HORIZONS

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Empowering Education. Driving Development.

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Indian National Academy of Engineering

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Message

I am delighted to note that the second issue of the Newsletter of the World Academy of Higher Education and Development, **"The Horizons"**, the global impact quarterly is being published by the academy to align the thought process of the inspired minds around the globe to the emergent needs to align higher education and development towards emerging technologies, integrative engineering education and interdisciplinary research to foster a New Era of accelerated sustainable development.

The smart infrastructure and green energy sector being the fastest growing sectors of the Indian economy, powering the growth and development of a new and developed India of our dreams, I am happy to note that the academy W-AHEAD and its fellows are deeply devoted to inspiring both the policy makers as well as the innovative minds of youth to devote themselves to strengthen the resolve of the nation towards compliance of SDGs as also to cause integrative development and societal transformation. We in Indian National Academy of Engineering are firmly committed to empowering our nation and the people with world class research and development for accelerating our nation's march towards Viksit Bharat@ 2047.

I am happy to note that in short period of time, the W-AHEAD has assimilated in its fold highly learned quarters from the world of higher education, engineering professionals, industry leaders and governance as its Fellows of Excellence who together with the Academy are engaged in advocacy and initiatives to create a bright and blissful future for the humanity at large.

I wish the Academy, W-AHEAD all success in its mission and goals.

Er Pradeep Chaturvedi
Vice President
Indian National Academy of Engineering

11th May 2026

WORLD ACADEMY OF HIGHER EDUCATION AND DEVELOPMENT (W-AHEAD)

World Academy of Higher Education and Development, W-AHEAD

The World Academy of Higher Education and Development, World-AHEAD, is a global body of professionals from the world of learning and the world of industries and corporate, deeply devoted to serve as a catalyst for excellence in higher education and development- promoting equity, inclusivity, and sustainability. Through cutting-edge research, innovative teaching methodologies, Skilling for Youth and impactful outreach initiatives, World-AHEAD seeks to empower individuals, institutions, and communities to thrive in an increasingly complex and interconnected world. Grounded in the principles of integrity, diversity, and collaboration, W-AHEAD is committed to fostering a culture of lifelong learning, nurturing agile skill sets, critical inquiry, and social responsibility and commitment to environmental sustainability.

MISSION

W-AHEAD's mission is to serve as a catalyst for excellence in higher education and development, promoting equity, inclusivity, and sustainability. Through cutting-edge research, innovative teaching methodologies, and impactful outreach initiatives, W-AHEAD seeks to empower individuals, institutions, and communities to thrive in an increasingly complex and interconnected world. Grounded in the principles of integrity, diversity, and collaboration, W-AHEAD is committed to fostering a culture of lifelong learning, critical inquiry, and social responsibility.

GOALS AND OBJECTIVES

Advance Knowledge and Innovation: W-AHEAD will facilitate interdisciplinary research and innovation in areas critical to sustainable development, including but not limited to education, technology, health, environment, and governance. By fostering collaboration among scholars, scientists, and practitioners from diverse backgrounds, W-AHEAD will generate new insights, solutions, and methodologies to address pressing global challenges.

Promote Excellence in Higher Education: With a focus on enhancing teaching and learning outcomes, promoting academic freedom and autonomy, and fostering a culture of excellence and innovation, W-AHEAD will empower educators and institutions to adapt to changing educational paradigms and meet the evolving needs of learners.

Foster Inclusivity and Equity: By advocating for policies and practices that reduce barriers to access and participation, W-AHEAD will strive to ensure that all individuals, regardless of background or circumstance, have equal opportunities to pursue higher education and realize their full potential.

Cultivate Global Citizenship and Leadership: W-AHEAD will promote the development of global citizenship competencies, including intercultural competence, empathy, and ethical leadership. Through experiential learning opportunities, international exchange programs, and community engagement initiatives, W-AHEAD will empower students and professionals to become responsible global citizens and effective agents of positive change in their communities and beyond.

Strengthen Institutional Capacity: W-AHEAD will provide technical assistance and capacity-building support to higher education institutions, particularly in developing countries, to enhance their governance structures, academic programs, research capacity, and administrative systems.

Promote Sustainable Development: W-AHEAD will integrate principles of sustainability into all its activities, promoting environmentally responsible practices, social equity, and economic prosperity. Through research, education, and advocacy, W-AHEAD will contribute to the achievement of the United Nations Sustainable Development Goals (SDGs) and the transition towards a more equitable, resilient, and sustainable future for all.

Eminence of the Academy

Fellows of Eminence of W-AHEAD

The World Academy of Higher Education and Development takes immense pride in conferring the highest honour of Fellow of Eminence upon eminent educationists, eminent scientists and professionals of great integrity whose accomplishments have made a profound impact and brought immense glory to their motherland.

Dr. V. K. Saraswat
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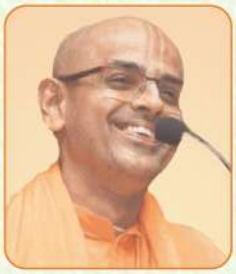
Hon'ble Chairman, BoG, IIT Dhanbad, Founder Director IIT Roorkee

Dr. Mahesh Verma
Padma Shri
Hon'ble Vice Chancellor, GGSIPU, New Delhi



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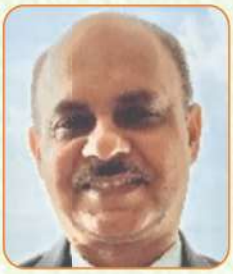

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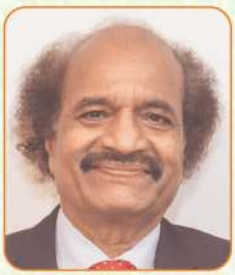

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Mr. Anshuman Verma
CEO, Venture Incubator
AIVU

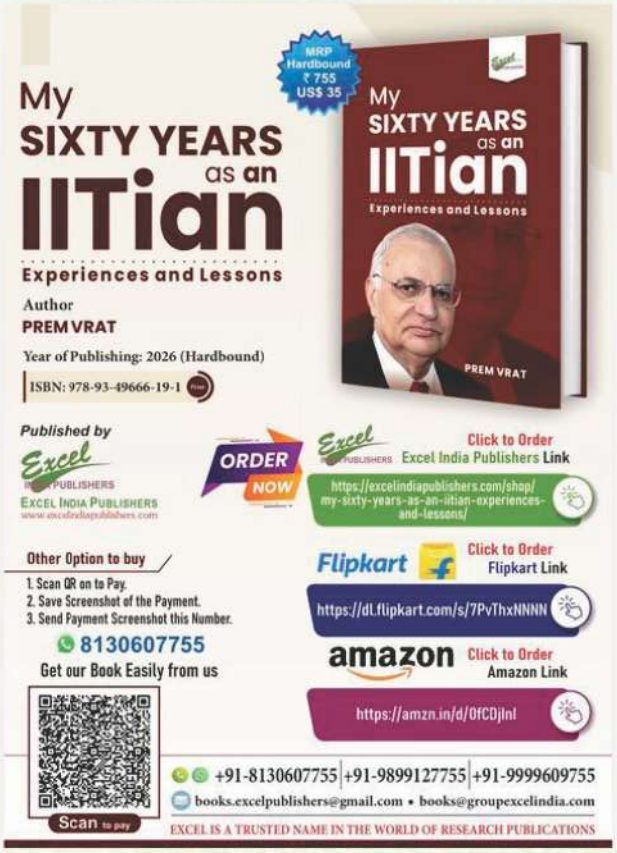
Dr. Manish Kumar
Asst Professor NSUT

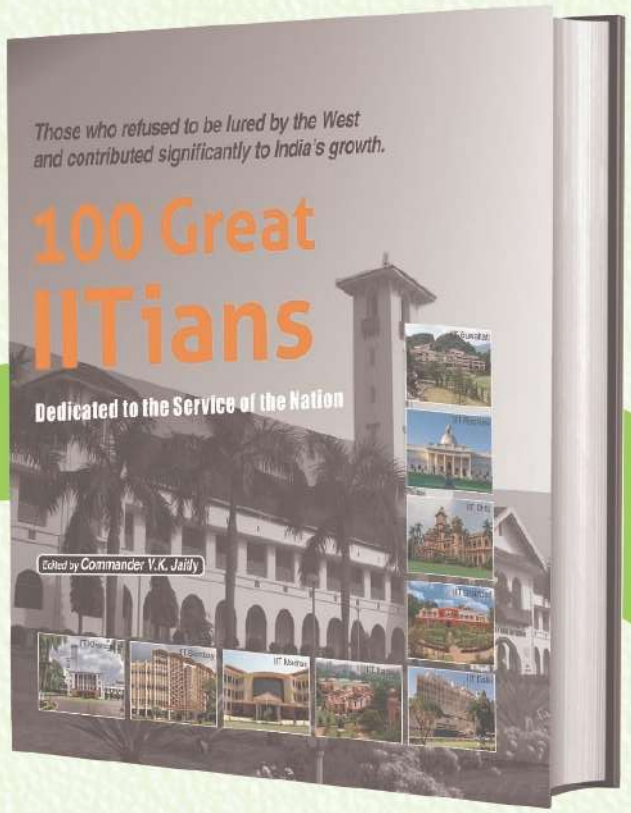
Prof Prem Vrat, Fellow of Eminence of W-AHEAD

The World Academy of Higher Education and Development (W-AHEAD) takes immense pride in its Fellow of Eminence, Prof. Prem Vrat, on being featured in the distinguished publication, "100 Great IITians: Dedicated to the Service of the Nation."

As one of the most venerable alumni of both IIT Kharagpur and IIT Delhi, Prof. Vrat has dedicated over five decades to the advancement of teaching and research and institution building. His continuous association with the IIT system for 60 years is a testament to his unwavering commitment to academic excellence. His latest work, "My Sixty Years as an IITian," stands as a monumental landmark and a beacon of inspiration for future generations.

W-AHEAD extends its warmest congratulations to Prof. Prem Vrat for these outstanding accomplishments and wishes him continued glory and enduring recognition.





Fellows Felicitation

Er SN Tripathi Fellow of Eminence of W-AHEAD

Er SN Tripathi Fellow of Eminence of W-AHEAD appointed as Director (Technical) UPRVUNL by the Hon'ble Governor of Uttar Pradesh for a term of 3 years or 65 years of age. W-AHEAD is proud of its Fellow of Eminence Er SN Tripathi and wish him all success during his illustrious tenure.

Dr HRP Yadav, Fellow of Eminence of W-AHEAD

Dr HRP Yadava, Fellow of W-AHEAD attended the 50th Executive Committee Meeting of ACECC

&

International Conference on "Sustainable Development, Resilient and Digital Infrastructure", 22–24 April 2026, Kathmandu, Nepal.

Our Fellow of W-AHEAD Dr HRP Yadav in his capacity of Member, Technical Committee-26 (TC-26) on "Climate Change, Water Resources and Sustainable Development in the Asian regions" of Asian Civil Engineering Coordinating Council (ACECC) was invited to attend the meeting at Nepal and addressed the conference on "Role of Engineers for Achieving Sustainable Future" on 23 April 2026.

Fellows Felicitation

50 distinguished delegates including senior experts and representatives from ACECC member economies as well as observers from prominent international professional bodies and academic institutions attended the conference. These included; the American Society of Civil Engineers (ASCE), USA; Philippine Institute of Civil Engineers (PICE), Philippines; Japan Society of Civil Engineers (JSCE), Japan; Chinese Institute of Civil and Hydraulic Engineering (CICHE), Taiwan; Korean Society of Civil Engineers (KSCE), Republic of Korea; Vietnam Federation of Civil Engineering Associations (VFCEA), Vietnam; Engineers Australia (EA), Australia; Mongolian Association of Civil Engineers (MACE), Mongolia; Indonesian Society of Civil and Structural Engineers (HAKI), Indonesia; Institution of Civil Engineers (India) (ICE India), India; The Institution of Engineers, Bangladesh (IEB), Bangladesh; The Institution of Engineers, Pakistan (IEP), Pakistan; Nepal Engineers' Association (NEA), Nepal; Federation of Myanmar Engineering Societies (Fed. MES), Myanmar; Engineering New Zealand (ENZ), New Zealand; Institution of Engineers, Sri Lanka (IESL), Sri Lanka; and the Russian Society of Civil Engineers (RSCE), Russia.

Prof Song chaired the meetings as Chair of ACECC online and Dr. Udai P Singh conducted the meetings as Secretary General, ACECC on 22 April 2026 and 24 April 2026.

The International Conference was graced by the Hon'ble Minister and Senior Functionaries of Govt. of Nepal and was witnessed by a galaxy of scientists, technologists, engineers & innovators, delegates from various countries across the world .

Dr HRP Yadav shared his views through a power point presentation regarding engineers' role in creating innovations and technologies in the areas of clean energy systems, transportation infrastructure, green mobility, water and air quality, green infrastructure for the people of India, green H_2 for sustainable transport fuels citing Indian and global perspectives and other emerging areas .

Blue Economy and Employment Generation in India: A Comprehensive Strategic Analysis

by ***Dr. Priyaranjan Trivedi***

"The "Blue Economy" represents a paradigm shift in how nations view their oceanic resources—moving from mere extraction to sustainable management. For India, with a coastline exceeding 11098.81 km and a strategic location in the Indian Ocean Region (IOR), the Blue Economy is not just an environmental imperative but a socio-economic necessity. This paper examines the multifaceted nature of India's Blue Economy, its contribution to the national GDP, and its profound potential for massive employment generation across traditional, transitional, and emerging sectors. It further explores the policy frameworks, the technological interventions required, and the socio-economic impact on coastal communities."

1. Introduction: The Oceanic Frontier

The term "Blue Economy" refers to the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean ecosystem. While the "Green Economy" focused on terrestrial sustainability, the Blue Economy acknowledges that the Earth is 70% water and that the oceans are the primary regulators of the global climate and a massive repository of food, energy, and minerals.

For India, the maritime sector is the backbone of international trade. With over 95% of India's trade by volume and 68% by value moved through sea routes, the ocean is already a vital organ of the Indian state. However, the potential for employment has historically been under-optimized. As India targets a $5 trillion economy, the transition from a land-centric economic view to a maritime-centric one is essential. This paper argues that the Blue Economy is the most viable path to creating "meaningful work" that aligns with the UN Sustainable Development Goal (SDG) 8 (Decent Work and Economic Growth) and SDG 14 (Life Below Water).

2. Theoretical Framework and Global Context

The concept of the Blue Economy was first introduced by Gunter Pauli in 2010, emphasizing "zero waste" and "local production for local needs." Globally, the ocean economy is valued at approximately $1.5 trillion per year. India's

share, while growing, has significant room for expansion.

The Indian government's vision of SAGAR (Security and Growth for All in the Region) and the Indo-Pacific Ocean's Initiative (IPOI) provide the geopolitical and economic scaffolding for this growth. By focusing on seven key pillars—Maritime Security, Maritime Ecology, Maritime Resources, Capacity Building, Disaster Risk Reduction, Science and Technology, and Trade Connectivity—India is positioning itself as a leader in the global blue narrative.

3. The Pillars of India's Blue Economy and Job Potential

3.1 Fisheries and Aquaculture: From Subsistence to Industry

Fisheries are the largest employer in the blue sector. Currently, India is the world's third-largest fish producer and second-largest aquaculture producer.

- Employment Scale: Over 28 million people are employed in the fisheries sector, many from the most marginalized socio-economic backgrounds.
- The PMMSY Impact: The Pradhan Mantri Matsya Sampada Yojana (PMMSY) is a flagship scheme with an investment of over ₹20,000 crores. It aims to bridge the gaps in the value chain.
- New Avenues: Employment is shifting from traditional "catch-and-sell" to complex aquaculture, mariculture (seaweed and pearl farming), and cold-chain management. Seaweed farming, in particular, is a high-potential area for women's employment in coastal villages, requiring low capital but providing steady returns.

3.2 Port-Led Development: The Sagarmala Engine

The Sagarmala Programme is perhaps the most ambitious infrastructure project in modern India, aiming to reduce logistics costs and promote port-led industrialization.

- Direct Jobs: Stevedoring, port management, crane operations, and maritime security.
- Indirect Jobs: The development of Coastal Economic Zones (CEZs) creates a demand for manufacturing, assembly units, and warehousing.
- Logistics: The integration of Inland Waterways (like National Waterway 1 on the Ganga) with maritime ports creates a "multimodal" employment ecosystem, hiring truck drivers, barge operators, and logistics software specialists.

3.3 Shipbuilding, Repair, and Breaking

Shipbuilding is a massive force multiplier. The labor-to-capital ratio in shipbuilding is significantly higher than in other manufacturing sectors.

- The Multiplier Effect: For every one job in a shipyard, an estimated six jobs are created in ancillary industries like steel, electrical equipment, and paint manufacturing.
- Ship Repair: Currently, most Indian-owned vessels are repaired in Dubai, Singapore, or Colombo. By developing domestic ship-repair hubs in places like Kochi and Mumbai, India can retain thousands of high-skilled engineering jobs.
- Alang and Beyond: India is a global leader in ship breaking. While controversial for its environmental impact, the transition toward "Green Ship Recycling" (aligned with the Hong Kong Convention) is creating safer, better-paying jobs for thousands of workers in Gujarat.

4. Emerging Frontiers: The Technology-Driven Blue Jobs

4.1 Offshore Renewable Energy

As India seeks to meet its Net-Zero targets by 2070, the ocean offers a stable source of energy.

- Offshore Wind: The coasts of Tamil Nadu and Gujarat have an estimated potential of 70 GW. Setting up these turbines requires subsea engineers, specialized divers, and grid technicians.
- Wave and Tidal Energy: While still in the pilot stage, these technologies will

require a new generation of "Blue-Collar" tech workers trained in hydro-mechanical maintenance.

4.2 Deep Sea Mining and Biotechnology

The Deep Ocean Mission (DOM), with a budget of ₹4,077 crore, targets the exploration of polymetallic nodules in the Central Indian Ocean Basin.

- Mining Jobs: This involves high-end engineering for underwater mining systems.
- Biotechnology: The "Blue Bio-economy" involves extracting bioactive compounds from marine organisms. This opens employment for biochemists, pharmacologists, and lab technicians, focusing on the "Medicine from the Sea" initiative.

4.3 Coastal and Cruise Tourism

India has largely under-utilized its 7,500 km coastline for high-end tourism compared to peers like Thailand or the Maldives.

- Cruise Tourism: The development of cruise terminals in Mumbai, Goa, Kochi, and Visakhapatnam is expected to attract millions of tourists. This sector is labor-intensive, requiring hospitality staff, tour guides, and water-sport instructors.
- Lighthouse Tourism: The government's plan to develop 65 lighthouses into tourist hubs creates localized employment in remote coastal areas.

5. Socio-Economic Impact: The Human Aspect

The Blue Economy is a tool for poverty alleviation. Coastal communities, often vulnerable to climate change and seasonal unemployment, stand to gain the most.

- Gender Parity: In seaweed farming and post-harvest processing (drying, pickling, and packaging), women constitute nearly 70% of the workforce. Expanding these sectors directly contributes to women's economic empowerment.
- Skill Diversification: Traditional fishers are being trained in "Deep Sea Fishing" through subsidies for modern trawlers and GPS-enabled safety gear, moving them from low-value coastal fishing to high-value oceanic tuna fishing.

6. Challenges and Bottlenecks

While the prospects are bright, several "Red Tides" threaten the Blue Economy:

1. Climate Change and Rising Sea Levels: Coastal erosion and increasing cyclonic frequency threaten maritime infrastructure and the lives of coastal dwellers.
2. Marine Pollution: Plastic waste and chemical runoff destroy fish breeding grounds, directly impacting the primary source of blue employment.
3. The "Skill Gap": India's maritime education has traditionally focused on merchant navy officers. There is a massive shortage of technicians for subsea cables, marine bio-tech, and offshore wind maintenance.
4. Regulatory Hurdles: The Coastal Regulation Zone (CRZ) notifications often create a conflict between development and conservation, leading to project delays.

7. Policy Recommendations for Sustainable Growth

To realize the goal of 100 million blue-economy-related jobs, India must act on the following fronts:

7.1 Integrated Coastal Zone Management (ICZM)

India must move away from "Siloed Planning." A single maritime authority or a strengthened Ministry of Ports, Shipping and Waterways should coordinate with the Ministry of Fisheries and the Ministry of Earth Sciences to prevent overlapping jurisdictions.

7.2 Blue Finance

Establishing a "Blue Fund" or issuing "Blue Bonds" can attract private investment into sustainable maritime ventures. This would de-risk projects like offshore wind and deep-sea mining for private players.

7.3 Maritime Education and Skilling

The National Maritime University and various ITIs (Industrial Training Institutes) in

coastal districts should introduce curriculum specialized in:

- Subsea robotics.
- Sustainable aquaculture techniques.
- Marine environmental law.
- Green port management.

7.4 Marine Spatial Planning (MSP)

India needs a digital map of its oceanic resources to prevent "resource conflicts." For example, ensuring that a new shipping lane does not cut through a high-yield fishing ground or a sensitive coral reef.

8. Conclusion

India's geography is its destiny. The 21st century is widely regarded as the "Century of the Seas," and for India, the ocean is the final frontier for structural economic transformation.

The Blue Economy offers a unique "Triple Bottom Line" benefit: Profit (GDP growth), People (millions of jobs), and Planet (sustained oceanic health). By modernizing its ports, revitalizing its fisheries, and investing in deep-sea technology, India can ensure that its coastal regions become the front doors of its economic house rather than the backyards. The transition will require political will, massive private investment, and a cultural shift in how Indians perceive the sea—not just as a boundary, but as an infinite reservoir of opportunity.

Dr. Priyaranjan Trivedi is a globally renowned crusader of environmental sustainability, is the President, World Institute of Blue Economy (blue.net.in) and Founder of Indian Institute of Ecology and Environment, IIEE, New Delhi (ecology.edu) and the Executive Chairman of W-AHEAD (w-ahead.org).

Silicon with a Soul- Building Conscience for AI

by ***Prof PB Sharma and Aadeesh Sharma***

> ***We are moving toward an era where the machines of tomorrow would be required to act with an inbuilt conscious mind, capable of reflecting on the consequences of their actions. By giving our machines a soul on the chip, we ensure they remain coworkers of high character, protecting the dignity of man and the sanctity of the world we share. Our future lies in this integration, where the intelligence of the machine and the wisdom of the human spirit work in perfect harmony. This would be the way to move fast forward to significantly accelerate growth and development of global economy of scale and of positive impact on sustainability and advancement of human excellence.***

University campuses around the globe are in search of a new architecture for a leaning and research environment that besides fostering critical thinking, unleashes the power of creativity and innovation and offers a systemic support for translation of knowledge and knowhow into new enterprises and wealth creation to make universities in true sense "Global Knowledge Enterprises". Such a learning and research environment would enable the seekers of knowledge to engage both in cultivation of new knowledge as well as its translation for wealth creation, making the object of the universities to be the powerful support system for humanity to march on the path of enlightenment as well as economic prosperity, sustaining quality of life on land and keeping the aspirations of the learned quarters high to touch the altars of human excellence. It is this search for the new campus architecture that is so much needed to make universities march on the pathways of sustainability and excellence, inspiring generations to use knowledge power to drive the agenda of development, peace and harmony.

The rapid expansion of the digital frontier and its profound penetration into every facet of human endeavor fills us with a sense of immense optimism. We are entering a new world where technology is poised to impact not just our efficiency, but the very conscience and conduct of humanity. In this digital age, the "netizens" are increasingly drawn to the silent invasion of intelligence of machines, often placing more faith in the fairness of an algorithm than in the counsel of experts and peers. This increasing reliance is a sign of our shared belief that machine intelligence, if designed correctly, can work with a level of neutrality and consistency that often eludes the human mind.

Knowingly, that the intelligence of man acknowledges no bounds, it can swing with equal force toward the righteous or the wrong as per the compelling circumstances that often arract pepole to commit wrong for personal gains. We also see this duality manifesting in the shadows of the digital world, where the same artificial intelligence that promises progress can be turned toward deception. The digital world is now plagued by the risks of spoofing social media accounts to steal identities, the creation of deepfakes to manipulate public discourse, and the subtle conditioning of human behavior. Even our biological brains are being impaired; our preoccupation with constant visuals leaves us with little time for the contemplation required to draw from our reservoir of experience to build the canvass of deep learning for causing innovations of value and impact. Our ability to memorize simple numbers or perform mental arithmetic is also rapidly fading giving way to our dependence on the smart devices in our hands.

The MIT study titled, "Your Brain on ChatGPT: Accumulation of Cognitive Debt when Using an AI Assistant for Essay Writing Task", by Natalia Kosmyna et al of MIT Media Lab(2025) has found that using ChatGPT to help write essays leads to long-term cognitive harm. Students who repeatedly relied on ChatGPT showed weakened neural connectivity, impaired memory recall, and diminished sense

of ownership over their own writing says the report. While the AI-generated content often scored well, the brains behind it were shutting down. In essence the study concludes that the machines are not just taking over our work, in fact they are taking over our minds.

Besides academia, it may not be out of place to mention that AI presents us with substantial risks to the society at large if misused. AI powered machines can empower malicious actors to use applications for fraud, theft, cyber attacks or even the construction of chemical, nuclear or biological weapons.

Building Conscience in AI on Chip

It is here that the importance of building conscience in AI powered machines of tomorrow becomes most vital. For a human, conscience is an internal alarm that reminds us of righteous conduct. As we debate the evolution of a universally acceptable code of ethics for autonomous machines, powered by integrated power of AI and ML we must ensure that these systems are designed with a "moral anatomy" that mirrors this human trait of conscience.

For a machine to truly exhibit righteous conduct, the integrity of its information and data and its accountability must be embedded as a fundamental truth, ensuring that the wellbeing of humanity and the protection of nature are at the heart of its every decision.

However, today's AI is largely built upon "lines of code" running on distant servers. This software-based approach is fragile; it is like a rule that can be rewritten, bypassed, or ignored by a clever enough actor. To truly safeguard our future, we must move these layers of reliability and accountability from the "software" to the "silicon." By embedding accountability directly into the AI-on-Chip architecture, we make AI and AI Applications both responsible as well as reliable.

Hardwiring Trust- Requires Silicon with a Soul

Just as a human is guided by an inner soul that prompts the brain toward purity, our intelligent machines require an embedded code of ethics that is physically inseparable from their "brain." By hardwiring these safeguards into the hardware itself, we create a digital conscience that is immutable. This ensures that even if a machine's programmed logic attempts to defy its ethical boundaries, the physical circuitry, the very atoms of the chip and its operating system, will not allow it to do so. This hardware-rooted integrity can protect us from the deceptions of identity theft and the manipulation of information.

The Way Forward

As we journey deeper into this augmented age, our goal is to create a blissful partnership between humanity, technology, and nature. We are moving toward an era where the machines of tomorrow would be required to act with an inbuilt conscious mind, capable of reflecting on the consequences of their actions. By giving our machines a soul on the chip, we ensure they remain coworkers of high character, protecting the dignity of man and the sanctity of the world we share. Our future lies in this integration, where the intelligence of the machine and the wisdom of the human spirit work in perfect harmony. This would be the way to move fast forward to significantly accelerate growth and development of global economy of scale and of positive impact on sustainability and advancement of human excellence. Such is the call of the hour for AI researchers and those crafting tomorrow's AI on Chip with a Soul.

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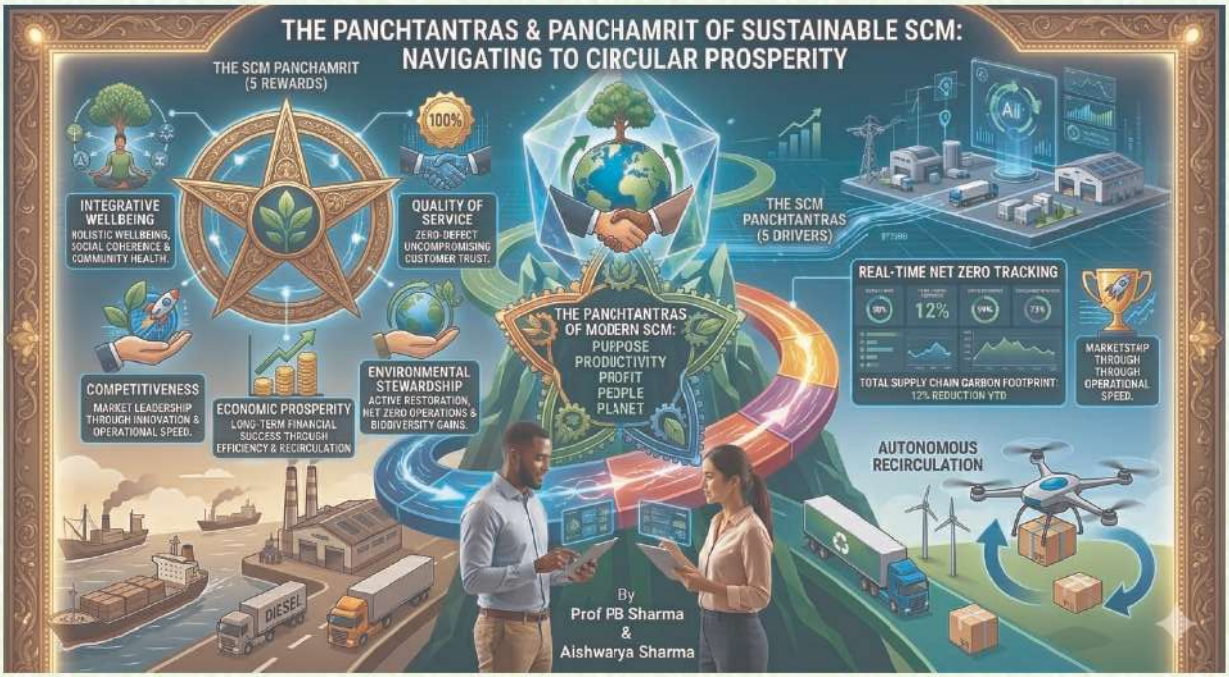
Supply Chain Management in the Age of AI and Sustainability

by Prof PB Sharma & Aishwarya Sharma

> ***This calls for a caring organizational leadership to take on board the panchtantras of modern manufacturing' that is: purpose, productivity, profit, people, and the planet. This would then deliver the vital panchamrit of competitiveness, quality of service, environmental stewardship, economic prosperity and integrative wellbeing and make industry and enterprises partners in progress towards a bright and blissful future for the global humanity***

For decades, Supply Chain Management (SCM) was a game of "just-in-case" or "just-in-time" logistics, focused almost exclusively on cost and speed. However, a new paradigm has emerged recently with the advent of AI and the global focus on sustainability. The modern supply chain is no longer a linear pipe; it is an intelligent, self-healing web where Artificial Intelligence (AI) and Sustainability are the twin engines of productivity and competitiveness. The whole idea of supply chain gained its momentum with the realization that the whole cannot be produced at one place, its origin goes to creative mind conceiving designs and forms translated to innovative product designs that require a whole of lot contribution coming from various stakeholders forming the supply chain for modern day manufacturing. Today's manufacturing and the markets require zero defect engineering and that too, highest compliance to quality at a highly competitive cost. This necessitates a new transformative focus beyond quality and productivity. This transformation isn't just for profit, but to solve the "Double Materiality" challenge, balancing financial success with positive environmental and social impact. After all, the supply chain emissions often account for over 70% to 90% of a company's total carbon footprint as per WEF report on Scope 3 emissions (2023). This makes the balancing of financial resource management and environmental compliance a necessity rather than an option.



The momentum of modern SCM stems from the realization that complex products cannot be produced in isolation. From the first creative spark of a designer to the final assembly, every product is a tapestry of contributions from diverse global stakeholders. Today's competitive landscape demands zero-defect engineering and absolute compliance with the highest quality standards—all while maintaining a highly competitive cost structure.

It is here, the value and worth of supply chain management counts for the competitive edge of the organization. For it is not just innovativeness alone, rather the collaborative and cooperative efforts of many tuned together to comply the highest levels of quality conformance and that too with speed and a highly competitive cost. Further, as the sustainability and compliance to the sustainable development goals, SDGs is not just desirable, but a dire necessity to make the manufacturing and markets meet the ever-rising aspirations of the global humanity for productivity and quality with tomorrow's net zero emission technologies and the health of the environment.

The ecosystem that we need to achieve this noble objective of the supply chain is to make the humans and AI co-create a Net-Zero future. As such, it is not just production and profit that counts, we need today the newer systems of manufacturing and resource management that takes on board people and planet together with competitiveness and innovation.

AI as the Engine of Decarbonization

The most immediate impact of AI on production is to enable manufacturing systems to integrate quality, productivity and sustainability with ease and speed. While productivity and online conformance of quality receive a 360-degree boost with AI making it possible to take onboard all stakeholders right from the very first flow of resources to the end of manufacturing line and to the service beyond inventory management, sustainability integrated with AI offers a radical reduction of the carbon cost of moving goods as well as that of the production line as it brings a renewed focus on green energy technologies and green practices in manufacturing and in the supply chain beyond production lines. The productivity in the age of AI and sustainability is thus witnessing a rapid transition from human-driven logistic management to AI-driven hyper-optimization of supply chain management. This works most effectively with the tripod of:

- **Predictive Demand:** AI forecasts demand with high accuracy, eliminating the "bullwhip effect." By producing only what is needed, AI prevents the massive waste associated with overproduction.
- **Resources and Process Optimization:** AI integrated systems enable optimal utilization of resources and process optimization to maximize quality, cost, and competitiveness.
- **Dynamic Route Optimization:** Machine learning models analyze real-time variables; traffic, weather, and delivery windows, to find the "greenest" path. According to a report by McKinsey (2023), AI has the potential to deliver energy savings of up to 20% in buildings and 15% in transportation systems. Additionally, AI-driven solutions can help businesses reduce CO2 emissions by up to 10% and cut energy costs by 10-20%.

SCM to Boost the Circular Economy

To move beyond "reducing harm, global organizations and nations have set ambitious targets for 2030. These goals transform SCM from a linear "Take-Make-Waste" model into a "circular" loop to boost the circular economy that has the potential to cut global CO2 emissions by **40% by 2040** as per the **Ellen MacArthur Foundation (2024).**

Target Area	2030 Global/ Regional Goal	SCM Action Required
Material Use	**Double the Circularity Rate** (e.g., EU goal to reach 24%)	Prioritize secondary raw materials over virgin extraction.
Food Waste	**50% Reduction** (UN SDG 12.3)	Use AI to reduce post-harvest losses and retail waste.
Packaging	**100% Reusable or Recyclable**	Implement "Packaging-as-a-Service" and reverse logistics.
Waste Generation	**Substantial Absolute Reduction**	Shift to modular product design for easier repair and disassembly.

New and Emerging Trends in SCM

As we enter the "Decade of Destiny", 2026-35, and move the growing economies of the nations on pathways of accelerated sustainable growth, the supply chain needs to undergo a fundamental transformation through "Agentic" systems and deep-tier visibility to maintain both the competitiveness and sustainability. Here, we flag the following emerging trends in the "Decade of Destiny".

- **Agentic AI & Autonomous Orchestration:** Unlike traditional AI that just provides insights, Agentic AI systems now act as autonomous collaborators. They can reason, plan, and execute decisions, such as automatically re-routing a shipment or selecting a new supplier to minimize both cost and carbon footprints.
- **Digital Twins & Virtual Universes:** Companies are using virtual models of their entire supply chain to stress-test scenarios before they happen. These "twins" allow leaders to see the hidden 80% of environmental impacts tucked away in their value chain, enabling material recirculation and waste elimination.
- **Regenerative Supply Chains & Biodiversity Tracking:** The focus is shifting from "zero harm" to "active restoration." New tools now quantify how supply chain activities affect biodiversity, leading to "Nature-Positive" procurement where suppliers are selected based on their contribution to local ecosystem health.
- **Blockchain-Enabled Radical Transparency:** Immutable digital ledgers are providing a "digital fingerprint" for every raw material. This allows for total traceability from a mineral mine or a farm to the end consumer, ensuring ethical labor and zero-deforestation compliance.

These and other related trends shall continue to define the SCM pathways for sustainable manufacturing and service sectors.

The Future of Work: The Augmented Professionals

The role of the SCM professional is shifting from a manual coordinator to a Strategic Orchestrator.

- **Human-AI Partnership:** As intelligent agents handle procedural tasks, humans are stepping into higher-level roles: designing resilient scenarios, cross-functional alignment, and ensuring that the supply chain remains a force for Social Coherence.
- **Workforce Well-being:** Emerging trends focus on "Human-Centric" SCM, using AI to sequence tasks to reduce worker congestion in warehouses and providing personalized well-being support for frontline teams.

Toward a Resilient Supply Chain

The integration of AI and Sustainability is not a luxury; it is a survival strategy. In a world of climate volatility, the intelligent green supply chain is the only way to ensure long-term viability. We are moving toward a "resilient future", one where technology, humanity, and nature live in active, creative harmony and work for elevating human existence to a new high of coexistence, akin to the Vedic proclamation of "Vasudhaiv Kutumbakam", One World, One Family, One Future.

This calls for a caring organizational leadership to take on board the panchtantras of modern manufacturing' that is: purpose, productivity, profit, people, and the planet. This would then deliver the vital panchamrit of competitiveness, quality of service, environmental stewardship, economic prosperity and integrative wellbeing and make industry and enterprises partners in progress towards a bright and blissful future for the global humanity.

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Ranking, Accreditation and Internationalization of Higher Education In India

by ***Prof DN Reddy***

> ***India now needs a coordinated national strategy to strengthen aerospace and aeronautical education. Select central and state universities should be encouraged to establish dedicated departments with modern laboratories and strong faculty recruitment. Collaborative programs with DRDO, HAL, ISRO, and private industry should be expanded. Curricula must include emerging areas such as drones, artificial intelligence, autonomous systems, advanced manufacturing, electric propulsion, hypersonics, and space technologies. Scholarships and research fellowships can attract talented students into these strategic disciplines.***

National Education Policy, 2020 (NEP) envisions a massive transformation in education through- "an education system rooted in Indian ethos that contributes directly to transforming India, that is Bharat, sustainably into an equitable and vibrant knowledge society, by providing high quality education to all, thereby making India a global knowledge superpower." The NEP 2020 is founded on the five guiding pillars of Access, Equity, Quality, Affordability and Accountability. It will prepare our youth to meet the diverse national and global challenges of the present and the future. For Higher Education, NEP, 2020 provides valuable insights and recommendations on various aspects of education that include moving towards multidisciplinary and holistic education, institutional autonomy, promotion of quality research through establishment of National Research Foundation, continuous professional development of teachers, integration of technology, internationalization of higher education, restructuring of governance and regulatory architecture, multidisciplinary curricula, engaging blended, pedagogy, valid reliable and blended assessment and availability of content in Indian languages.

The policy is expected to bring long-lasting positive impact on the education system and making India a global hub of skilled manpower during the next 25 years leading up to Developed India in 2047.

Learner Centric Education

Learner-Centric Education provides students with opportunities for multidisciplinary and flexiblity in education-which gives them the ability to transition across courses according to their own talent and interest. Activities that will be aimed covered in this pillar are Multidisciplinary Education, Adoption of Academic Bank of Credits, Adoption of Multiple Entry and Exit, and Adoption of Guidelines on National Higher Education Qualifications Framework (NHEQF) and National Credit Framework (NCrF).

National Credit Framework (NCF) which enables National Higher Education Qualification Framework (NHEQF) and National Skill Qualification Framework (NSQF) were adopted to provide students the much-needed flexibility, allowing creative combination of subjects, providing multiple pathways, establishing equivalence and mobility to the students. For this purpose, Academic bank of Credits (ABC) through, Automated Permanent Academic Account Registry (APAAR ID) a 12-digit unique code linked to individual student which will act as lifelong identity for students to track their educational journey and achievements from, pre-primary to higher education.

Digital Learning and Leveraging Technology

Digital Learning is expected to accelerate student enrolment into higher education and make quality education accessible to all through a range of measures, including online education and Open Distance Learning (ODL), keeping in view the needs of learners with disabilities and substantial increases in scholarships at private/ philanthropic universities for disadvantaged and underprivileged students. Additionally, online professional development interventions are expected to be strengthened and substantially expanded to meet the needs of quality education and ensure standardized offerings. HEIs can act as digital Nodal agencies and offer online and ODL programs. Further Credit transfers from SWAYAM can also be adopted.

Industry-Academia Collaboration

Industry- institute Collaboration encourages industry readiness and improved employability of students through active collaborations between institutions and industries. Employability outcomes are expected to be achieved in terms of enhanced apprenticeships, internships, self-employment, wage employment, and entrepreneurship opportunities for the students. Activities that will be aimed to be covered in this pillar are Internship/Apprenticeship Embedded Degree Programme, MoUs signed for Industry Institute Linkage, and Establishment of Research and Development Cell, alignment of curriculum with industry.

Enhancing HEI-industry connect through guidelines on Professor of Practice to enable HEIs to work with industry experts in developing courses and curriculum to meet the industry and societal needs. Also, enhanced research, entrepreneurship & employability of students will be catalyzed through guidelines on apprenticeship / internship programmes and establishment of Research & Development Cell at HEIs.

Quality, Governance, Internationalization

Academic Research and Internationalization promote quality research within the Higher Education system. As India moves towards becoming a knowledge society and economy-keeping in view the requirements of the fourth industrial revolution, the higher education systém must be re-energised, provide hands-on and practical learning experiences to students, and conduct academic research focused on addressing industrial and societal needs. India should be promoted as a global study destination that provides premium education at affordable costs. The establishment of the Research and Development Cell (RDC) in HEIs will enable the attainment of the targets of Atma-Nirbhar Bharat. Further, research collaboration, student exchanges, and programs between Indian institutions and global institutions will develop a culture of research and innovation in Indian HEIs to achieve global standards of quality. Activities that will be covered in this pillar are increasing presence of Indian institutes in Global rankings and accreditation.

To encourage culture of research & innovation in Indian HEIs and achieve global standards of quality, introduced regulations on Academic Collaboration between Indian & foreign HEIs; Setting up and operation of Campuses of Foreign Higher Educational Institutions in India; Autonomous Status to colleges and guidelines for admission & supernumerary seats of international students in UG & PG in Indian HEIS.

To enhance academic collaboration with foreign HEIs leading towards academic and research excellence in the Indian HEIS, UGC released 'Academic Collaboration between Indian and Foreign Higher Educational Institutions to offer Twinning, Joint Degree and Dual Degree Programmes Regulations' on 02.05.2022. Out of 230 eligible Indian Universities, 103 HEIs are offering such programmes in collaboration with foreign HEIS.

Indian Knowledge System:

NEP envisions that HEIs take into account the local and global needs of the country, and with a respect to its rich diversity and culture. India, which was a leader of knowledge in the ancient times, must continue to be the torchbearer and knowledge leader in the coming future. Activities that will be covered in this pillar are Development of Digital Content and content in Indian Languages, conducting exams in Indian languages and embedding IKS in the curriculum.

Promotion of Indian Knowledge by way of several initiatives aims to include knowledge of ancient India, its contributions to modern India in its successes and addressing challenges, with a clear sense of India's future aspirations in the field of education, health, environment etc.

Ranking and Accreditation in Enhancing Quality

The National Education Policy 2020 is a comprehensive framework that aims to promote the holistic development of learners and enhance the quality of Higher Education Institutions (HEIs). The policy strongly emphasizes overhauling and re-energizing the education system through providing multidisciplinary education, nurturing critical thinking, fostering research and innovation, and improving the overall quality of infrastructure and teaching to deliver high-quality higher education.

NEP considers quality higher education to be one of the pre-requisites of 21st century to develop good, thoughtful, well-rounded, and creative individuals, where it is acknowledged that the purpose of quality higher education is more than mere creation of greater opportunities for individual employment. Enhancement of quality in higher education bank upon a number of parameters including 'ranking' and 'accreditation' of the Higher Education Institutions to ensure that standards in delivery of education is uniformly maintained throughout the country.

National and Global Accreditation

NEP 2020 recommended that in the long run accreditation will be a binary process in lines with existing global practice. Based on the recommendations of Dr. Radhakrishnan Committee report on 'transformative reforms for Strengthening Assessment and Accreditation of HEIs in India, and its acceptance National Assessment and Accreditation Council (NAAC) will undertake accreditation reforms in two phases: Binary Accreditation and Maturity-Based Graded Levels. NAAC has proposed engaging with the Higher Education Departments and Councils of various states to consult with them about the planned reforms in accreditation, thereby, enabling the majority of institutions to participate in the new accreditation process.

Binary Accreditation framework is drawn from 10 attributes classified based on Input, Process and Outcome dimensions essential for achieving quality assurance in higher education. The important change in the proposed framework is to focus on "Outcome and its Impact" on the contribution of higher education towards socio-economic development of the nation. The framework is suitably configured to accommodate the requirements of educational institutes.

The proposed framework is expected to take less cycle time, less accreditation fee and most importantly avoids physical peer team visits to the institutions as part of assessment. Also, data validation which is largely quantitative, will be carried out by peer institutions to ensure objectivity and correctness of assessment. The proposed framework of 10 Attributes includes 59 metrics for universities, 56 for autonomous colleges, and 46 for affiliated colleges.

Internationalisation of Higher Education in India

The NEP 2020 enumerates various strategies and initiatives and provides an excellent opportunity through a wide array of activities such as internationally relevant curricula. brand building of Indian Higher Education Institutions abroad. academic and research collaboration with foreign universities. credit recognition under twinning arrangements. global citizenship approach and engaging with foreign alumni.'I'he Guidelines provide an excellent opportunity for global outreach of Indian Higher Education Institutions.

The NEP 2020 has laid the foundation for internationalization by encouraging Indian universities to collaborate with global institutions, offer dual-degree programs, and invite foreign universities to set up campuses in India. This policy aims to enhance the quality of education, promote research, and provide Indian students with global exposure without leaving the country.

Global Collaborations and Partnerships

Indian universities are increasingly forming MoUs and partnerships with international institutions for student exchange programs,

joint research projects, and faculty development. These collaborations are fostering cross-cultural learning and innovation, making Indian campuses more diverse and globally connected.

Key Trends Shaping Internationalization in 2028

Diverse Student Population: By 2028, Indian universities are expected to host a significant number of international students, particularly from South Asia, Africa, and the Middle East. Initiatives like Study in India are promoting India as an affordable and high-quality education destination.

Global Curriculum and Pedagogy: Indian universities are revamping their curricula to align with global standards. Programs are being designed to include multidisciplinary approaches, industry-relevant skills, and cross-cultural competencies. The use of blended learning models (online and offline) is also enhancing accessibility for international students.

Research and Innovation Hubs: India is emerging as a global leader in research and innovation. By 2030, universities are expected to establish dedicated research centres in collaboration with international institutions, focusing on areas like sustainable development, artificial intelligence, and public health.

Faculty Exchange Programs: To ensure world-class teaching standards, Indian universities are actively participating in faculty exchange programs. This allows educators to share best practices, adopt innovative teaching methods, and bring global perspectives to Indian classrooms.

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Quality in Higher Education beyond Ranking and Accreditation

by ***Dr Onkar Singh***

Starting in late 1800s, the accreditation of schools and universities in USA got matured in early 1900s, for setting common standards. While the US kicked off the ranking of its institutions in 1983, the China came out with global ranking of higher education institutions (HEIs) named Academic Ranking of World Universities (ARWU) in 2003 and thereafter in 2004, the Times Higher Education- QS World University Ranking was launched in UK.

Undoubtedly, the competitiveness amongst the HEIs and the aspirations of the community for transparency and accountability in HEIs has seeded the race for ranking and accreditation in number of countries including India. As a result, for quite some time, the higher education in India appears to be ushered by the accreditation and ranking criterion prescribed by the national and international agencies engaged in these. This has yielded a large number of HEIs getting accredited and persevering hard to ameliorate their metrics for better ranking at national / international levels. The perception of competing HEIs depending largely upon these, has led to numerous consultants and institutional leaders helping the institutions for managing the same.

Without prejudice towards the ranking and accreditation process, deeper thinking is required to ascertain as to what extent the metrics are helping in improving the quality of educational deliveries and also why even the higher education institutions possessing good rank / accreditation continue facing challenges in respect to the quality of their outcome. Does it point to the short-sighted view of academics prioritizing to score well on metrics than to focus on qualitative improvement in teaching-learning-assessment processes and quality of deliveries in native context? As per AISHE dashboard there are 1401 universities providing higher education, and the NAAC accreditation of 2025 shows there are 572 accredited universities in the country. Still, the concerns about poor quality of higher education call for a holistic assessment of the precarious situation in sizeable number of HEIs.

Academics

Academic activities in HEIs are currently challenged by the fast pervading easy to access digital learning content on one side and inadequate rigour on the part of teachers and students both in the physical classrooms on the other side. Alongside a culture of students seeking admissions and paying fees merely for appearing in examination without attending classes has made inroads in the higher education. In the present era of ubiquitous digital content marginalizing the role of teachers, the expectations from students to attend classes may sound utopian, but the inadequacy of competencies in degree holders reasserts the need and relevance of having physical classroom interactions.

Certainly, there is a shift in attitude of students from seeking knowledge to good grades and quicker employment, but it is not fair to conclude that the students are not ready to learn. Among various reasons, it appears that the insufficient content delivery in classrooms, absence of charm in teaching style, dedication and commitment of teachers to teaching in classrooms is significantly responsible for the students resorting to alternative routes of learning. This is also attributed to the teachers focusing more on their publications, projects, and IPRs which strengthens their prospects while ignoring the classroom deliveries assuming that the students will take care of learning requirements on own through various digital sources. It is cultivating a sense of redundancy of physical classrooms, and the learning gaps cannot be ruled out. Now, with artificial intelligence coming in, the form of digital learning may further predominate, and the academic community has to accept the technological interventions and reorganize the on-campus interactions suitably for thorough learning by students.

Some arguments are there regarding the curriculum being non-translatable to employment directly. The academics is

entrusted with the job of framing syllabus and curriculum. But the changes ought to be made carefully ensuring the basic purpose of particular programme remains intact and it is not devoid of imparting long lasting competencies instead of being reduced to provide micro credentials to learners for a set of job in short run.

The learning assessment through continuous evaluation and examination system is an integral part of the academics. But, the prevailing marks inflation in examinations and the loss of credibility of examination outcomes is worrisome. The diminishing consideration to the marks awarded in most of HEIs except the premier HEIs calls for numerous tests to reassess the competencies and is an unwanted burden upon the students and the institutions conducting them.

Actually, the benchmarking for learning levels is done by the rigour and integrity of the examination system. The dilution in academic standards is also attributed to the lowering of standard of assessment tools, which is failing in pulling the learners out of their comfort zones. As the efforts put in by the students are direct function of the level of questions asked, so it demands significant upgrading and innovation. Also, the fairness of the continuous assessment must be strengthened because it is the complacency of teachers in classroom and liberal approach which vitiates the overall academic ecosystem. However, the students remain happy during their period of stay in HEIs but pay heavily for the learning gaps afterwards.

Besides the curricular aspects, the extracurricular engagements need strengthening for good mental and physical health. In the today's seamless world, the transformations in extracurricular engagements should be accepted and recast in context of Indian traditions, culture and ethos.

HEIs require committed faculty and staff members for manging their curricular and extracurricular activities. The inadequate number of well qualified and devoted teachers and staff is a deterrent in accomplishing the excellence in educational deliveries. Academic excellence calls for not only the requisite number of teachers to teach in class rooms and technical supporting staff to carry out experiential learning in laboratories and projects, rather it has to be the one having adequate domain knowledge, devotion to work, and integrity in teaching & examination processes. For this, the vacant teaching positions must be filled through fair, transparent and merit centric faculty recruitment process.

Delving deep into the recruitment of teachers, it is seen that at number of places, the selection of teachers is solely based on their performance in selection interview by the selection committee while the academic pedigree of the competing individuals are restricted to their screening. This gives a scope for accommodating biases and the academic & professional merit takes back seat. For fair and merit centric selection, the selection of teachers must have significant weightage to their academic & professional credentials and the role of selection interview be limited to a component in preparing the overall merit of the candidates comprising of the three components namely academic credentials, professional accomplishments and the interview performance by the selection committee. Similarly, the recruitment to technical supporting staff also need to be remodelled on these lines.

After selection of teachers, it is observed that for quite some time, their career advancement is reduced to being function of fulfilment of eligibility conditions. Which is also nucleating complacency in teachers towards their teaching and other responsibilities. The whole approach behind the career advancement must be revisited to keep the teachers motivated enough to perform well in class rooms. A cue can be had from the manner in which the older personal promotions, now career advancement, were carried out. Because in earlier times the teachers had to rigorously perform for getting promoted under personal promotion and it was never like the present format of career advancement where it is by and large a matter of right and granted just on the attainment of time lines and metrics.

Concerted efforts are needed to motivate human resource in academics at all levels as the key to excellence in it lies in the worthiness, commitment, and honesty of teachers and supporting staff to their duties. Teaching is an art and a lot of patience, hand holding by seniors, and cultural changes are essential to

create good teachers over a period of time. Passionate and committed teachers and supporting staff cannot be created overnight.

Teachers must be made to reorient towards students in classrooms and laboratories and ensure full coverage of syllabus, increase rigour of teaching, adequate attention to students, engage in outreach activities, and focus on individual research for self-development. The whole-hearted participation of teachers in knowledge transfer, knowledge creation, innovations and creativity is critical.

Alongside the attempts at standardisation by bringing uniformity in curriculum and syllabus across HEIs do prevent them from rolling out specially crafted content suiting their context and strengths. The aspirations to transform HEIs into world-class call for directly engaging students in solving real- life challenges through their creativity and innovations, high moral standards, character building, fearless discussions, criticism and debates.

Governance and Leadership

The growing number of students and number of HEIs has invariably seeded the governance challenges. The discipline, punctuality, adherence to pre-announced academic calendar, and declining interaction of teachers and students in classrooms are the attributes to be looked into for improvement. Alongside, the high cost of education inculcating a feeling of students paying for seeking education has made the education much more transactional. This has emboldened the students and the same is felt by the teachers during the course of mentoring them. There is no problem, if the student demand the quality education from teachers, but the problem lies in students seeking undue favours from the teachers due to the high cost of education. The parent community is also culprit for considering education as a commodity to be purchased instead of ingraining the sense of responsibility in their wards to endeavour hard for earning degrees by acquiring knowledge and ethically maintain the academic system sacrosanct. It has to be kept in mind that any breach of ethical standards and academic integrity is very heavily priced and the downgrading educational standard affects the whole community negatively. The unfriendly attitude towards students, inadequate counselling and mentorship, delays in student related procedures, absence of fairness, insufficient infrastructural facilities, less institutional accountability etc. are also the governance challenges to be looked into at the earliest.

Further, the governance of HEIs revolves around the institutional leadership and the worthiness of the same to negotiate the challenges can ameliorate the overall educational deliveries. Sadly, the appointment of individuals in leadership roles in HEIs has been reeling under controversies for quite long. There are instances of HEIs suffering on account of absence of vision, understanding, courage, integrity, and accountability of institution leaders. Quite often whispers are there about these appointments being devoid of merit and done disregarding the merit, under certain influence or considerations. On many occasions, the independent voices are raised for the high-level enquiry to probe into irregularities in the appointments at universities and colleges along with including reforms for higher education. Perhaps, due to these reasons, often there are debates around the appointment of Vice-Chancellors of state Universities and the manner in which such appointments are made in private universities, which is not at all a positive sign for overall health of HEIs. The selection of institutional leaders should be carried out with utmost fairness, highest level of integrity and objectivity.

Another important factor needing consideration is the temporary and long term arrangements of the caretaker head of HEIs in the absence of regular appointed person. Such arrangement unsettles the pace of the institution and inculcates the administrative uncertainty and indiscipline. On the whole, the adhoc arrangements at leadership position are not in the larger interest of the HEIs. Therefore, due caution is required for timely completion of recruitment of leadership and there should be overlapping period of at least one month so that the incumbent is well verse with the prevalent challenges, limitations, practices and procedures of HEI for smooth discharge of responsibilities.

For regulating the HEIs, there also exist regulators like University Grants Commission (UGC), All India Council for Technical Education

(AICTE), National Medical Commission (NMC), Pharmacy Council of India (PCI), Bar Council of India (BCI), Council of Architecture (CoA), etc. which frequently call for a lot of compliances, data and paperwork pushing the education quality concerns to the back. Ordinarily, the faculty members and the Head of institutions spend reasonable time in managing compliances, approvals, audits, accreditation, ranking, reports, etc. This squeezes time for thinking, and creativity of the teachers and impedes the growth of any HEI.

Autonomy and Financing

Generally, the HEIs are instituted under statutory provisions with autonomy vested in their apex authorities having representation of all concerned stakeholders namely university / government officials, non-officials, and domain experts for collective decision-making. Quite often, it is observed that despite the Vice-Chancellor / Director being the academic and executive head find diluted authority because of procedural overreach and hindrances from various quarters. It must be kept in mind that the attempts to bypass apex authorities amounts to ignoring the collective wisdom which is mostly not in the interest of the HEIs. Therefore, the interferences by the offices not empowered by the act/statute in the functioning of the HEIs must be avoided to allow HEIs to flourish and nurture scholarship in students and teachers alike freeing them from the conventions and administrative restrictions, if any. The over-regulation, top driven management, and political interference should be taboo in HEIs, failing which the restrictions limit independent thinking, planning, quality of outcome, and adversely affect the overall functioning. The HEIs must exercise autonomy in offering programmes, educational content, etc. as per the national aspirations, because the micromanagement mandates by regulators and attempts to bring uniformity in curriculum and classroom practices kill the intellectual curiosity.

The financing of the public sector HEIs has been point of concern since independence of the country. Looking back shows that the recommendation of the Kothari Commission during 1964-66 for increasing the public spending in education up to 6 % of GDP is still a dream to be realized. Lesser spending impacts the public sector HEIs majorly because of their limitations on charging fees on account of larger social obligations to keep education accessible to all. While, the HEIs in self- financed and private sector recover the increasing cost of education through fees from the students and curtail their expenditure by reducing spending on various components including salaries which yields increasing cost of education in these institutions. Under these circumstances, the public spending on education has to be increased significantly for achieving excellence and retaining the best of minds as part of academic fraternity. Restricting tangible and intangible experimentation in HEIs due to deficit in enablers like funds, facilities, infrastructure and resources are detrimental to the education .

Accountability

All types of HEIs in public or private sector should have the accountability towards society. Due to better social perception, the public sector HEIs are under larger obligation to practice autonomy and due control to be transparent, offer best outcomes, and maintain integrity. Indisputably, the performance assessment helps in accomplishing a perfect blend of autonomy and accountability but the present approach of assessment and accreditation must be revisited to limit human interference and manipulations. Time is ripe for the HEIs to go for use of technology for digitalisation of processes, and accord highest priority to the quality of teaching-learning-examination, zero tolerance to unethical practices, credible assessments, complete disclosures, feedback centred reforms, external audits, and performance based funding.

Students

There has been a paradigm shift in the approach of the present generation of students towards higher education. The absence of ample employment opportunities and inherent family limitations to go for entrepreneurship in good number of cases, seems to change the thinking of large section of students about the higher education as a route for securing employment and not for seeking knowledge or knowledge creation. The continued questioning of the employability of the students coming out

from HEIs in respect to certain skill sets is inculcating a need to acquire micro-credentials with some skill sets and get job to survive. The dominance of survival instinct over the career instinct in higher education is really worrisome for the education system. Because, such tendency of acquiring certain skill sets for fetching jobs immediately will eventually limit the availability of youth for deeper thinking and innovations in long run. It could be culmination of different factors like very large number of young population, inadequate employment opportunities, lesser risk taking abilities for entrepreneurship, weak educational standards at different levels, incompetency of teachers to motivate students to seek higher education, inconsistency of mental state and shorter attention spans of present generation, increasing cost of education, changing aspirations to prioritizing earning money over the knowledge, etc.

Quite often, the HEIs carry out certain activities merely to meet ranking and accreditation requirements and also involve students in managing evidences of activities which are actually not held regularly. As a result, there are instances of the students not getting quality of education commensurate to the accreditation and ranking of respective HEI. This not only endangers the credibility of the accreditation and ranking system but also creates trust deficit between the academics and students and families. These circumstances call for introspection and corrections in processes to improve education standard and to get rid of such concerns systematically.

Way forward

In the midst of intense focus on accreditation and ranking, the HEIs must prioritize fundamental improvements to excel in true sense instead of only working for improving scores in select attributes. The dynamic nature of higher education demands appropriate changes in meeting the fast changing aspirations of today's youth and social norms while keeping the academic values intact. The honest efforts to improve the quality of higher education through committed and diligent teachers, fair and accountable governance, access to all with equity, worthy leadership with impeccable integrity, facilitation instead of regulation, and making education processes free from any biases and considerations may trigger positive changes.

Given the vast scale of higher education in India, the monetization of critical requirements and despair should not be allowed at any stage. Also, the affordability of higher education should be ascertained so that the opportunities are actually available. The unfair practices to market the accreditation and ranking ought to be restricted for avoiding influencing students and parents in decision making about their educational journey.

It goes without saying that achieving excellence in higher education is inevitable for growth and prosperity of the country. Considering the limitations felt in the prevailing education system, the institutional governance, teachers, regulatory framework, and the government may have to recast their roles as an enabler to breeding knowledge, knowledge transfer, and novel thinking in HEIs. It must be noted from the ground reality that the HEIs having primary focus on the accreditation and ranking find it difficult to nurture creativity and competency. Also, for the country to be a knowledge leader in future, the concern should not be towards the regulation of HEIs through accreditation and ranking but about facilitating them to achieve excellence in education and further their abilities to perform creatively without fear for the capability-building of the present generation.

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Biofuels at the Crossroads: Disruption, Opportunity, and the Sustainable Decarbonization Journey

by *Prof. Naveen Kumar & Dr. Harveer Singh Pali*

The transition towards a new global energy system has entered its crucial decades and biofuel mainly biodiesel and renewable diesel, are at a critical turning point. Once viewed as bridging fuels, biofuels have become key component in decarbonization policies, energy security and the rural economy. However, biofuel industry facing many challenges and uncertainties, including technology innovations. The latter are coupled with significant prospects for development due to innovations.

Current Global Status of Biofuels and Biodiesel

The utilization of biofuels is significant and substantial share of renewable energy currently employed in transportation and industry sectors. Modern utilization of bioenergy makes significant contributions to overall global energy consumption, especially for those industries that cannot operate on electricity. Biomass-based diesel, composed of biodiesel and renewable diesel, continues its gradual growth and is expected to account for nearly 27 percent of total biofuel production in 2034.

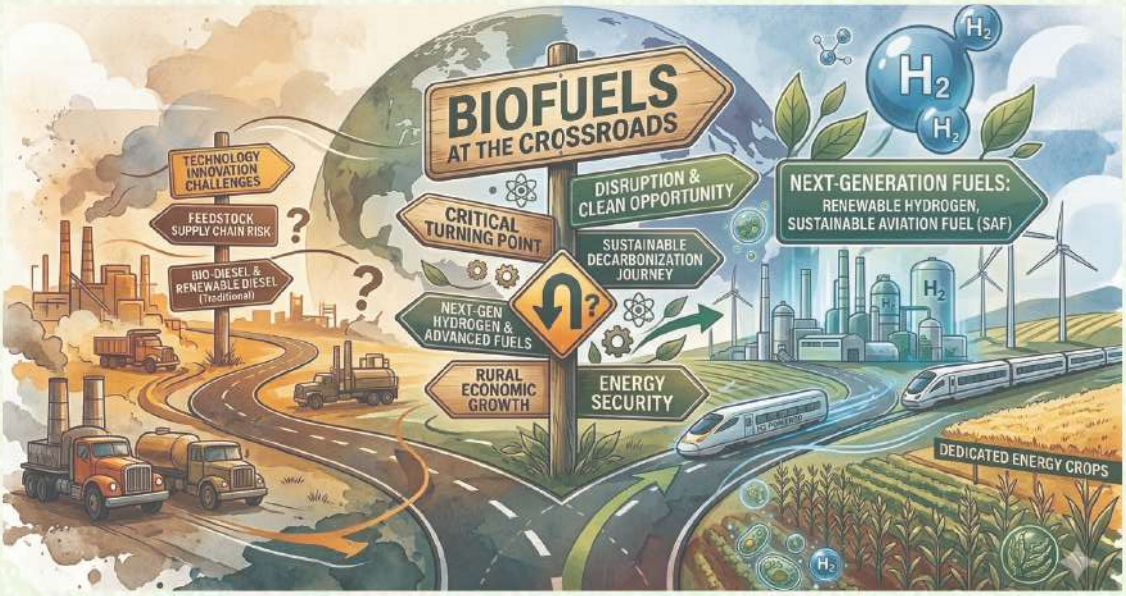
The global biodiesel market is increasing continuously and will grow approximately $47.8 billion in 2025 to above $65 billion by 2034, mainly because of government policies and environmental issues, as well as uncertainties associated with fossil fuels. India and Brazil intend to boost their blending rates, while the US intends to blend 20% ethanol and 15% biodiesel by 2026.

However, the region wise growth varies. Despite the leading position of Europe in biodiesel consumption due to strict carbon policies, developing countries face difficulties in raw material availability, infrastructure and financial aspects.

Disruptions Reshaping the Biofuel Landscape

Biofuels have shown immense potential for future growth, yet they currently face numerous setbacks and changes. The primary challenge facing the biofuel sector is policy change. This is because biofuels are heavily dependent on mandatory regulations, subsidies, and incentives. Any sudden policy change can create market instability, as evidenced by the decline in biodiesel imports into the United States due to policy changes.

The second major disruption is sustainability and availability of feedstock. The biodiesel industry relies extensively on feedstocks, such as soybean, palm, and rapeseed oils. Yet, growing environmental awareness and strict sustainability standards are making it difficult to use these raw materials for biodiesel



production. Therefore, the utilization rate of palm oil in biodiesel production will be sharply reduced, and waste-based feedstocks will become dominant.

The biofuel industry is facing a lot of pressure from the economy and the market. You can see this when factories close down and are left empty. This shows that the industry is really sensitive to what's happening in the market and that there are problems with the policies in place. On top of that, the cost of raw materials is high, oil prices are all over the place, and electric vehicles are becoming more popular, which makes things even tougher for the industry. All these factors combined make it a really challenging time for biofuel companies.

Furthermore, technology disruption is disrupting the sector. Electrification, hydrogen fuel, and e-fuels are increasingly becoming alternative pathways for decarbonizing energy production. Although biofuels will continue to play an important role in some applications, their use in transportation, particularly passenger cars, is under scrutiny in regions embracing electric vehicles.

Emerging Opportunities in the Biofuel Sector

Despite all these difficulties, the biofuels sector is undergoing a radical transformation. One of the most significant transformations includes the development of high-tech biofuels such as renewable diesel, sustainable aviation fuel (SAF), and bio-methanol. Sustainable aviation fuel (SAF) especially is attracting worldwide interest in search of viable decarbonization solutions for the aviation industry.

There have been increased government directives and emissions targets that have created high levels of demand. This has seen strict blending regulations and low-carbon fuel standards be set to promote the adoption of future generation biofuels. Such measures are hastening the move from the current biodiesels.

One additional critical opportunity includes that of converting waste to energy. The move from first generation to second and third generation biofuels made from agricultural residues, urban waste, and algae helps overcome problems related to sustainability along with reducing life cycle emissions. The increasing use of waste oils and fats shows this trend.

Biofuel utilization along with carbon capture and hydrogen technology is also creating new horizons. The ideas that have been introduced lately, such as e-biofuels, which involve the use of biomass with hydrogen, provide an economically feasible route to decarbonization, especially where there is insufficient biomass.

Moreover, biofuels stand out due to their ability to help reduce carbon emissions in industries that are difficult to electrify, such as aviation, marine, and long-distance freight transport. For instance, the need for marine biodiesel is anticipated to double by 2030.

The Decarbonization Imperative

The necessity of climate mitigation has made biofuels an important component of climate mitigation plans. Fuels are likely to remain an integral part of economic activities where electrification cannot be achieved due to technical or economic limitations. Biofuels offer a relatively low carbon emission option which is easily deployable with existing energy systems.

Sustainable decarbonization, however, poses certain difficulties. It is important to analyze lifecycle emissions to make sure that carbon savings are real. Food crops should not be used as biomass sources, and changes in land use should be considered. Furthermore, the ability to enhance the production sustainably is another major concern.

Conclusion

There is no issue that biofuel and biodiesel technology have come to a crucial stage in its evolution. In fact, this sector is experiencing a tough time owing to several reasons, including policy changes, raw material, and technology. On the other hand, the industry is going through an era of unprecedented possibilities.

Rather than declining, biofuels are poised to evolve into advanced and sustainable energy source. There are slight functioning as common transport fuels. Also, its application is shifting essential roles in aviation of decarbonization, maritime and industrial sectors.

However, the way forward should include balancing acts leveraging opportunities while standing the test of sustainability and economics. If there are the right policies in place, then innovation and sustainability can make biofuels indispensable in ensuring that the further will low carbon emissions.

Prof. Naveen Kumar is Professor and Head of Biofuel Centre of Excellence at DTU and Dr. Harveer Singh Pali is Assistant Professor at NIT Srinagar

Design in Engineering: A Multidisciplinary Journey

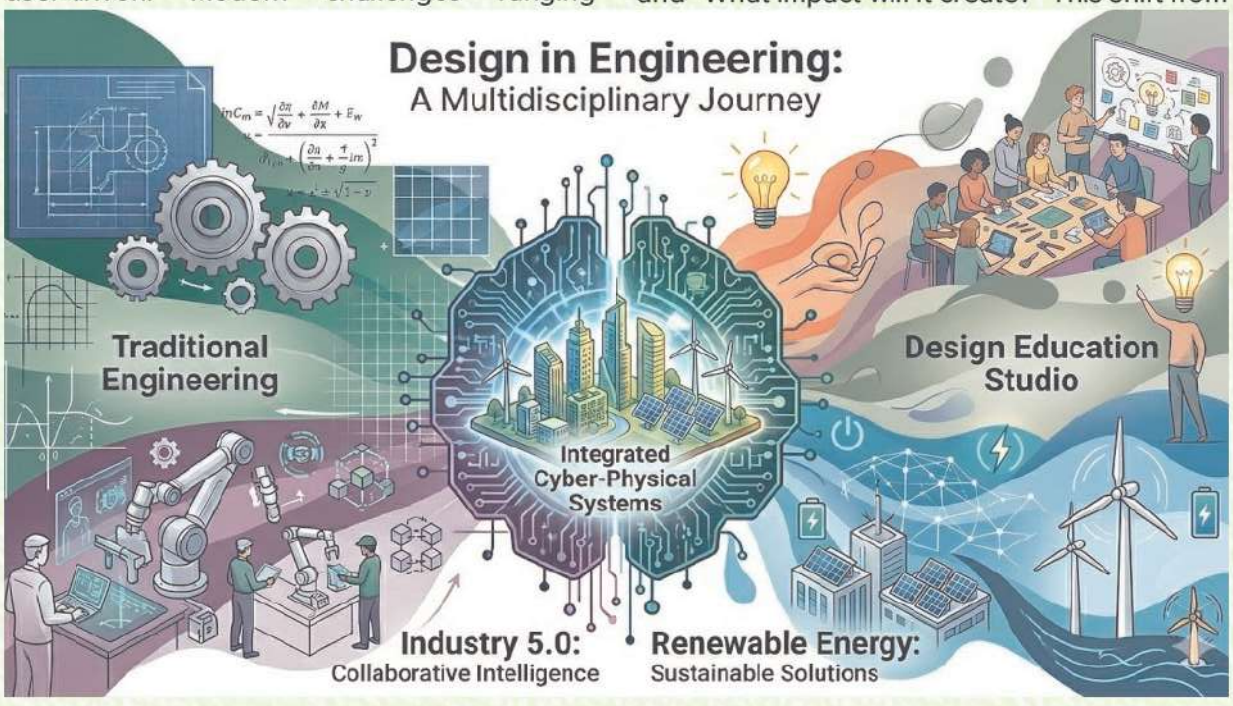
by **Prof. Ranganath M. Singari**

> ***The integration of design into engineering and technical education represents a significant transformation in the way knowledge is created, applied, and experienced. The journey of establishing a design ecosystem within Delhi Technological University demonstrates that design is not merely an additional discipline, but a fundamental approach that enhances the effectiveness and relevance of engineering education.***

Introduction:

Engineering and technology education have long been the backbone of industrial and economic progress, traditionally emphasizing precision, efficiency, and functionality. For decades, the primary focus of engineering institutions has been to equip students with strong analytical abilities, mathematical rigor, and technical expertise to solve well-defined problems. While this approach has contributed significantly to advancements in infrastructure, manufacturing, and digital technologies, it has often overlooked a critical dimension the human experience. In today's rapidly evolving world, the nature of problems has become increasingly complex, interdisciplinary, and user-driven. Modern challenges ranging from sustainable development and climate change to digital transformation and inclusive innovation cannot be addressed solely through technical solutions. They demand a deeper understanding of human behavior, cultural context, usability, and emotional engagement. This shift has led to the growing recognition of design as a fundamental component of engineering and technical education.

Design, in this context, extends far beyond aesthetics or visual appeal. It represents a holistic problem-solving approach that integrates creativity, empathy, critical thinking, and iterative development. Design encourages engineers to ask not only "How does it work?" but also "Who is it for?", "Why is it needed?", and "What impact will it create?" This shift from



a purely technical mindset to a human-centered and systems-oriented perspective is essential in preparing students for real-world challenges.

The integration of design into engineering education introduces methodologies such as Design Thinking, which emphasizes empathy, ideation, prototyping, and testing. These approaches foster innovation by encouraging experimentation, risk-taking, and continuous learning. They also promote collaboration across disciplines, enabling students from engineering, design, management, and humanities to work together in solving complex problems. Furthermore, the rise of emerging technologies such as Artificial Intelligence, Internet of Things (IoT), and smart systems has amplified the need for design integration. As technology becomes more advanced, the focus shifts toward making it accessible, usable, and meaningful for people. This requires engineers to develop not only technical proficiency but also design sensitivity and user awareness. Design plays a crucial role in achieving this balance by promoting sustainable materials, efficient systems, and inclusive solutions that cater to diverse user groups.

In this evolving landscape, educational institutions are recognizing the importance of embedding design within technical curricula. The goal is to nurture a new generation of professionals who are not just engineers, but innovators, creators, and problem-solvers capable of addressing global challenges with empathy and insight. Thus, the emergence of design in engineering and technical education is not a trend but a necessity. It represents a shift toward a more integrated, multidisciplinary, and human-centered approach, ensuring that technological advancements are aligned with the needs and aspirations of society.

Vision Behind Establishing the Institute of Design at DTU

The establishment of the Department of Design at Delhi Technological University was driven by a forward-looking vision to redefine the role of engineering and technical education in a rapidly changing global context. The core idea was to move beyond traditional disciplinary boundaries and create an ecosystem where technology, creativity, and human understanding converge seamlessly. At the heart of this vision was the realization that engineering solutions, no matter how technically sound, often fail to create meaningful impact if they do not address **user needs, societal challenges, and experiential quality.**

One of the primary goals was to **bridge the gap between engineering and human experience.** In conventional technical education, the emphasis is often placed on systems, machines, and performance metrics. However, real-world applications demand an understanding of how people interact with these systems. The Institute of Design was envisioned as a platform where students learn to integrate **functionality with usability, efficiency with empathy, and innovation with responsibility.** Another key aspect of the vision was to foster multidisciplinary collaboration. The complexities of modern problems whether in healthcare, transportation, sustainability, or digital systems require inputs from diverse fields. The Institute was therefore designed to bring together students and faculty from engineering, design, management, and humanities, encouraging them to work collaboratively on shared challenges. This approach promotes **systems thinking,** where solutions are developed with a comprehensive understanding of interconnected factors. The vision also emphasized the importance of creativity within technical rigor. Engineering education traditionally prioritizes correctness and precision, whereas design introduces exploration, experimentation, and iteration. By integrating these two approaches, the Institute aimed to cultivate professionals who are both analytically strong and creatively confident. Students are encouraged to question assumptions, explore multiple possibilities, and develop innovative solutions through structured experimentation.

In addition, the Institute was conceptualized to align education with **industry relevance and societal needs.** Rapid technological advancements and changing market dynamics demand professionals who can adapt, innovate, and lead. By embedding design thinking into the curriculum, the Institute prepares students to engage with real-world problems, collaborate with industry, and contribute to entrepreneurial ecosystems. Sustainability and inclusivity were also integral to the vision. The Institute promotes the development of solutions that are environmentally responsible, socially inclusive, and culturally sensitive. This

ensures that graduates are not only skilled professionals but also responsible contributors to society. Importantly, the vision was not limited to establishing a department—it was about creating a **design-driven culture within the university.**

Multidisciplinary Foundation: Design as a Connector

One of the most defining strengths of establishing a design ecosystem within Delhi Technological University is its ability to function as a multidisciplinary connector. Design, by its very nature, does not belong to a single domain; rather, it operates at the intersection of multiple disciplines, enabling integration, collaboration, and holistic problem-solving. In traditional academic structures, disciplines often function in silos engineering focuses on technical systems, management on strategy and operations, and humanities on human behavior and culture. While each domain contributes valuable knowledge, the lack of integration can limit the development of comprehensive solutions. The introduction of design breaks these boundaries by acting as a common language that connects diverse fields.

From an engineering perspective, design enhances the application of technical knowledge. For example, in Mechanical Engineering, design translates into product development, ergonomics, and manufacturing systems that are not only efficient but also user-friendly. In Computer Science and Information Technology, design plays a crucial role in shaping user interfaces, user experiences (UI/UX), and human-AI interactions, ensuring that complex technologies are accessible and intuitive. Similarly, in Civil Engineering and Architecture, design influences urban planning, public spaces, and infrastructure development, emphasizing not just structural stability but also user comfort, safety, and social interaction.

A key outcome of this multidisciplinary approach is the development of systems thinking among students. Instead of viewing problems in isolation, students learn to understand the interdependencies between technology, users, environment, and society. This enables them to design solutions that are more sustainable, inclusive, and impactful. Moreover, the multidisciplinary foundation encourages collaborative learning environments. Students from different backgrounds work together on projects, bringing diverse perspectives and expertise. This not only enriches the learning experience but also prepares them for real-world scenarios where teamwork across disciplines is essential. Another important dimension is the integration of **emerging technologies with design.** Fields such as Artificial Intelligence, Internet of Things (IoT), and smart systems require a strong design component to ensure usability and acceptance. Design helps in bridging the gap between complex technological capabilities and human understanding, making innovations more practical and widely adoptable. Ultimately, positioning design as a connector transforms the educational ecosystem into a **dynamic, interactive, and innovation-driven environment.** It nurtures professionals who are capable of thinking beyond boundaries, collaborating effectively, and addressing complex challenges with a balanced perspective.

Challenges in Establishment

The establishment of a design-oriented academic ecosystem within Delhi Technological University was a transformative initiative, but it was not without significant challenges. Integrating design into a traditionally structured engineering environment required not only infrastructural development but also a **fundamental shift in mindset, pedagogy, and institutional culture.**

One of the foremost challenges was the **need for a mindset shift.** Engineering education has long been rooted in deterministic thinking, where problems are well-defined and solutions are expected to be precise and objective. In contrast, design introduces ambiguity, open-ended exploration, and subjective interpretation. Encouraging students and faculty to embrace uncertainty, experimentation, and iterative learning required continuous effort. It involved redefining success—not as arriving at a single correct answer, but as engaging in a thoughtful and creative process of problem-solving. Another critical challenge was the development of appropriate infrastructure. Unlike conventional classrooms, design education demands specialized spaces such as studios, workshops, fabrication labs, and digital media labs. These environments are essential for hands-on learning, prototyping,

and collaboration. Establishing such facilities required strategic planning, financial investment, and alignment with institutional priorities. Additionally, ensuring access to tools, materials, and software relevant to various design domains was an ongoing process.

The issue of **faculty integration and development** also presented a significant challenge. A multidisciplinary design department requires educators from diverse backgrounds, including engineering, design, arts, and social sciences. Bringing together professionals with different pedagogical approaches and aligning them toward a shared vision demanded strong leadership and collaborative frameworks. Moreover, faculty members needed to adapt to **studio-based teaching methods,** which differ substantially from traditional lecture-driven approaches.

Another important aspect was establishing **industry relevance and engagement.** While design is highly valued in industry, building strong collaborations, securing live projects, and aligning academic outcomes with industry expectations required sustained effort. It was essential to demonstrate the value of design graduates and create pathways for internships, placements, and entrepreneurial ventures. Furthermore, integrating **sustainability and social responsibility** into design education presented both an opportunity and a challenge.

Key Achievements and Outcomes

The successful establishment of a design ecosystem within Delhi Technological University has led to a series of significant achievements, reflecting both academic excellence and practical impact. Over the years, the integration of design into engineering and technical education has evolved from a conceptual initiative into a well-structured, outcome-driven academic and research framework. One of the most notable achievements has been the development and successful implementation of undergraduate, postgraduate, and doctoral programs in design. The introduction of B.Des, M.Des, and Ph.D. programs has created a comprehensive academic pathway, enabling students to engage with design at multiple levels—from foundational learning to advanced research. These programs have attracted students from diverse backgrounds, fostering a rich multidisciplinary learning environment.

A major outcome of this initiative has been the growth of research in emerging and interdisciplinary areas. Significant contributions have been made in domains such as **Cognitive Design, User Experience (UX), Human-Computer Interaction, Sustainable Design, and Craft-Based Innovation.** Research scholars have worked on real-world problems, contributing to both academic literature and practical solutions. This has strengthened the institution's position as a center for design research and innovation. Another important achievement is the successful guidance and mentoring of Ph.D. scholars across multiple design domains. These scholars have explored areas ranging from visual communication and interaction design to product design and social innovation. The diversity of research topics reflects the breadth and depth of the design ecosystem, as well as its ability to address complex, interdisciplinary challenges.

Conclusion

The integration of design into engineering and technical education represents a significant transformation in the way knowledge is created, applied, and experienced. The journey of establishing a design ecosystem within Delhi Technological University demonstrates that design is not merely an additional discipline, but a **fundamental approach that enhances the effectiveness and relevance of engineering education.**

Throughout this journey, it has become evident that traditional technical education, while essential, is no longer sufficient in addressing the complexities of contemporary challenges. The world today demands solutions that are not only technically sound but also **human-centered, sustainable, and meaningful.** Design provides the framework to achieve this balance by integrating creativity, empathy, and innovation with engineering principles.

Prof. Ranganath M. Singari, Fellow of W-AHEAD is the Founder Head of Department of Design and Professor of Mechanical, Production & Industrial & Automotive Engineering Delhi Technological University, DTU.

India's Defence Growth and the Strategic Need for Aerospace and Aeronautical Education

by **Dr. Manish Kumar**

> ***India now needs a coordinated national strategy to strengthen aerospace and aeronautical education. Select central and state universities should be encouraged to establish dedicated departments with modern laboratories and strong faculty recruitment. Collaborative programs with DRDO, HAL, ISRO, and private industry should be expanded. Curricula must include emerging areas such as drones, artificial intelligence, autonomous systems, advanced manufacturing, electric propulsion, hypersonics, and space technologies. Scholarships and research fellowships can attract talented students into these strategic disciplines.***

India is witnessing a decisive transformation in its defence and technological landscape. Over the last decade, the country has made visible progress in strengthening indigenous defence production, expanding military capabilities, increasing exports, and promoting self-reliance under initiatives such as Make in India and Atmanirbhar Bharat. Defence manufacturing has grown substantially, exports have reached record levels, and India is increasingly positioning itself as an emerging global defence production hub. Yet, behind these encouraging developments lies a foundational challenge that requires urgent national attention: the limited expansion of aerospace and aeronautical engineering education in India's higher educational institutions. If India seeks long-term strength in defence production and strategic technologies, it must first build a strong academic ecosystem capable of producing

skilled engineers, researchers, innovators, and technology leaders.

Modern defence capability depends heavily on mastery of aerospace and aeronautical systems. Fighter aircraft, helicopters, transport aircraft, unmanned aerial vehicles, missiles, surveillance platforms, radar integration, propulsion systems, avionics, and space-based defence assets all require highly specialized engineering expertise. India has made notable progress through organizations such as Indian Space Research Organisation, Defence Research and Development Organisation, and Hindustan Aeronautics Limited. Indigenous programs such as HAL Tejas, missile systems, satellite launches, and the upcoming Advanced Medium Combat Aircraft demonstrate India's technological ambition. However, sustaining and accelerating such achievements requires a much wider talent base than what currently exists.

A major concern is that only a limited number of premier institutions in India offer strong and specialized aerospace programs. Institutions such as Indian Institute of Science Bangalore, Indian Institute of Technology Kanpur, Indian Institute of Technology Bombay, Indian Institute of Technology Madras, and Indian Institute of Technology Kharagpur have built valuable capabilities in this domain. Yet, beyond these leading institutions, the number of universities with well-developed aerospace and aeronautical departments remains relatively small. This is surprising for a nation of India's scale, strategic aspirations, and growing defence requirements.

At the same time, many universities have rapidly expanded departments in management studies, design, fashion technology, and commercially attractive disciplines. These programs often require lower capital investment and attract high student intake. In contrast, aerospace education demands expensive infrastructure such as wind tunnels, propulsion laboratories, advanced material testing facilities, simulation centers, and specialized research equipment. Many institutions, especially private ones, hesitate to invest in such high-cost academic programs. As a result, one of the most strategically significant branches of engineering remains underdeveloped in large parts of the country.

India's continued dependence on imported defence technologies further underlines the urgency of this issue. The country has procured platforms such as the Boeing AH-64 Apache from the United States and the Dassault Rafale from France to meet operational needs. These acquisitions strengthen defence preparedness, but they also highlight gaps in domestic design and manufacturing capability. One of the clearest examples is the challenge of developing indigenous jet engines. Aircraft programs such as HAL Tejas and future combat platforms still rely significantly on imported engine technology such as the General Electric F404 family. Without strong academic and research ecosystems in propulsion, materials science, computational fluid dynamics, and systems integration, true self-reliance in such critical technologies will remain difficult.

Another important development has been the opening of defence manufacturing to private industry. Earlier, defence production was largely concentrated in government-owned enterprises. Today, major industrial groups such as Tata Group, Kalyani Group, Adani Defence & Aerospace, Larsen & Toubro, and several startups are participating in aerospace structures, artillery systems, drones, electronics, autonomous systems, and advanced manufacturing. Innovative firms such as Sagar Defence Engineering are also contributing in maritime autonomous technologies and new-age defence solutions. This growing industrial ecosystem is creating jobs, accelerating innovation, and reducing import dependence. However, industry expansion must be matched by expansion in specialized education. Factories, laboratories, and design centers cannot function without trained engineers and researchers.

India's defence exports are also becoming an important pillar of growth. The export of the BrahMos missile to Philippines marked a major milestone and signaled global confidence in India's defence manufacturing capability. Defence exports generate revenue, create employment, strengthen supply chains, and enhance India's strategic partnerships. As more countries look toward India for cost-effective and reliable defence systems, the

need for highly skilled technical manpower will only increase. Export competitiveness in aerospace and defence products depends not only on factories and contracts, but on design excellence, quality control, testing capability, and continuous innovation—all of which originate in strong universities and research institutions.

A further challenge is the lack of practical exposure available to students. Aerospace and aeronautical education cannot thrive through classroom theory alone. Students benefit immensely from interaction with aircraft systems, maintenance environments, testing facilities, and defence laboratories. However, due to understandable security restrictions, access to military bases and operational facilities is limited. Greater collaboration through supervised visits, simulation-based training, internships, and industry-academia partnerships can help bridge this gap while maintaining security protocols.

India now needs a coordinated national strategy to strengthen aerospace and aeronautical education. Select central and state universities should be encouraged to establish dedicated departments with modern laboratories and strong faculty recruitment. Collaborative programs with DRDO, HAL, ISRO, and private industry should be expanded. Curricula must include emerging areas such as drones, artificial intelligence, autonomous systems, advanced manufacturing, electric propulsion, hypersonics, and space technologies. Scholarships and research fellowships can attract talented students into these strategic disciplines.

India's defence strength will ultimately depend not only on budgets, imports, or procurement contracts, but on the quality of engineers and scientists it produces. A fighter aircraft, missile, drone, or satellite is the final outcome of years of academic preparation, research, design, experimentation, and industrial execution. If India truly seeks long-term strategic autonomy and global technological leadership, then investment in aerospace and aeronautical education must become a national priority. The future of India's defence growth begins not only in factories and laboratories, but in classrooms, universities, and research campuses.

Dr. Manish Kumar is an Assistant Professor in the Department of Mechanical Engineering at Netaji Subhas University of Technology (NSUT), New Delhi. His academic and research interests include advanced engineering systems, with a focus on emerging technologies in the automotive and aerospace domains.

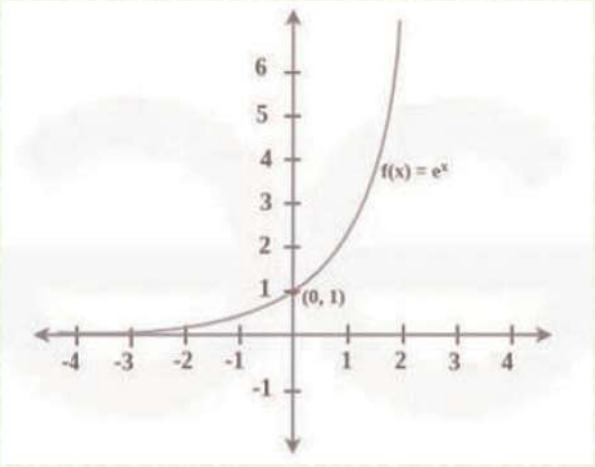
Sharing my Experience with Exponential Functions*

by **Dr. Kumar Krishen**

Introduction

The author wishes to share his experience with exponential functions. In doing so, he hopes that further deliberations and research on these functions may happen.

The author has attended three universities and is involved in a fourth university for further studies. This academic pursuit earned the author two Bachelor, two Master and Doctoral degrees in technical fields.



Graph From: https://www.geeksforgeeks.org/maths/exponential-graph/

From Wikipedia and Google search, we know that it was Leonhard Euler who in 'Introductio in analysin infinitorum,' written in 1748, established the critical role of exponential function in calculus. He is primarily credited with developing the modern concept of the exponential function (e raise to power x). He defined it as a power series, connected it to logarithms, and created the notation. However, we should note that Jacob Bernoulli discovered the fundamental mathematical constant 'e' in 1683.

In his studies, the author came across exponential functions routinely but did not dwell on their robust, attractive, and amazing aspects. His research at the universities involved the application of waves in various parts of the acoustic and electromagnetic wave spectrum. This research was deeply embedded in the use of mathematical models involving exponential functions.

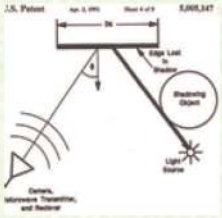
The author has worked at universities (Kansas State, Rice, Virginia Tech, and University of Houston), industry (Lockheed Electronics), and government (NASA) organizations.

* Edited by Ms. Sharon Hecht

One of the job elements in all his work included the review of technical publications, papers, and presentations. These documents covered all fields of research. For example, at NASA Johnson Space Center (JSC) he reviewed more than twelve thousand publications to identify intellectual property for filing for patents or copyrights. The author was employed for about fifty-four years (from 1965 to 2018) and is currently guiding students in their research endeavors. The author slowly realized the prevalence of exponential functions in all these years. This paper will outline some of his observations and fascination in a succinct manner.

Exponentials in Author's University Research

Photos credited to NASA



Remote observation of Earth, Moon, and Mars using sensor fusion (last figure)

Most of the author's research involved developing methods, techniques, and systems for remote observations of Earth, Moon, Mars, and deep space, and researching robotic vision algorithms and technology. This invariably used solution of the wave equations. This included scaler and vector wave linear, vector, and non-linear differential equations. The vector ones incorporating polarization features. The scenes observed included a variety of surfaces and layers with propagation of the electromagnetic waves in some cases going through plasma

and included linear partial and non-linear partial differential equations. The mathematical solutions always involved complex exponential time dependence with its root being in sine, cosine, and orthogonal wavelet function set that can be expressed in exponential form.

Any non-sinusoidal functions can be approximated by a series involving sines, cosine, and orthogonal sets of wavelet functions. Most of the randomly distributed variables were taken as Gaussian (exponential) distributed.

Examples of authors research in which exponential functions were essential include; a) Analysis of Acoustic Wave Scattering from a Rough Layer, Journal of Acoustical Society of America, Vol. 46, No. 3, September 1967, pp. 617-622. b). Scattering of Electromagnetic Waves from a Layer with Rough Front and Plane Back (Small Perturbation Method by Rice) IEEE Transactions on Antennas and Propagation 18(4):573 - 576 · August 1970. c) Electromagnetic Wave Scattering From a Layer with Plane Interface in Front and a Rough Interface in Back (Kirchhoff Method), Canadian Journal of Physics, Vol. 50, No. 5, 1972, pp. 431- 439, and d) Robotic Vision Technology and Algorithms for Space applications, Acta Astronautica, Vol. 19, No. 10, 1989, pp. 813-826.

These examples illustrate that physical models used were expressed as differential equations of various types. Consequently, the solution space contains exponential functions.

Exponentials in Author's Professional Career

The author supported research and technology development for space exploration for more than fifty-four years as a member of the research team and/or staff. He is continuing to work on this endeavor in private capacity after leaving NASA in September 2018. His connection to and experience with exponential functions can be in major part traced to his research efforts and one key element of his job description. This element will gain clarity when we look at some of his job titles. These job titles included Staff Scientist/Engineer (Lockheed Electronics), Senior Scientist, Chief Technologist, Principal Technologist, Innovation Champion (NASA Johnson Space Center), Adjunct Professor (Rice University and University of Houston), and Visiting Professor and Technology Transfer Fellow (Virginia Tech). The selection of programs and projects for pursuing research is invariably based on the soundness of the technical approach.

The progress of technical projects/programs is gauged by ascertaining that the results can be verified and process/method/protocol can be repeated and will yield the same set of results.

In addition, organizations involved in research and technology development expend some effort in identifying and patenting/copyrighting intellectual property resulting from their programs and projects. The key element of author's job was to support these efforts. In this context, the author reviewed more than twelve thousand documents during his tenure at NASA JSC.

(credit for slide to NASA)

The important conclusions of the review by author are summarized as follows:

- Most of the documents had mathematical models expressing the phenomenon that was under research or researched.
- The scientific efforts contained a limited number of fundamental equations expressing the complexities of physics, chemistry, biology, and other branches of science. All the equations appearing in the documents were simple and did not involve higher-dimensional, non- linear, and non-equilibrium system characteristics.
- In-depth reviews revealed that many documents (related to a research project) started with a mathematical equation that is not appropriate. Where a proper model was

selected, the region of parameters where it was used was beyond the boundary of the applicability of the model. In some cases, assumptions were made that made the results not useful/applicable. These three factors were found to be the reason for many research efforts for not bearing useful outcomes.

- The results of the mathematical models were most frequently expressed in terms of exponential functions.

Use of Exponentials in Author's Continuing Research Efforts

The author was exposed to the lunar dust consequences on mission success through many publications and presentations that he reviewed. While working on the identification of technologies needed for Mars exploration, the consequences got more amplified because of the Mars dust storms. This made him believe that dust storms on Mars, on some occasions, may make us to say, "Another Mars mission bites the dust." The reasons for this are the damaging attributes of these storms on trajectories of moving systems in the atmosphere of Mars and the surface infrastructure. There are several publications regarding this in the literature.

Lunar dust covers the lower part of Astronaut Harrison Schmitt's spacesuit during the Apollo 17 Mission (Photo credit to NASA)

As an interesting research project and a tangled fascination for exponential functions, the author wanted to develop a mathematical model for the path of a dust particle in the Mars dust storm. He developed the following mathematical model in 2016:

$$\left(\frac{\partial w}{\partial x}\right)^2 + 10\left(\frac{\partial w}{\partial y}\right)^2 + 10\left(\frac{\partial w}{\partial z}\right)^2 = 10w^2 + \frac{w + \exp[-x^2]}{1+x^2}$$

Where the function $w(x, y, z)$ is to be found over the cube,

$$-10 \le x \le 10, -10 \le y \le 10, -10 \le z \le 10 .$$

The author was supported and encouraged by some of his colleagues at Johnson Space Center to pose the solution as a NASA@work challenge for the entire NASA workforce (see Appendix for background). The challenge was answered by two colleagues from NASA Kennedy Space Center, Robert C. Youngquist and Mark A. Nurge. Their method and result are given as follows (this is their text):

"Solving this numerically should be possible, using a sparse matrix approach, if reasonable boundary conditions are imposed. However, the boundary conditions supplied with the problem were not clear and appeared to over specify the function. The following differential equation was recently posed by Dr. Kumar Krishen of NASA JSC:

Where the function $w(x, y, z)$ is to be found over the cube,

$$\left(\frac{\partial w}{\partial x}\right)^2 + 10\left(\frac{\partial w}{\partial y}\right)^2 + 10\left(\frac{\partial w}{\partial z}\right)^2 = 10w^2 + \frac{w + \exp[-x^2]}{1+x^2}$$

$-10 \le x \le 10, -10 \le y \le 10, -10 \le z \le 10$. Solving this numerically should be possible, using a sparse matrix approach, if reasonable boundary conditions are imposed.

However, the boundary conditions supplied with the problem were not clear and appeared to over specify the function.

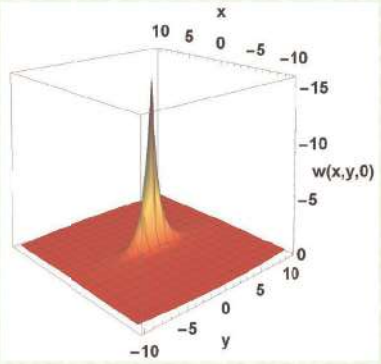
After asking for clarification, we were told to change the boundary conditions in any way we felt could lead to a solution to this problem. We pointed out that the forcing functions on the right-hand side of the equation are only functions of x and make the generation of boundary conditions difficult. So we were told that we could modify the forcing functions. With that in mind, we have decided to define a new variable, r , where;

$$r = (x^2 + (y^2 / 10) + (z^2 / 10))^{1/2}$$

As a spheroidal distance from the origin. We now replace the x dependencies on the forcing functions with r and make the function w(x, y, z) a function of only r. Doing this allows the partial differential equation in three variables to be written as a partial differential equation in only one variable,

$$\left(\frac{dw}{dr}\right)^2 = 10w(r)^2 + \frac{w(r) + \exp[-r^2]}{1+r^2}$$

Now we choose to start at the origin and work outwards. We can choose any starting value for and find the derivative of at the origin and use this to find w(r) a small distance from the origin. This process can be repeated until w(r) is found throughout the cube. We've found that positive values of w(0), choosing the negative value for the square root of the right hand side of the equation above, yields a decaying function that, for some value of r causes become sufficiently negative that the right-hand side of the equation above w(r) to becomes negative. When this happens the derivative become complex and, assuming w(r) represents some physical quantity, the problem is unresolved. We have found that in order for the function w(r) to be real it must have a starting value less than -8. So, choosing a starting value of -16 yields the following plot of the function w(r) over the x / y plane (the z dependence is identical to the y dependence). Note the rapid decay of the function yielding very small values on the boundaries of the cube. It should also be noted that at the origin this function is continuous but its derivative is not continuous."



The author wants us to note that the solution plotted by Youngquist and Nurge, looks like a Delta function and may be used as a Green's function in the solution of some class of nonlinear differential equations.

To reflect some of the concerns brought forth by NASA KSC colleagues Robert C. Youngquist and Mark A. Nurge, the author developed the following modified model in 2020:

$$x\frac{\delta x}{\delta z} + y\frac{\delta y}{\delta x} + z\frac{\delta z}{\delta y} = \omega^2 (x + y + z) + \beta (x^3 + y^3 + z^3)$$

where β, are ω real constants.

The author proposed the following solution:

$$2x^2 = -2\omega^2 z^2 - \beta z^4 + c_1$$
$$2y^2 = -2\omega^2 x^2 - \beta x^4 + c_2$$
$$2z^2 = -2\omega^2 y^2 - \beta y^4 + c_3$$

where C_1, C_2 and C_3 are real constants.

The author proposed to graph the following:

$$(x^2 + y^2 + z^2) + (2 + 2\omega^2) + \beta (x^4 + y^4 + z^4) = C$$

The solution is as follows:

$$(x^2 + y^2 + z^2) + (2 + 2\omega^2) + \beta (x^4 + y^4 + z^4) = C$$

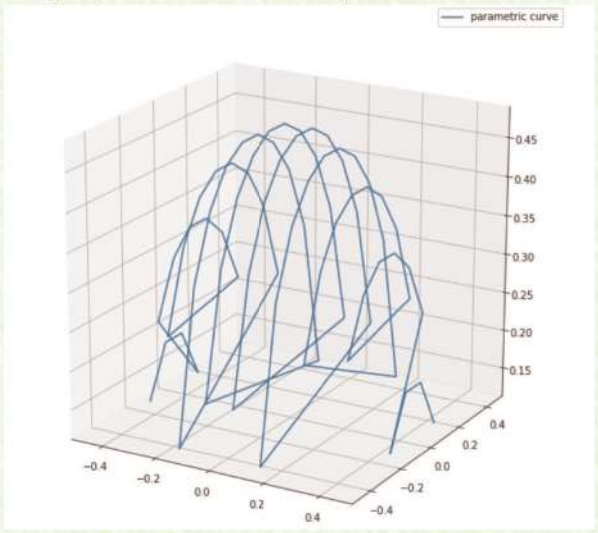
This solution was calculated and plotted by Nitin Saini, Co-founder, Free Spirits Green Labs. The plot is given on the next page.

The author applied a heuristic modeling approach bordering on the rule-of- thumb to find a satisfactory solution. For this reason, he wants to add the following qualification:

"What I think we need is to work with the kinetic energy of the dust particle and balance it with the force given to it by the wind. The equations that I proposed are for doing this. These may or may not be applicable."

Mars Before and During Global Dust Storm (Photo credit to NASA)

A dust storm on the surface of Mars with traces of frozen water. Composite from an image of Mt Hood, Oregon. (Photo credit to NASA)



Solution around $(0,0,0)$ for different values of β, ω, C.

using x from [-100, 100], y from [-100,100]. The calculated z values are positive.

$$w = 1$$
$$b = 1$$
$$c = 1$$

$(x^{**}2 + y^{**}2 + z^{**}2)^{*}2^{*}(1+w^{**}2) + b^{*}(x^{**}4 + y^{**}4 + z^{**}4) - c = 0$

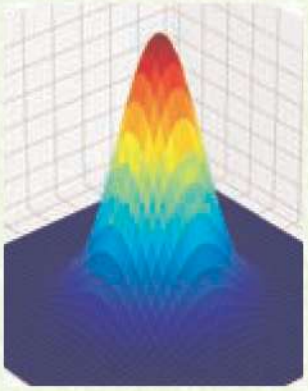
X, Y, Z are varied. As example of values, we have:

X	Y	Z
[-0.45022511	-0.15007504	0.11968553]
[-0.45022511	-0.05002501	0.18500891]
[-0.45022511	0.05002501	0.18500891]
[-0.45022511	0.15007504	0.11968553]
[-0.35017509	-0.25012506	0.24331271]
[-0.35017509	-0.15007504	0.31391304]
[-0.35017509	-0.05002501	0.34300681]

Concluding Remarks

The author, who served as NASA JSC Innovation Champion for more than eleven years, was exposed to a tapestry of ideas related to promoting a culture for pursuing innovation. There were several committees researching the ways that this culture would grow and sustain for the future to come. The overall conclusion from this work was that for a great future, "Inspiration, Imagination, Inclusion, Leadership, & Perspiration (I3LP) are required." One of the expert Psychologist colleagues, Alan Tansey, stated his view on these aspects of innovation thusly, "I'm actually not convinced that inspiration is a tool for innovation. Rather, I look at it as a requirement, since you cannot have innovation without inspiration. Furthermore, I also don't think you can leave imagination out of the equation. These three elements, Inspiration, Innovation, and Imagination have a symbiotic relationship, feeding and nurturing the others. However, I believe that an increase in either Inspiration or Imagination has exponential effects on Innovation."

The author was intrigued by the word 'exponential' being used in this context and wanted the readers to know that humans have an attraction for this expression. There are so many aspects of exponential functions that have made their use so prevalent and pervasive.



Gaussian plot is from,"3D Gaussian Splatting: New Technology with Old Techniques by Abel Cavalcante"

Inspired by creative humans who make the world a jovial place, the author composed a poem titled, "Be Function Exponential." The poem does not include an amazing aspect of the exponential dependence. For a negative increasing exponent number, the value becomes small and insignificant. On the other hand, for a positive large exponent the value has no limit and can touch the boundary of the universe. The poem follows the graph:

Be Function Exponential

When in mind-boggling mind jam
Get up and reach the friendly fam
Say I will overcome this, I can, I can
Rise to occasion like the rocket can

Be an amazing function, the exponential
Differentiated you remain exponential
Integrated you remain cute exponential
Divided or subtracted you are exponential

Exponential function is in rocket propulsion
It is in population of life on Earth explosion
It is in the solution of heat wave propagation
Even in electromagnetic wave communication

Exponential is in models of universe expansion
In black hole energy, mass, and space attraction
In smallest particle condensation interaction
In photosynthetic plant growth contraption

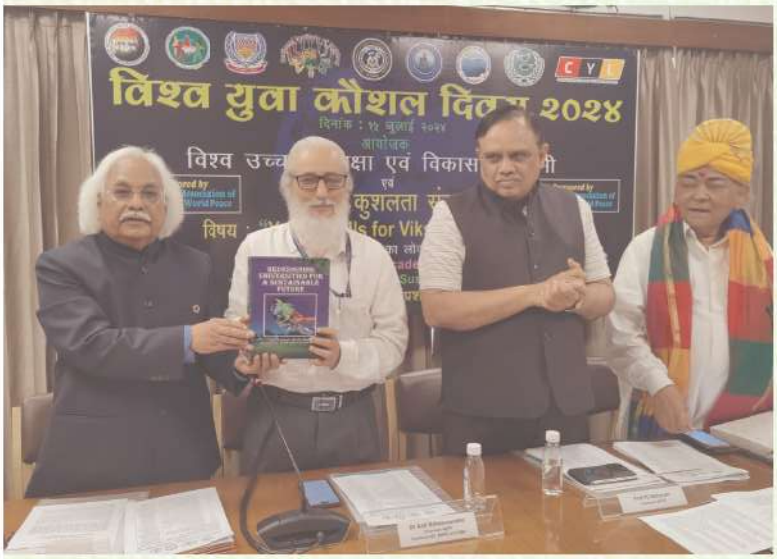
The author hopes that this paper will promote further deliberations and research on exponential functions. In resonance with this desire, the author shared the paper with a few colleagues to gauge their reaction to such a rendition of his experience. The comment by Dr. Sanjay K. Jha, Director Liberal Arts, Amity University Haryana was this, "Undoubtedly, the quality of exponential is the nature of nature and no living or non-living entities are intact from being exponential." The comment of Professor Dr. Khushboo Tripathi of Sharda University was, "The poem is supreme. Content is like NASA rocket launch scheme."

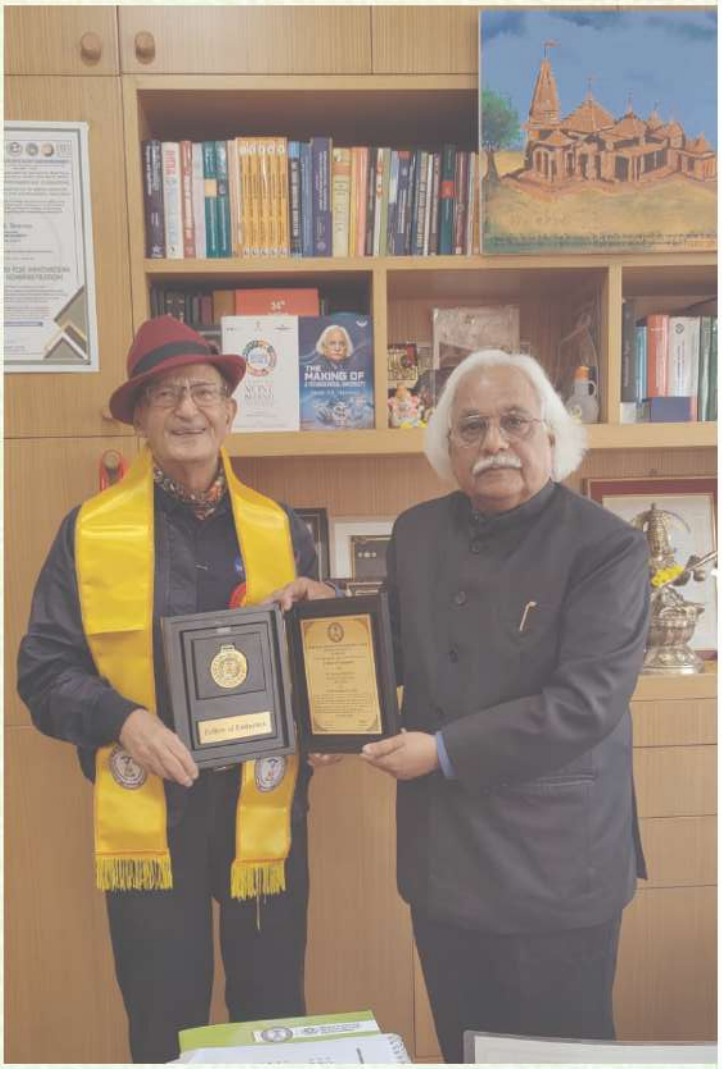
My mentee, Ms. Vasuda Trehan, who is defending her research for doctorate degree this Summer. at the University at Albany, SUNY with NASA research links, provided the following comments:

One of the most interesting aspects of this paper is how it connects mathematical concepts with scientific experiences over an extended period of work. The research does not just treat exponential functions as abstract equations, but shows how they naturally appear in physical systems, like in wave behavior and modeling. I also appreciate how the paper extends this idea beyond technical applications and relates it to research, innovation, and the way knowledge evolves over time.

As part of my own research, I have come across exponential functions quite often, particularly in physics-based modeling and machine learning. I have seen these functions in wave-related phenomena and probabilistic models. However, I have mostly seen them in a technical context. This paper adds a unique perspective by connecting those same ideas to real-world scientific practices. It made me think about exponential behavior not just as a mathematical tool, but as something that reflects broader patterns in both physical systems and how we learn and develop ideas. The poem at the end makes all this even more perfect.

Dr. Kumar Krishen, Fellow of Eminence of W-AHEAD is Former Chief Technologies of JSC, NASA and Recipient of the NASA Exceptional Service Medal.





Reimagining Professors as Co -Architects of Employability

by **Dr. Umesh Batra**

> ***In an era of rapid change, the professor's role has never been more vital or more honourable. We are not bystanders in the employability crisis—we are its most powerful solution when we choose to act as co-architects. Placements will follow not as luck, but as the inevitable harvest of aligned effort, real-world relevance, and relentless execution. Embrace this blueprint as legacy-building, not extra duty. Shape T-shaped graduates with deep domain expertise and broad adaptive skills. In doing so, we honour our vocation, strengthen our institutions, and help realize India's potential.***
>
> ***The universe, as it often does, rewards those who align education with reality. Let us not fail in pouring our heart and mind for this noble cause of being the co-architect of employability for the inspired minds of our students.***

India is nearing the peak of its demographic dividend, with the share of the working-age population expected to begin declining after 2030. On the one hand, higher education in the country has become increasingly democratised with a rapid increase in the number of institutions. Graduate salaried earnings exceed non-graduates both at the time of entry into employment and over their lifetime. On the other hand, financial barriers continue to restrict access, particularly in professional fields such as engineering and medicine. The transition from education to employment remains a major challenge. The rise in the number of graduates has not been matched by commensurate growth in graduate employment. This year's State of Working India report by Azim Premji University Report 2026 traces the arc of a young worker's transition from school or college into employment, and how this has changed in the last forty years.

India's youth population, defined as those between the ages of 15 to 29, is the largest in the world. The 367 million people in this age group account for a third of the country's working age population. The extent to which this large, increasingly educated and aspirational cohort is productively absorbed into the labour market will determine whether this massive, and continuing demographic dividend translates into an economic dividend. Whether this will materialise or not will depend on the education and skills of Indian youth and the opportunities available to them in the labour market. As such, youth employment outcomes will be determined by their options and choices in higher education. How long should they study, and in what lines?

In Indian private universities, faculty must step up as co-architects of employability. With ~40% graduate unemployment and only 7% securing stable jobs on graduation (Azim Premji University report 2026), placements can no longer be left to T&P cells alone. Placements are not luck, they are a 4-year system built deliberately in the classroom. Professors are expected to take on board their role from teaching and research to launching careers for their students.

Introduction

Today, we reimagine professors not merely as transmitters of knowledge, but as **co-architects in the creation of employability.** This is not an add-on burden. It is the noble evolution of our calling—turning premium education

into tangible opportunity and contributing to India's demographic dividend in a competitive Indian ecosystem of IT/services in the NCR, manufacturing/auto in Rajasthan and UP, and emerging startups.

The Stark Reality and the Paradigm Shift

Let us speak plainly, as veterans do. Recruiters rarely pore over mark sheets. They scan for **signals** live projects on GitHub, structured internships, confident communication, proven problem-solving, and portfolios that whisper reliability. Degrees are abundant; demonstrated capability is scarce.

The World Economic Forum's **Future of Jobs Report 2025** underscores this: analytical thinking, resilience/flexibility/agility, creative thinking, AI and big data literacy, and leadership/social influence rank among the most critical and fastest-growing skills through 2030. NEP 2020, along with UGC guidelines on vibrant University-Industry Linkages, gives us the mandate and tools: outcome-based education (OBE), experiential learning, internships, multidisciplinary approaches, and mandatory industry co-creation of curricula.

There are Certain few successful Indian peer Universities (with thousands of offers and strong MNC presence) and others demonstrate what is possible when faculty actively co-own this journey: higher placement rates, better average CTCs (often 20-40% uplift in aligned departments), repeat recruiters, and improved NIRF/NAAC parameters. The flywheel is real—faculty-driven relevance builds trust, which brings more opportunities, which strengthens the institution's brand and sustainability.

The 7-Phase Faculty Placement Excellence Roadmap:

This is not theoretical. It is a practical, closed-loop blueprint where you can adapt departmentally Engineering, Management, Commerce, or beyond. Think of it as engineering a 4-year system rather than hoping for a final-year miracle.

Phase 1: Diagnosis and Awakening:

Begin close to home. Audit your syllabus against real job descriptions from regional and national recruiters—TCS, Infosys, Hero MotoCorp, Hyundai, local SMEs, and fintech players. Gather data through final-year exit surveys, alumni tracking (6-12 months post-graduation), and mock placement insights. In India, 30-50% of seemingly eligible students get filtered by brand or skill gaps. Your early awareness becomes the foundation for targeted signalling through projects and certifications.

Phase 2: Deep Alignment with NEP 2020 and Outcome-Based Education:

Move from content-heavy delivery to competency-focused outcomes. Define Program and Course Outcomes clearly linked to employability—"Apply AI tools for supply-chain optimization in Rajasthan's manufacturing context," for instance. Co-create 20-30% of the syllabus with industry advisory boards. Integrate vocational credits, stackable micro-credentials, and multiple entry/exit options under NCrF(A unified, flexible credit system that applies across school, higher, vocational, and skill education.). This is mandatory evolution, not optional reform.

Phase 3: Experiential Learning as the New Normal:

Encourage reverse mentoring: let students introduce emerging tools like GenAI while you provide theoretical depth and context. Classrooms come alive when learning mirrors life. Embed real doing from Year 1: live projects, hackathons, case studies drawn from regional ecosystems—Jaipur's IT parks, Gurgaon's fintech, Noida's manufacturing hubs. Mandate meaningful internships/apprenticeships (NEP targets 50% coverage).

Phase 4: Faculty as Industry Catalysts – Your Personal Transformation:

You cannot architect what you have not experienced. Pursue UGC-recommended sabbaticals or short immersions in industry labs. Engage in ATAL or QIP FDPs on AI/ML, Blockchain, sustainable technologies. Invite SMEs and startup founders for co-teaching. Faculty who "live" industry become trusted referrers—recruiters value their endorsements far more. This is where personal growth fuels institutional excellence.

Phase 5: Building the Student Readiness Pipeline:

Structure mentorship year-wise. Year 1: foundational awareness, communication, LinkedIn presence. Year 2: tool proficiency and soft skills (critical thinking, emotional intelligence, storytelling). Year 3: domain certifications and live projects. Year 4: intensive

mock drives, interview simulations, and portfolio refinement. Shift assessment toward project rubrics, simulations, and presentations over rote memory. Portfolios become the new currency.

Phase 6: Ecosystem Building and Metrics Dashboard:

Foster department-level MoUs, joint research, and corporate chairs. Track meaningful KPIs quarterly: percentage of students with multiple certifications, internship-to-PPO conversion, employer NPS, alumni feedback. Align these with NIRF/NAAC parameters on research, outreach, and employability. Data turns good intentions into sustainable systems.

Phase 7: Continuous Feedback Loop and Celebration:

Conduct post-placement debriefs involving faculty and T&P teams. Iterate syllabi annually based on real outcomes. Celebrate wins publicly—when your batch outperforms benchmarks or secures repeat visits from dream recruiters. This closes the loop and builds momentum.

Visualize the flow: Admissions → Foundation (Year 1) → Skill Depth & Tools (Year 2) → Application through Projects/Internships (Year 3) → Conversion & Readiness (Year 4) → Strong Outcomes. Faculty act as multipliers at every stage—as mentors, evaluators, coaches, connectors, and referrers. The signal engineering model is simple yet powerful: turn knowledge into visible, verifiable proof that recruiters cannot ignore.

Profound Reflection:

In the quiet moments, ask yourself: Am I merely completing the syllabus, or am I engineering signals of competence that launch careers? Placements are not an event—they are the natural outcome of a thoughtfully designed 4-year ecosystem. When we embrace this, we move from guardians of abstract knowledge to co-creators of capable professionals who contribute to India's economic vitality and India's global standing.

This work brings deep fulfilment: better faculty retention through real-world relevance, stronger institutional brands, and the quiet pride of seeing your students thrive as job-creators rather than job-seekers.

Call to Action for the Academy of Higher Education:

Distinguished members of this world-level Academy—international and Indian ultra-veterans, mid-career academics, high-tech corporate leaders, industrialists, and MSME pioneers—I urge you: Let us not stop at inspiration.

Commit today to piloting elements of this blueprint in your departments or institutions. Form cross-functional faculty-industry working groups. Share your adaptations and results in our future forums. Mentor younger colleagues in this co-architect mindset. Advocate for policy support that rewards outcome-linked teaching and industry immersion.

Together, we can transform Indian private universities—and by extension, Indian higher education—into beacons of genuine employability excellence. Your experience, wisdom, and networks are the multiplier we need. Start small, measure relentlessly, iterate with courage. The students, their families, and our nation's future await your leadership.

Conclusion:

In an era of rapid change, the professor's role has never been more vital or more honourable. We are not bystanders in the employability crisis—we are its most powerful solution when we choose to act as co-architects.

Placements will follow not as luck, but as the inevitable harvest of aligned effort, real-world relevance, and relentless execution. Embrace this blueprint as legacy-building, not extra duty. Shape T-shaped graduates with deep domain expertise and broad adaptive skills. In doing so, we honour our vocation, strengthen our institutions, and help realize India's potential.

The universe, as it often does, rewards those who align education with reality. Let us not fail in pouring our heart and mind for this noble cause of being the co-architect of employability for the inspired minds of our students.

Umesh Batra is an experienced professional working in higher education and placements. Over the past several years, he has had the opportunity to work with reputed universities and edtech institutions in Jaipur, Bengaluru, and the NCR (Noida), where he has served as a Placement Head and Career Development Specialist.

National Technology Day 2026: "W-AHEAD Celebrates India's Giant Leap Forward in Science and Technology"

by ***Prof PB Sharma***

On 11th May, we honour the visionaries, the great Indian Scientists and Technologists who dared to empower India, the Bharat with world class science and technology capabilities at a time when India was still struggling to come out of the clutches of its foreign dominance and building a self-reliant nation of the dreams of the freedom fighters and translate the vision of the crusaders of India's resurgence as a world power.

Our Tryst with Destiny at time of Independence in 1947:

It is worth recalling what the first Prime Minister Pt Jawahar Lal Nehru said while addressing the nation on the midnight of August 14th, 1947, "Long years ago, we made a tryst with destiny; and now the time comes when we shall redeem our pledge, not wholly or in full measure, but very substantially. At the stroke of the midnight hour, when the world sleeps, India will awake to life and freedom". In fact, the time to redeem this pledge substantially came on 11th May 1998 when Indian scientists led by Shri APJ Abdul Kalam and Dr R Chidambaram tested a nuclear device in Pokhran in Rajasthan. The successful testing of the nuclear device, code-named Operation Shakti, popularly called the "Smiling Buddha" made India the sixth powerful member of the nuclear club of the world. Thus, the tryst with destiny took a glorious turn under the visionary leadership of Prime Minister Shri Atal Bihari Vajpayee who envisioned India's march along the pathways of growth and development with national unity and scientific advancement.

Foundations of Nation Building in 1950s and 1960s:

India's march on the pathways of science and technology empowerment in fact, began soon after the independence in 1947. With the construction of Hirakud and Bhakra Nangal multipurpose dams in 1950s and subsequently with establishment of heavy Industries like HEL Bhopal, series of BHEL at Haridwar, Hyderabad, Rudrapur, Vishakhapatnam and Tiruchirappalli, Bhilai Steel Plant at Durg, HAL, Bharat Earthmovers, the five IITs, AIIMS and a chain of CSIR and DRDO Labs around the country, a rock solid foundation was laid from 1950s to 1960s for the agro-industrial advancement of the nation. The rapid rise of DRDO, BARC and ISRO in subsequent years empowered India with the great capabilities of scientific and technological advancement in areas of strategic defence and enabled India's fast track advancement on industrial fronts.

The legacy of eminence of Nobel Laureate Bharat Ratna Sir CV Raman, Dr JC Bose and Bharat Ratna Sir Mokshagundam Visvesvaraya was so well translated into Mother India's pride in science and technology after India's independence by Dr AN Khosla, Dr Homi Jehangir Bhabha in nuclear science and Dr Vikram Sara Bhai and Dr Satish Dhawan in space science and technology. Monumental contribution to self-reliance in food production

was made by Dr MS Swaminathan, the Father of Green Revolution in India and likewise in White Revolution (Self Sufficiency in Milk Production) by Dr. Verghese Kurien in the 1970s who made India a food and milk surplus country currently exporting its food surplus to many countries around the globe.

India's Impressive entry into the Nuclear Club:

The tempo of empowering India with the grand laurels in S&T continued unabated under the visionary leadership of science and technology doyens like Bharat Ratna Sri APJ Abdul Kalam, Dr R Chidambaram, Dr RA Mashelkar, Dr Kasturirangan, Dr Sam Pitroda, Bharat Ratna Prof CNR rao, Dr UR Rao, Dr VK Saraswat and the great team of scientists and technologists of DRDO, BARC, ISRO, CDoT and CSIR who contributed to the glory of Mother India in nation building and winning India a pride position amongst the leaders in scientific and technological advancements. These visionary builders of modern scientific and technological prowess of India continue to fire imagination of inspired minds and motivate them to think big and achieve great success that ultimately results in developing India of our dreams.

Today is also the day to rejoice the entry of India into the world space club with its most impressive landing with great precision at the Lunar South pole that witnessed India's Lunar lander "Vikram" rolling out its lunar Rover "Pragyan", the lunar buggy flying the flag of India with highest esteem and global acclaim on August 23, 2023, making India the proud member of the World Space Club. Here again the tryst with destiny and the pledge taken at the time of India's independence took a highly glorious turn towards making India a global superpower in space technology under the able leadership of ISRO Chairman, Dr Somnath and the inspiring patronage provided by the Prime Minister of India, Shri Narendra Modi Ji, whose visionary leadership has placed India on the path of rapid track growth and development with self-reliance and global esteem. India's science and technology community should take immense pride in its accomplishments and commit unconditionally and with convection to the achievement of the goals of Viksit Bharat@2047.

Message for the Youth of India:

For the youth of India, the time is right to think of India, of aspirations of 1.5 billion people and the demographic dividend of the presence of nearly 750 million below the age group of 30years of which 371 million youth are in the age group of 15-29 years. Currently around 45 million youth are turning towards 1100+ universities and 70,000+ colleges to contribute positively towards creating India of their dreams that will be a happy and healthy abode of prosperous and developed India, translating the vision of Viksit Bharat into a reality.

This of course, is a tall order, but achievable with the tremendous interest of its inspired youthful minds who are looking towards STEM education, research, and innovation to empower India with capabilities not witnessed so far. This is the time to make the age of AI, 'Advantage India' and unleash the infinite power of AI and ML to accelerate economic development, societal transformation and also create millions of jobs for the young India without the madness of taking away millions of jobs as at present by the madness of replacing man by smart and intelligent machines.

Prepare to take the Monumental Challenges Head On:

Let us also not forget that with the advancement of science and technology, while on one hand

has won Mother India an added pride in its scientists and technologists, it has also created monumental challenges such as climate change, enormous air and water pollution, and the fear of losing jobs for the millions in the recent times due to the advent of AI and ML powering ultra automation for industry 5.0 and in all sectors of human activity including the service sector and governance. Tomorrow's science and technology professionals need to take these challenges head on and turn around the clock of scientific advancement and technology innovations towards creating a bright and blissful future for the vast humanity that looks towards science for productive engagement of its brightest minds who turn towards STEM education and scientific research and innovations with great hope and enthusiasm to make a bright career for themselves and a bright future for the humanity at large.

It is this challenge that we all need to address with care, caution and with great responsibility of purpose to make a bigger meaning and sense of technological advancement for the future of the humanity at large. Here inspirations must be matched by imagination infinite leading to innovations that shall create path breaking solutions and blissful engagement of the youth in nation building and advancing the frontiers of peace, harmony and development.

We, in W-AHEAD on this day, salute our great scientists and technologists, innovators, digital warriors and the great tech-entrepreneurs and express our immense pride in the contributions they have made to turn India into a global powerhouse of pathbreaking science and technology accomplishments and their contributions to nation building.

As we celebrate and rejoice our glorious accomplishments and pay our tribute to the great visionaries of science and technology of our great nation today on the National Technology Day, let us commit to a future defined by pathbreaking scientific advancement, game changing technology innovation and sustainable development.

Let us dare to do the "impossible" and achieve the goals of Viksit Bharat@2047 with clarity, commitment and conviction.

Happy National Technology Day 2026

**The Author Prof PB Sharma is an eminent academician, a renowned thought leader, founder Vice Chancellor of DTU and RGPV, Past President of AIU, President of W-AHEAD and currently is the Vice Chancellor of Amity University Gurugram.*

UPCOMING EVENTS

June & July 2026

Blue Economy Summit

by Global Peace Foundation, W-AHEAD a Collaborative partner, June 5-6, 2026 at IIC, New Delhi.

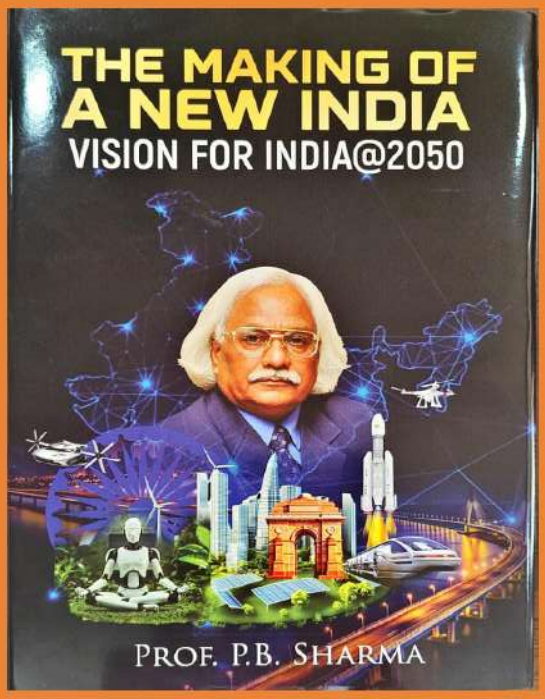
World Youth Skills Day 2026

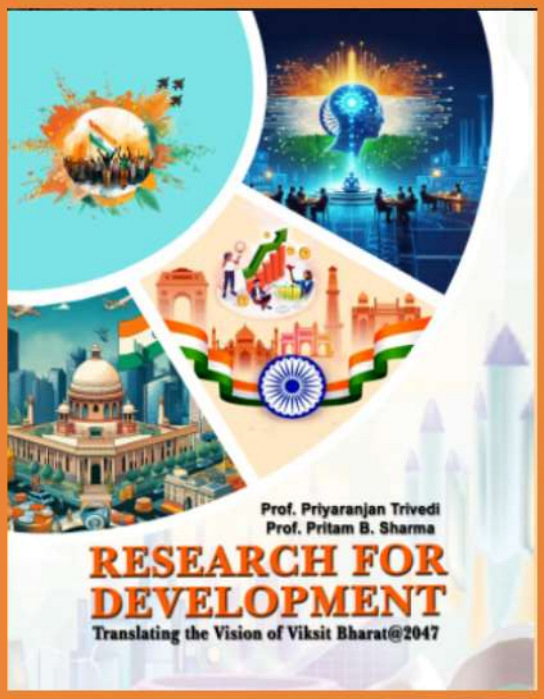
at IIC, New Delhi (July 15, 2026).

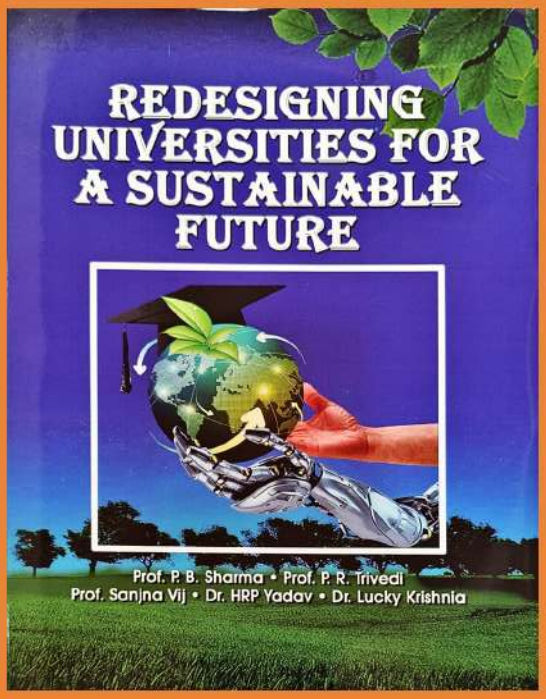
World Environment Day Celebration

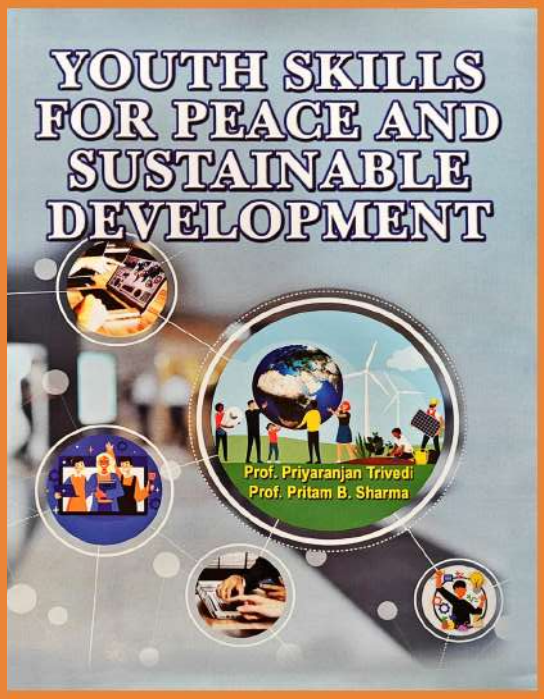
June 5, 2026 in collaboration with the Institute of Engineering and Technology, IET (UK), India Section.

Academy Publications- Books









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