Rai is also the Chancellor of Indira Gandhi Technological and Medical Sciences University. Ziro, Arunachal Pradesh and the Global Open University Nagaland. Dr. Rai is associated with the Global peace Foundation, World Spiritual Parliament and International Association of Educators for World Peace in different capacities.

**Dr Govind Sharan Dangayach** is the Dean of Research & Consultancy and a Professor in the Department of Mechanical Engineering at Malaviya National Institute of Technology (MNIT), Jaipur. Dr. Dangayach serves as the Editor-in-Chief of the Journal of Manufacturing Technology Research and as an Associate Editor for the International Journal of Business Systems Research and the International Journal of Global Business Competitiveness. Additionally, Dr Dangayach is a Guest Editor for three international journals and a reviewer for 37 international journals. Dr. Dangayach is a Visiting Professor at DHBW Mosbach, Germany, the Asian Institute of Technology (AIT) Bangkok, IIM Kozhikode, and IIM Shillong . Dr. Dangayach's contributions have been recognized with several awards, including the 2011 Emerald/IAM Research Fund Award and the Best Case Study award from the Indian Institution of Industrial Engineering.

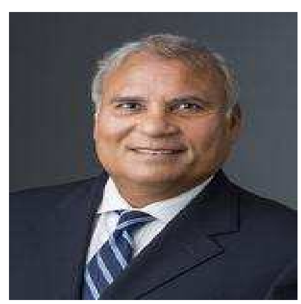


**Dr. Gyanendra Singh** is the Ex-Vice-Chancellor of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, and RKDF University, Bhopal. Dr. Singh illustrious career began at the Indian Institute of Technology Kharagpur and included notable tenures at the Indian Agricultural Research Institute, New Delhi, and the Central Institute of Agricultural Engineering, Bhopal, where he served as Head and Director. Over 48 years, Dr. Singh collaborated with numerous national and international organizations, including FAO, UNIDO, and the British Council, and contributed to professional societies and editorial boards. Dr. Singh played a significant role in technical committees for the Ministry of Agriculture and other governmental bodies, focusing on machinery development and educational quality reforms.

**Prof. Dr. PCS Devara** is currently the Director of ACOAST at, Amity University Haryana. A Fellow of Royal Meteorological Society, UK Prof. Devara is a renowned expert in the area of air quality monitoring and analysis. Former Scientific Adviser at Indian Institute of Tropical Meteorology, IITM Pune, Prof. Devara has collaborations with NASA Goddard Space Flight Centre for aersols network. Prof. Devara is recipient of several awards and recognitions for his outstanding contributions to research in the area of air pollution and climate science, he has been the President of Indian Aerosol Science and Technology Association (IASTA).

**Dr. Sushil Kumar Dash** is currently the President, Foundation for Education and Research in Climate Change & Formerly Professor and Head, Centre for Atmospheric Sciences, IIT Delhi. Prof. Dash is actively involved in R&D activities, including 35+ sponsored projects. Prof. Dash has authored one book and edited three books related to Weather and Climate. He has been deputed to many reputed institutions across the world as Visiting Scientist. Prof. Dash is the Fellow of Indian Meteorological Society. Fellow of Royal Meteorological Society, UK. He is the member of the National Academy of Sciences, India Senior Associate, Climatology & Meteorology, Abdus Salam ICTP, Trieste, Italy.

**Dr. Debabrata Banerjee** is an Emeritus Professor and former Assistant Dean, Global Initiatives, School of Graduate Studies at Rutgers University. A renowned bio scientist Dr. Banerjee has published over 100 peer-reviewed articles and book articles, and he holds 5 patents. His h-index is 38. He serves as a reviewer and on editorial boards for numerous journals and reviews drug development projects as an independent consultant. Dr. Banerjee is an honorary visiting professor at Amity University, India, and Universitas Padjadjaran, Indonesia.



**Dr. Raj K Tiwari** is currently a distinguished professor of microbiology and immunology, associate professor of otolaryngology, and Graduate Program Director at New York Medical College in US.. Dr Tiwari's research in cancer biology, chemoprevention, tumor immunology and cancer therapy has led to numerous peer-reviewed publications, book chapters, and international lectures. Dr. Tiwari also holds a faculty appointment in the Department of Otolaryngology, where he led collaborative research on thyroid neoplasms. Dr. Tiwari's work has garnered support from the NIH, Department of Defense, and American Institute of Cancer Research. Dr. Tiwari has secured an ECRIP training grant for Westchester Medical Center and Metropolitan. Dr. Tiwari has been conferred with the honour of honorary professor at Amity University Haryana, Gurugram India, and holds memberships in various academic societies, including the American Association for Cancer Research. Dr. Tiwari is also an international reviewer of cancer research for several countries.

**Dr. S P Kaushik**, With over 45 years of exemplary leadership and organizational transformation, Prof. Wg. Cdr. Dr. S.P. Kaushik stands as a distinguished academic and research leader. Dr. Kaushik has served in pivotal roles such as Pro-Vice Chancellor, DGT, Director, Principal, Research Scholar, Scientist, and Member Secretary across renowned institutions. His prolific research career includes 8 patents, over 95 published research papers, and authorship of 21 books. Recognized by Dr. APJ Abdul Kalam for his contributions at DRDO and IIT Delhi, Dr. Kaushik is a visionary in integrating professional culture with academic excellence. His initiatives, including the Industry Edge program and the Biorythm theory, have significantly advanced academic standards and research outcomes.

**Dr. Luxita Sharma** is presently working as an Associate Professor and Head of Department of Dietetics and Applied Nutrition, Amity University, Haryana, India, Dr Luxita is a Fellow of Eudoxia Research University, USA and Executive Director (Hon.) with the Hindustan Agricultural Research Welfare Society. She is life member of Indian Dietetics Association and IAPEN India Association. Dr. Luxita has received an International Award in the category of Contribution to Education Community & Outstanding Accomplishments from Asian Education Awards and IAPEN-Indian Association of Enteral and Parenteral Nutrition and several other awards from organizations like ICAR, IIMR and MGA.

**Dr. Neelam Sahu** is currently working as Professor, Computer Science at Rabindrnath Tagore University Bhopal. Dr Sahu has 18 years of rich experience in teaching and research. Her area of specialization includes Data Science. Fuzzy Logic, Emerging Computation, AR/VR and Data Mining etc. Dr. Sahu is also author of 6 text books on different topics of computer science. These have been translated into 5 different foreign languages. Economic Growth Foundation New Delhi has awarded her in 2022 " Best Educationist in Computational Field". Currently, Dr Sahu is working on a research project related to development of livelihood business model for the weaker section of the society with Sisil fiber production in an innovative way using most modern technology.

With over 30 years of professional experience in engineering, energy, environment, climate management & higher education, **Dr. HRP Yadav** is currently Professor & Head of Civil-Environmental Engineering, Amity University, Gurugram. A Doctorate from IIT Delhi in Environmental Engineering, Dr. Yadav has a long experience of working with Institution of Engineers (India), where he had held various positions including Director General of the Institution. He has been Expert Member of the Technical Committee for Climate Change, Water Resources, and Sustainable Development representing American Society of Civil Engineers at the “Asian Civil Engineering Coordinating Council.

**Prof. Shashibala** is currently the Dean at the Centre of Indology of Bhartiya Vidya Bhawan, New Delhi. Prof. Shashibala is the recipient of the prestigious Order of the Polar Star, Mongolia's highest civilian award. She is a member of the International Advisory Committee of G20 and has served on various high-level committees, including the Indian Knowledge Systems. Prof. Shashibala is the President of the International Council of Cultural Studies, Bharat, and an executive member of the International Academy of Indian Culture and Bharatiya Shikshan Board. Prof. Shashibala has held esteemed positions as a Visiting Professor at the National Museum Institute, a Guest Professor at Bristol and Ural Federal Universities, and a Consultant at IGNCA. Prof. Shashibala's expertise encompasses India's cultural contributions to the world, the global perspective of Sanskrit, the history of arts, Buddhism, and cross-cultural connections.

**Dr. Smita Mishra** is currently the Consultant and HOD Pediatric Cardiology at Manipal Hospitals, Dwarka. With more than 29 years of clinical experience in the field of Pediatrics and 19 years in the Pediatric Cardiology, her wide area of expertise includes Pediatric Cardiology-Noninvasive imaging, Fetal Echocardiography, Transthoracic and Esophageal Echocardiography, 3D Echocardiography, Pediatric Cardiology- Intervention, ASD,VSD & PDA device closure, Valvuloplasties (Pulmonary , Aortic valvotomy) and Coarct ballooning and stenting.

**Dr. Payel Sen**- Currently Dr. Sen is working as Assistant Professor and Coordinator-Training in JAIN (Deemed-to-be) University, Bangalore. As a young academic she merits the credit of leading the department of Political Science in West Bengal State University for 8 years since the institution's very inception. As an academic administrator she has also briefly worked as Academic Programme Coordinator in ITM University Gwalior and as Coordinator-Research in CHRIST (Deemed-to-be) University, Bangalore. Dr. Payel Sen is formally trained in Political Science with specialization in Public Administration and local governance. She has nearly 15 years of experience of teaching various courses in Indian Politics, Public Administration and Public Policy at the undergraduate and post graduate levels.

**Dr. Shibu John** is currently Professor in the Department of Hospital Management & Hospice Studies, Faculty of Management Studies, JMI. Before joining JMI Dr. John has served as Dean School of Management and Business Studies and Head of the Department of Healthcare and Pharmaceutical Management, Jamia Hamdard. Dr. John has published more than 30 research papers in reputed national and international refereed journals. Dr. John has also worked in healthcare industry before coming to higher education system.

**Dr. Sunil Abrol** is Director on the Board of World Confederation of Productivity Science (WCPS) and Vice President of World Academy of Productivity Science (WAPS) since 2005. He is President of Institute for Consultancy and Productivity Research, India, since 2010 and Director NOCN India Skills Foundation. A doctorate in Organizational Psychology from University of Delhi, and with Ph.D. degree in International Business from Indian Institute of Foreign Trade, New Delhi. Dr. Abrol is a Certified Trainer by Auckland College of Education, New Zealand, and a Certified Management Consultant by International Council of Management Consultants Institutes (ICMCI), U.S.A.

Dr. Abrol has held position of Chairman/President/Director/Advisor in various international professional organizations, including IFTDO, AHRD, ISTD, IMCI, CEAI , AIMA and DMA.

**Dr. Lucky Krishnia** is currently working as an Assistant Professor at Amity University Haryana, she has significantly contributed to the Amity Centre of Nanotechnology through administrative, academic, and research roles. Dr. Krishnia holds a Ph.D. in Nanotechnology from Delhi Technological University, specializing in the synthesis and characterization of carbon nanomaterials. Dr. Krishnia has 1 patent granted on synthesis of diamonds from agricultural waste and published around 30 research papers in international journals and conference proceedings. She holds several patents, copyrights and has received multiple awards, including the Indian Inspirational Women Award for Research & Development in Nanotechnology (2020).

**Dr. Vaibhav S. Bhugra** is currently working as the Scientific Staff Officer to President of Science, Technology & Innovation Foundation of Amity Education Group. Dr Bhugra is a motivated researcher and a strong believer in the importance of technology development and relationship building. Dr. Bhugra has been extensively involved in the field of scientific administration, management of research activities and promotion of research and innovation. Dr Bhugra was awarded my Ph.D. in Materials Science and Nanotechnology from Victoria University of Wellington, Wellington, New Zealand. Dr. Bhugra is also instrumental in building strong partnerships with industries and academic institutions to promote trans-disciplinary research and the development of new technologies.

**Ms. Nisha llyas** currently spearheads Academic Quality Improvement initiatives for Australian School of Global Studies, Sydney Australia. Ms. llyas has led projects on QMS implementation, admissions process redesign and stakeholder feedback management. Past roles at Amity University and All India Management Association further showcase her proficiency in managing end-to-end academic processes, Study Abroad Programs, and central admissions. With over 19 years of distinguished experience in academic operations, she is a proactive and accomplished professional known for strategic leadership and effective problem-solving. Adept at managing documentation for both National and International Accreditations, Nisha specialize in accreditation processes such as ACBSP, IACBE, WASC, AACSB in the USA and NAAC in India among others. Her expertise extends to rankings management for higher education institutions and quality management in the education sector, supported by certifications in Six Sigma-Black Belt, Lead Implementation Practitioner, and Certified Internal Auditor.

**Rear Admiral Kishan K. Pandey** served the Indian Navy for 36 years. He has commanded various Naval Missile Corvettes, Frigates, Destroyers and other frontline Warships. He was instrumental in Operational Planning for naval element of the Kargil War, Operations in Sri Lanka and UN Mission in Somalia.

He has been instrumental in transforming naval digital communications and operationlisation of naval geostationary satellite "*Rukmani*". Post 26/11 attacks on Mumbai, he executed a massive nation-wide digital network across entire Indian coastline to monitor entire Indian Ocean Region from IMAC Fusion Centre at Gurugram.

Admiral Pandey had also held various Operational and Administrative Assignments at Naval HQs. He was appointed as Flag Officer Fleet Review (FOFR)for the International Fleet Review, which saw 50 foreign country's participation in the august presence of Hon'ble Prime Minister Shri. Narendra Modi as well as Hon'ble President Shri. Pranab Mukherjee at Vishakhapatnam in 2016.

For his meritorious & illustrious service in the Indian Navy, he was awarded with Ati Visihsht Seva Medal (AVSM) by the President of India in 2016 and Vishisht Seva Medal (VSM) in 2012 for his distinguished service.

After superannuation, Rear Admiral Kishan Pandey has joined Amity University Haryana as the Director HR as well as Director Amity Academic Staff College.

**Dr. Sneha Nair** serves as the Assistant Director - Research at the Amity Science, Technology & Innovation Foundation, the research and innovation arm of the Ritnand Balved Educational Foundation, which oversees the Amity Group of Institutions and Amity Universities. Dr. Nair has extensive experience in coordinating and managing national and international accreditations and certifications, including NAAC, QS, and NIRF, with a focus on research and innovation. She promotes and monitors research activities to enhance the university's research profile and foster potential collaborations.

Dr. Rana Bedi is an assistant professor in Amity School of Communication, Amity University Haryana. Dr. Bedi holds a Ph.D. in Journalism and Mass Communication and has published research work with reputed publishers like Palgrave Macmillan (Springer Nature), and has worked as a reviewer for a Taylor & Francis Journal called 'Feminist Media Studies.' Dr. Bedi's research interests lie in Digital media trends, higher education, with a penchant for studies at the intersection of gender and media.