Rs. 30.00

ISSN- 0566-2257

UNIVERSITY NEWS

A Weekly Journal of Higher Education

Association of Indian Universities

Vol. 59 • No. 17 • April 26-May 02, 2021

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AIU House, 16, Comrade Indrajit Gupta Marg
New Delhi 110 002
EPABX : 011-23230059, **FAX :** 011-23232131
E-mail IDs : publicationsales@aiu.ac.in / advtun@aiu.ac.in / subsun@aiu.ac.in
Website : http://www.aiu.ac.in

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UNIVERSITY NEWS
Vol. 59 April 26-
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Price Rs. 30.00

A Weekly Journal of Higher Education Published by the Association of Indian Universities

In This Issue

Disruptive Reforms in Global Higher Education with Bharathiar University as a Model

P Kaliraj*

The fifth industrial revolution, Industry 5.0, is changing the world around us. Artificial Intelligence and Machine Learning, Automation and Robotics, Big Data, Internet of Things, Augmented Reality & Virtual Reality, and Creativity are the tools of Industry 4.0. The Industry 5.0 is set to bring human touch to the manufacturing domain, which in turn will see more improved collaboration between smart systems and humans, which results in the merging of the critical and cognitive thinking abilities of humans with the highly accurate and fast industrial automation. The article opens with a discussion on the disruptive reforms that are to be brought in the higher education arena and the reforms to be carried out in the higher education sector on the verge of Industry 4.0. It speaks about how the wave of innovation is overwhelming us and, as an example of innovation, cites the author's work in translational research. The role of digitization and how Bharathiar University is moving forward to incorporate these technology; what might be the future of jobs and skills when Industry 4.0 and 5.0 are taking over the world; skills required to face the new world of innovation and transformation; curriculum prepared by the University in the light of Industry 4.0 and Curriculum 4.0 together with the new courses introduced are discussed in the subsequent sections. The article comes to an end by demonstrating how Bharathiar University is marching towards global excellence with its stature, leadership, achievements, funding, and collaborations.

Disruptive Reforms in Global Higher Education

Disruptive Reforms are the need of the hour in Global Higher Education. Disruptive technologies are innovations that considerably change the way businesses, industries, and consumers operate by superseding an older process, product, or habit. A technology that is disruptive sweeps away the systems and operations it replaces by the superior attributes it owns. The television, the electricity, and the automobile were disruptive technologies in their own times. The idea of disruptive technologies came up in 1997 and has become a buzzword in the start-up business world since then. Products from start-ups that were creating a mass appeal were considered to be disruptive technologies. Blockchain is an example of modern-day disruptive technology by which banks and stock brokerages can execute peer-to-peer trade confirmations on the blockchain, thus, removing the need for custodians and clearinghouses, which in turn will reduce intermediary financial costs and dramatically accelerate

* *Vice Chancellor, Bharathiar University, Coimbatore-641 046 (Tamil Nadu). E-mail : vc@buc.edu.in.*

transaction times. Other modern-day disruptive technologies that are making the pace of innovation fast are listed below:

- 3D Printing
- 5G and improved connectivity
- Artificial Intelligence and Machine Learning
- Automation and Robotics
- Cyber Security Advances
- Edge Computing
- Virtual and Augmented Reality
- Headless Technology
- Space Colonisation

Since education is a vehicle of development for social progress, recommendations for reforming education should always include social production and state regulation. Higher education reformation should consider factors such as educational philosophy, student policies, curriculum, pedagogy, didactics, organization, management, finance, and their links with the development of the nations. Here, in the context of Industry 4.0 and Education 4.0, the reforms that can be brought about in the higher education sector are as follows:

- Establish a virtual school/center for strategic futures/foresight with nodes in each department
- Integrate prediction markets into curriculum design
- Use analytics to inform course content and design, with rapid refresh cycles
- Jobs/skills - Gig platforms, Emerging technologies, and identify hiring hotspots
- Integrate nano-courses from global universities into regular content
- Collaborate with an innovative next-generation international virtual education player(s).

Wave of Innovation

The wave of innovation is set to sweep us off our feet. Automation, artificial intelligence, and micro innovation will be the three mega-trends that will drive tomorrow's world. Many old jobs will go up in smoke, and new ones that we do not know today will emerge. Micro innovation will bring in winners. Together, the three trends will change the landscape of life and business. For good health or improvisation of health, infectious disease management and development of vaccines need to be carried out. The growing emergence of epidemics and pandemics will also call for collaborative research in infectious disease management. The development of vaccines and resultant social issues heightens the need for multidisciplinary learning. Another important area where innovation is required is in the research work carried out by universities and institutions so that innovative, creative, and useful products and services are made available to the society through translational research.

India and Innovation

When light passes through a transparent material, some deflected light changes its wavelength, called the Raman effect. This discovery changed our lives, from the way brain biopsies are conducted to detect explosive materials. It made C. V. Raman win the Nobel prize in 1930 and made him the first Asian to win a Nobel in Sciences and the first non-white to win a Nobel in Physics. This discovery was made on Feb 28, 1928. Being 93 years now, it is time to think whether India has kept C.V Raman's legacy or has forgotten innovation? Indeed, today's India focuses more on routine learning than research.

- We do not have an environment for innovation
- We do not have enough researchers
- There aren't enough resources for research

If the first factor, environment, is considered, it can be seen that today's students are running a rat race. For a child who is formally introduced to science around the age of six or seven, Science soon becomes an IQ marker, and it is not at all fun. In high schools, the focus of science shifts to learning outside classrooms, not laboratories, but coaching classes. Students are told to embrace smart learning, learn only what's required and relevant for the college exam, and prepare for IIT-JEE and NEET. Most Indian science students land with a decent paying desk job, which has no resemblance to science. Their careers are then shaped by the grids of Excel sheets, and th eir innovations are limited to Powerpoint slides.

Thinking about researchers, India ranks 48 in the global innovation index, 2020, and the 64th in creative outputs. How will India innovate when students are not even ready to take risks but want safe and secure jobs. The Indian student does not want to get into research. Only 252.7 people per million Indians get into research in India, whereas the numbers are in thousands for other countries.

In the case of resources, India spends around 0.7% of its GDP on research and development, whereas most other countries spend about 4% of their GDP on research. India is way below the other BRICS nations. Today's India creates top-notch corporate labour force, people who are the best in the industry. 2% of the fortune 500 companies of American origin like Microsoft, Alphabet, Adobe, and IBM are led by Indian Americans. In an article published by Forbes in 2017, it is said that 90% of Indian start-ups will fail because of the lack of innovation. The international patents filed by India are significantly less in numbers when compared to other countries.

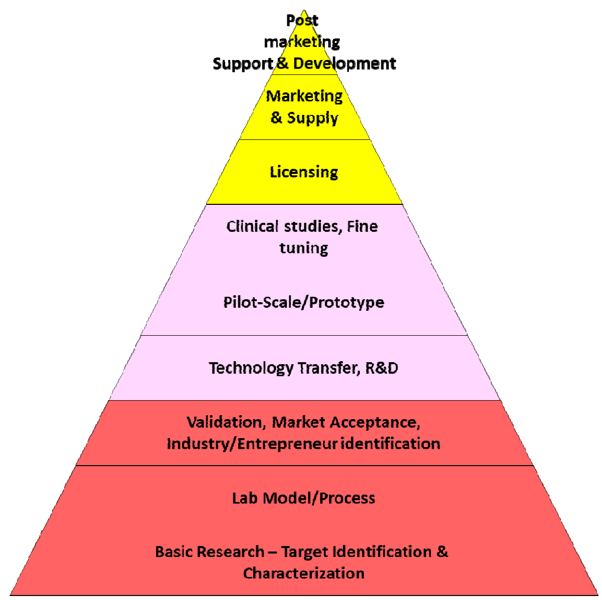
India was the land of prominent scientists like Aryabhata, Homi J Bhabha, Venkataraman Radhakrishnan, S. Chandrasekhar, Satyendra Nath Bose, Meghnath Saha, Srinivasa Ramanujan, Jagdish Chandra Bose, Vikram Sarabhai, Har Gobind Khurana, and Dr. APJ Abdul Kalam. It is worth mentioning what Dr. APJ Abdul Kalam said, "when children are encouraged to express themselves by taking risks and creating art, they develop a sense of innovation that will help produce the kind of people that society needs to take it forward". In this sense, it is worthwhile to think if India is moving forward. From C.V. Raman Sir, only five scientists have won the Nobel prize, and that too as non-residents of India, which means the environment for innovation is lacking here.

It is high time to reverse the trend. India has a new policy aimed at encouraging innovation, the Science Technology and Innovation Policy (STIP) 2020. India also has a new education policy for fostering innovation and creativity. The National Institution for Transforming India (NITI) Aayog, having introduced the India Innovation Index in 2019, India needs to press the accelerator. It must realize that Make in India can only be driven by innovation. Atmanirbhar Bharat relies on innovation. India needs innovation to drive its 5 trillion dollar dream. The approach towards Science should be changed. Science should not be forced on students. It should not be an IQ marker. It should be a passion, not part of a race for jobs. Those who choose to specialize in science should be allowed to experiment with the subject, grow, and their creativity should not be confined. India does not need more robots to work in a factory, but India needs people who can create those robots and the best of their kind.

Translational Research

Translational research is the process of applying knowledge from basic biology and clinical trials to techniques and tools that address critical medical needs. Unlike applied sciences, translational research is specifically designed to improve health outcomes. Translational research facilitates basic scientific discoveries in clinical and community settings to prevent and treat human diseases. The translation of knowledge and innovations from basic laboratory experiments to point-of-care patient applications; production of new drugs, devices, and healthcare products; and promising treatments for patients is referred to as bench-side to bed-side transition. Figure-1 shows the various stages of translational research.

Figure-1: Translational Research



Basic Research – Target Identification and Characterization

Translational research starts with basic biomedical research, including preclinical and animal studies. Here, the target for which the product/drug is to be developed is identified, which might be a biochemical mechanism involved in a disease condition. The remedial product/drug too is defined in detail, and the analysis of the project's feasibility is carried out. Moreover, the product/drug characteristics are defined and finalized, including its size, shape, strengths and weaknesses, preferred conditions for maintaining its function, toxicity, bioactivity, and bioavailability.

Lab Model/Process

Here, the identified target/product is developed in the laboratory. Product development, of course, includes the design and development of the prototype. The whole structure of the project is built with the final prototype, and mock-ups are carried out.

Validation, Market Acceptance, Industry/ Entrepreneur Identification

In this step, the product/drug is validated for industry use. Whether the product/drug satisfies specifications and standards and fulfills the required purpose is examined. Market acceptance of the product/drug is also checked. When a product goes to the market for the first time, it is quite important that it meets the target population's needs. It is also equally important the right industry or entrepreneur is identified.

Technology Transfer, R&D

Technology transfer is the process by which innovations flow from the basic research bench to commercial entities and then to public use. This step is essential in translational research since knowledge sharing always enhances knowledge and prompts new ideas and innovations. The idea and work behind each product development must surely come after ample Research and Development in the respective field. Even after the development of the drug, research and development must happen continuously.

Pilot-Scale/Prototype

This is when the product/drug developed is given to a sample of the target population for a pilot-run to test its feasibility. If found feasible and economical, the prototype is finalized. Pilot studies help gather preliminary support for the following research step also.

Clinical Studies, Fine-Tuning

In this stage, clinical trials are conducted with the prototype. The prototype is fine-tuned to become the final finished product that is beneficial to the target population.

Licensing

Here, the product is registered for obtaining a license for public use. This is the permission from the government to carry out a business concerning the product/drug.

Marketing & Supply

Getting hold of the right market is crucial to the success of any product. This phase deals with planning the appropriate strategies to market the drug and identifying the right person or place where the drug can be quickly sold.

Post-marketing, Support & Development

Post-marketing refers to the process of monitoring the safety of drugs once they reach the market, after the successful completion of clinical trials. The primary purpose for conducting post-marketing surveillance is to identify previously unrecognized adverse and positive effects as effects.

Translational research is to be accelerated in almost all disciplines, thereby enabling true research results to reach the common person. It is used to prevent and treat human diseases. The innovative research that happens in research institutes and labs should reach the community and benefit them. This should be reflected as point-of-care patient applications, production of new drugs, devices, and healthcare products, and promising treatments for patients. Translational research is none other than bench-to-bedside transition. Bharathiar University is committed to making translational research happen. The author of this paper has the first-hand experience in bringing his research results to the benefit of the common person, which is detailed below.

The author has developed a rapid flow-through diagnostic kit for filariasis detection due to his sustained research on the molecular pathogenesis and genomics on filariasis, affecting millions in the country. This was achieved with years of international and national collaborations like Indo-US PL480 program and industrial collaborations in which Ph.D. students were trained in advanced techniques and international quality work was published in reputed scientific journals (Setty Balakrishnan Anand et al., 2007; Vijay Bhaskar et al., 2004). The entire genome of the filarial parasite has been sequenced and 15 molecules of diagnostic and prophylactic importance were identified, and these contributions were duly recognized by WHO, who selected the diagnostic kit developed for multi-center evaluation for global screening.

Digitisation

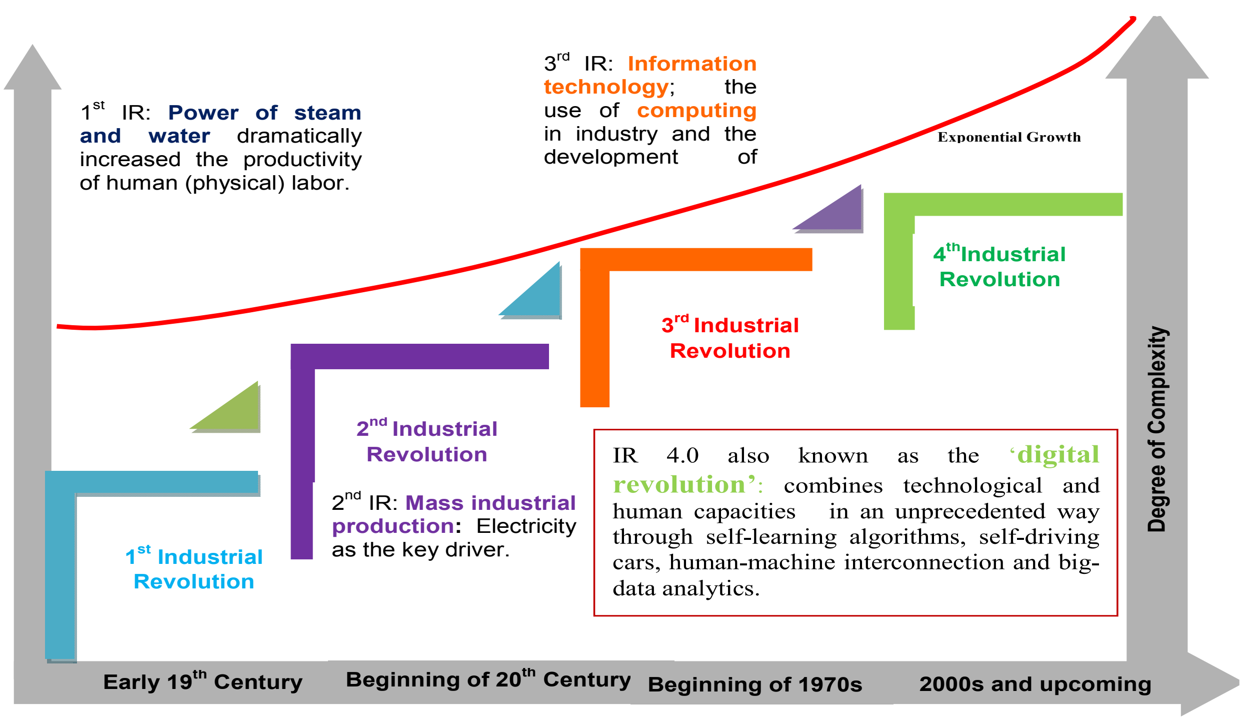
Digitisation is the process of creating and sharing digital resources using computers and other associated tools. These resources are considered valuable and hence have to be shared with others over time and space. They can include creative ideas, expressions, information, and knowledge that are to be encoded to be processed by a computer. Digitisation requires an organizational change that forces a shift in skill requirements. It comes with rising shares of alternative work arrangements due to more outsourcing, standardization, fragmentation, and online platforms. Both new challenges and innovative opportunities can be included within these alternate work arrangements. Digital technologies are transforming the world and helping humankind at all times and increasingly, during pandemic situations mainly by facilitating communication. Industry 4.0 and 5.0 involve technologies for transformation. Bharathiar University is marching towards globalisation by incorporating these technology tools across science, social science and arts education.

Cyber Physical System (CPS) and its associated technologies, like Artificial Intelligence (Al), Internet of Things (loT), Big Data Analytics, Robotics, Quantum Computing, Quantum Communication, Quantum encryption, Data Science; Predictive analytics, Cyber Security for physical infrastructure and other infrastructure, have pervaded and is playing a transformative role in almost every field of human endeavour in almost all sectors. It has become imperative for government and industries to be prepared to adopt these emerging and disruptive technologies to remain competitive, drive societal progress, generate employment, foster economic growth, and improve the overall quality of life and sustainability of the environment. DST has established 25 Technology Innovation Hubs under National Mission on Interdisciplinary Cyber Physical Systems (NM-ICPS).

Industry 4.0 and 5.0

The fifth industrial revolution, Industry 5.0 is changing the world around us. Industry 5.0 is future, but already penetrating trend, of change processes directing towards closer cooperation between man and machine and systematic prevention of waste and wasting including Industrial upcycling. There are two common themes in each phase of industrial evolution - 1. Speed and 2. Energy. From the start itself, the race is always about achieving the speed by exploiting the energy sources (Figure 2). Speed from Mechanical Automation to Mass scale Cognitive Automation. Energy exploitation from

Figure-2: The History of Industrial Revolutions



Steam power to, nowadays, nuclear power. Growing clamour about the Sustainability and environment will push Leaders towards looking for alternative means for achieving both 'Speed and Energy'. It is believed that New Innovations will be about Industrial transformation in the face of even faster and scalable production in a sustainable manner. Technology-wise, the evolution of 5G and Quantum Computing will play significant roles in achieving the speed factor along with Industrial innovations in Energy Production, Distribution, and Consumption.

Artificial Intelligence and Machine Learning, Automation and Robotics, Big Data, Internet of Things and Augmented Reality & Virtual Reality, Creativity are the tools of Industry 4.0 (Figure 3). The fourth and fifth industrial revolutions are affecting the roles that Indian Universities and Colleges prepare students for, and educational institutions are ideally placed to help produce the workforce for this new world and the student experience to match it. It is necessary to align higher education with industry 4.0 and 5.0 through the education on the tools of Industry 4.0 and 5.0. It is also essential to impart the essential skills to develop the students to face the Volatile, Uncertain, Complex and Ambiguous (VUCA) world around us. Thus, awareness and practice on industry 4.0 and 5.0 tools, skill development to face the VUCA world and the technologically advanced infrastructure become the keys for successful development of future pillars of our Globe. Linking Industry 4.0 and 5.0 with arts and science education is the need of the hour.

Jobs 2030 and Skills

Prominent sectors that will have more jobs are *Healthcare, Education, Information Technology,*

Figure-3: Industry 4.0 Tools

Digital Marketing, Automation, Manufacturing, Logistics and the like. The demand for doctors, nurses, pharmacists and drug developers will be ever-increasing and so will be the demand for better medicine and treatments. Though the digital transformation will happen in Education 4.0, the demand for teachers as facilitators and mentors will never decrease. As Industry 4.0, will take over our daily workspace and Artificial Intelligence, Internet of Things (IoT), Data Analytics, Augmented Reality will be the driving force, specialists in these areas are ever more be needed. Digital marketing will be another area where experts will be required to market and promote online businesses and firms. Any business without an online platform will find it hard to thrive in this digital era and hence digital marketing experts will be ever in need. Automation specialists like drone pilots, data specialists, and informatics specialists will be in high demand due to advancements in technology. The manufacturing field will require specialists when robots and Artificial Intelligence will take over most of the jobs. Global trade will take new forms which will create more jobs in logistics. Moreover, digital careers like 3D printing, User Experience designing, mobile application development, cyber-security, data analysts also will be in high demand in the industry. When robotics is gaining more roots, skills needed to design, build and service robots will be difficult to master and robotics engineers will be in high demand.

By 2030, automation and artificial intelligence will drive the world. Automation is already manifested by driverless cars and machines that can read X-rays and algorithms that can react to customer-service queries (Pavan, 2019), i.e. intelligent systems based on data analytics & artificial intelligence. As per the report of McKinsey Global Institute entitled *Jobs lost, jobs gained: Workforce transitions in a time of automation* (McKinsey, 2017a), when Jobs in 2030 are looked at, it is estimated that about 250 to 280 million new jobs can be made from the effect of rising incomes on consumer goods alone, with an additional 50 to 85 million jobs generated from increased expenditure in education and health (McKinsey, 2017b). As per this report on workforce transitions in a time of automation, Pharmaceutical – Research & Development, Automotive (Redesign and new development), Oil and Gas, Marketing (Consumer Marketing) jobs can be automated to a maximum extent as shown in Table 1.

Table-1: Sectors and Extent to which Automation can be Applied Worldwide

Sector	Extent to which automation can be applied
Pharmaceuticals (research and development)	96%
Marketing (consumer Marketing) Digital Marketing	90%
Automotive (redesign and new development)	86%
Oil and Gas	85%

It is predicted that there will be good demand for jobs in sectors such as Healthcare, Computer Engineering, and Construction. In 2030, prominent sectors that will have more jobs are:

1. Healthcare - Medical: doctors, nurses, pharmacists, drug developers - demand for better medicine and treatments are ever-increasing;
2. Education – Teachers (School, College), Other education professionals, Education support workers;
3. Information Technology Specialists: Internet of Things (IoT), Artificial Intelligence, Data Analytics, Augmented Reality Computer Specialists;
4. Digital Marketing;
5. Automation Specialists: Drone Pilots;
6. Manufacturing: Automation using Robots and Artificial Intelligence;
7. Logistics: Globalisation will lead to more global trade;
8. Restaurant Cooks.

To meet out the future jobs, the skills needed include *Creative Thinking,* Lifelong learning, industry orientation, People Management, *can-do* attitude, Emotional Intelligence, Critical Judgement, Negotiation, Cognitive Flexibility, and Knowledge Production & Management. In the curriculum, creativity, ideation, conceptualization, design of new products, and development are to be included. Assessment of Students needs to be linked to stages of product development.

Education 4.0 and Curriculum 4.0

For Education 4.0 to be a reality, the back force will be *Curriculum 4.0*. The end result of the Curriculum should be industry-ready students. Rigorous re-training of teachers and careful coordination and groundwork of students will be the backbone for this. If the delivery of academic content is not modernized, learning also will not become modern. Curriculum 4.0 should be the weapon for Faculty 4.0. Technological applications should be in the toolset of teachers for carrying out cognitive learning. Adaptive learning techniques which are personalized should be the foundation for learning outcomes. Intelligent and smart digital assets should power teaching concepts. The whole experience of teaching-learning should be made more exciting and engaging by active teacher-student interactions (Jain, 2020).

Intellectual Property (IP) awareness should be made a part of the curriculum in schooling. This will ensure that an effort to ingrain IP awareness in the education systems begins at an early stage, encouraging students to understand the importance of start-ups, thus directing their focus towards entrepreneurship.

Involvement of Industry Experts

Curriculum 4.0 calls for more *industry exposure*, emphasizing the involvement of more industrial experts as special invitees in the Boards of Studies of each programme. These experts can be Research and Development Managers, Product development managers or Industrial experts. The quality and relevance of curriculum 4.0 should promote and encourage more strong cooperation between education, research, industry and training organizations, and should be capable of aligning advanced education and training envisioning the requirements of the new industrial era (Skills for Industry Inc., 2019).

Contribution of Retired Teachers

Any Higher Educational Institution (HEI) should have a network of eminent retired Professors, Scientists, and Industry experts, who are willing to provide their academic services voluntarily to HEIs in nearby geographical vicinity. With experience and the desire to continue to contribute, retired teachers are valuable resources in colleges. They can play irreplaceable roles in the cultural heritage and cultural education which will benefit students in having cultural education. Moreover, it will have positive effects on retirement management and the construction of a harmonious campus. Their services can also be employed as advisors or mentors to not only students but to faculty and even, administration.

Another area where their expertise can be employed is in sharing the subject knowledge for e-learning development using augmented reality, artificial intelligent "technology for education" development.

Bharathiar University Marching towards World Class Universities

Bharathiar University has to its credit many notable achievements and it keeps on improving its standards to attain international acclaim.

Ranking

Bharathiar University has been ranked 13th under the Universities category by the National Institute Ranking Framework (NIRF), Ministry of Human Resource Development, Government of India, in 2020. Furthermore, the University is ranked 21st among the top 100 institutions in the overall category. In World University Rankings, under The Times Higher Education Rankings 2020, in National Level, 19th rank and Global Level, 818th rank. The Times Higher Education Emerging Economies University Rankings 2021 has raised to the rank range of 251-300. In UI Green Metric World University Rankings which proves the green environment in the campus, at the National level, the university is at 19th rank and at World level 538th rank.

Innovation

Bharathiar University has three patents to its credit in the field of Botany and Medical Physics. Plant-based phytocompounds with profound anti-diabetic property was developed in the Department of Botany and a positive ion detector which is a non-invasive device for early detection of respiratory diseases was developed in the Department of Medical Physics. Herbal masks which can remove viruses on the wearables automatically have been produced under RUSA. Many other innovative reforms were initiated in the area of Healthcare Instrumentation Development, Centre for Research and Technology Development, Centre for Skill Development and the Centre for International Affairs.

Vibrant Research and Innovation Culture

Bharathiar University has very dynamic and spirited research and innovation culture that aims to attain the highest quality higher education standards. The University is equipped to set the highest standards for multidisciplinary education across India. It is giving more focus on research and innovation which is demonstrated by the setting up of start-up incubation centres, Technology Development Centres, and centres in frontier areas of research. Greater Industry-Academia linkages are sought out for and interdisciplinary research including Humanities and Social Sciences is promoted. In the scenario of epidemics and pandemics, it is critical that institutions should take the lead role to conduct research in the areas of infectious diseases, epidemiology, virology, diagnostics, instrumentation, vaccinology, and other relevant domains, and try to develop specific hand-holding mechanisms and competitions for promoting innovation among student communities.

Roadmap

Bharathiar University has meticulously planned and prepared its Roadmap for the next ten years considering the teaching, learning and research excellence, students excellence, faculty excellence, infrastructure excellence and International excellence. The aims of the roadmap are:

- Aim of Research Excellence: Achieve pre-eminence in research leading to knowledge-based innovations and generation of solutions to community/ societal problems
- Aims of Students Excellence: Ensure equal access to education for all students from diverse cultural, social and economic backgrounds and
- Develop students capability to obtain, to sift and to evaluate information and reach rational

Marching towards World-Class University

Rankings	Indian	World
MHRD-NIRF 2020, in Universities category	13	-
Times Higher Education Emerging Economies Universities Rankings, 2021		250 - 300
Times Higher Education World University Rankings, 2021	19	801 - 1000
Shanghai Rankings, 2020	-	901 - 1000
University Rankings by Academic Performance, 2020	19	982
UI Green Metric Rankings, 2020	19	638
World's Top 2% Scientists by Stanford University, 2020	14 Faculty from University	
Clarivate Analytics India Research Excellence Award, 2019	WINNER	
Highly cited Researcher by Clarivate Analytics	2 Faculty from University	
Research Excellence: 9988 Publications, 122582 Citations, 'h' index 118	SCOPUS DATABASE (16 March 2021)	

conclusions and make appropriate decisions in situations of increasing complexity and uncertainty

- Aim of Faculty Excellence: Ensure adequacy in terms of availability; infrastructure and funds for teaching and research

- Aim of Infrastructure Excellence: Provide adequate and appropriate facilities such as classrooms, labs, library facilities, computer facilities, internet connectivity, hostels and canteen

Curriculum 4.0 at Bharathiar University

Innovating the education to align with Industry 4.0 and 5.0 requires that the curriculum must be revisited, the faculty need to be given training and the students should have more access to sustainable and quality knowledge which would help them to face the demands of the future. Moreover, it requires upgradation of institutions in terms of infrastructure and other facilities that match Industry 4.0 and 5.0.

Bharathiar University has designed guidelines for Curriculum 4.0 and has revamped the syllabi for all subjects intertwining Industry 4.0 and 5.0 tools onto various disciplines such as Science, Social Science, Arts and Education. Bharathiar University has identified the gap in knowledge resources such as books, course materials, interdisciplinary curriculum and innovative programmes. To fill this gap and to prepare the future pillars of our Globe to face the Volatile, Uncertain, Complex and Ambiguous (VUCA) world, and to help the academic community, Bharathiar University has seriously prepared the Guidelines for revising the syllabus, designing innovative Faculty Development Programs, establishing connectivity to the real world for students, incubating creativity and design thinking, and editing interdisciplinary Books for Education 4.0 and 5.0 with the active participation of all stakeholders under the esteemed leadership of the author.

It is necessary to introduce new courses for Industry 4.0 technologies as specified in Table 2. Industry 4.0 transforms all domains and sectors into Smart Factories through automation. Automation replaces the repetitive tasks, which is boredom for the job aspirants but will not take away the opportunities but replace their technology-based skills. It is essential to equip the learners with the basic operating technological skills required for Industry 4.0. All the technologies run through the fuel of data which is a crucial component to drive the insights, solutions and challenges. The new courses for Industry 4.0 Skill-set cut across disciplines such as Big Data Analytics for Social

Table-2 : Tools of Industry 4.0 as Courses in the Departments

Course	Departments where courses are to be introduced
Introduction to Industry 4.0	All Departments
Big Data and Data Analytics	Commerce, Social Science, Management, Social Work, Economics, Applied Maths, Women Studies, Bioinformatics, Environment Science, Biotechnology, Extension and Career Guidance, Physical Education, Human Genetics, Statistics, Maths, Psychology, Computer Science
Internet of Things (IoT)	Environment Science, Physics, Medical Physics, Nanotechnology, Electronics and Instrumentation, Computer Science
Augmented Reality	Chemistry, Textiles, Communication and Media Studies, Education Technology, Education, Computer Science
Artificial Intelligence	All Departments
Robotic Process Automation	All Departments

Science, Artificial Intelligence for Biology and Business Analytics.

Thus, *Industry 4.0 & 5.0* have been successfully incorporated in the Syllabi of undergraduate and postgraduate programs of Affiliated Colleges and University Departments of Bharathiar University. Table 3 shows the courses proposed for Under-graduation in Commerce & Management to equip the students with Industry 4.0 skill sets. Apart from these courses, there are add-on courses, value-added courses and certificate programs offered in Industry 4.0 tools.

Learning and Examinations

Students not only learn but, more importantly, learn how to learn. Education, thus, must move towards less content and more towards learning about how to think critically and solve problems, how to be creative and multidisciplinary, and how to innovate, adapt, and absorb new material in the novel and changing fields. Pedagogy must evolve to make education more experiential, holistic, integrated, inquiry-driven, discovery-oriented, learner-centered, discussion-based, flexible, and, of course, enjoyable. Due to pandemic lockdown, online classes, blended learning, online tests and online examinations were the need of the hour.

Projects and Funding

MHRD has sanctioned 36 fellowships for Bharathiar University – DRDO Collaboration for Futuristic Technology Research sponsored by MHRD to work on Ph.D. in collaboration with the DRDO labs. Discussions and plans on the initiation of the third phase of BU-DRDO Centre for Life Sciences, taking to the next level of R&D activities leading to translational research are in progress.

The Government of Tamil Nadu has sanctioned Rs. 1.15 crore to Bharathiar University for establishing Enterprise Resource Planning (ERP) system to incorporate computer-based application to operate external and internal resources and plan, design and operate academic resources. Bharathiar University is carrying out projects on Career, Entrepreneurship and Innovation with financial support from the Government of India. The Ministry of Human Resource Development (MHRD) has sanctioned ₹50 crores under RUSA – Phase II for innovative research.

The faculty members from Science departments have been awarded 51 projects of UGC, DST-SERB, DST, ICMR, NRDMS, TNSCST, CSIR, NRB, DRDO and BRNS to a total value of Rs. 25.5 crores and, the faculty members of the Humanities have been awarded 21 projects of UGC, ICSSR, CPHE /NCERT, RGNIYD, SERB-DST, ICMR, NHRC and NCN, to the tune of Rs. 2.91 crores. The faculty and students of Bharathiar University have been sensitized and are working towards achieving Top Global University Ranking and NAAC score.

New Programmes

The University has initiated collaborations with universities in Australia for offering joint UG and PG programmes, and has started new programmes,

Table-3: Learning Path – Industry 4.0 Skill Sets – Scheme for Under-graduation in Commerce & Management

Sl. No.	Subject	Credits	Theory /Practical	Semester
1	Industry 4.0	4	T	1 or 2
2	Introduction to Databases	4	T	1
3	Data Manipulation using SQL		P	2
4	Big Data Analytics		T	2
5	Data Analytics using R	4	P	3
6	Artificial Intelligence	4	T	3
ELECTIVES				
1	AI – Robotic Process Automation (UIPATH) – E	4	P	4
2	Advanced Data Analytics using R			
3	Sentiment Analysis			
4	Android Programming			

DBT supported M.Sc. Medical Biotechnology, and M.Sc. Cyber Security in the year 2021.

Industry infusion into curriculum

Industry infusion into the curriculum is given much importance by involving more industry experts - R&D managers, product development managers, technical managers as special invitees in the Board of Studies. 147 industry experts are members of various boards of studies of Bharathiar University since 2020. In order to increase employability potential, involve industries in curriculum design and curriculum delivery (20% to 30%). Match curriculum with the state-of-art industrial requirements say, Industry 4.0 and 5.0. Start from "What skills Industries expect from students" through academic Industry interface, carry out reverse engineering - map skills with the syllabi content, sequence the subjects.

Internationalisation

Bharathiar University Centre for International Affairs (BU-CIA) is formed to facilitate admission to international students through study in India (MOE) and Indian Council for Cultural Relations (MEA). BU-CIA operates in liaison with the Association of Indian Universities, Association of Commonwealth Universities and Shastri Indo Canadian Institute. This academic year, 15 international students are enrolled in various PG, PG Diploma and Ph.D. programs. Research and academic collaboration with Universities abroad is fostered through this Centre. Bharathiar University has initiated discussions with the University of Melbourne, Australia, for a collaborative MBA Executive program.

Translational Research

Indian research and technology institutes filed over 25,000 patent applications from 2009 to 2019, but only one-fifth of those were approved. Less number of patents are granted and very few patents are converted into Products. Activities that are to be performed to convert patents, concept of proof and prototypes into products include:

- Acceleration of translational research
- Clinician driven product development
- IPR generation, Product Development
- Clinical Validation, Industry association
- Technology transfer support
- Entrepreneurship Development, Start-up support
- Revenue generation for University
- Adding to Socio-Economic value

Students should be sensitized right from the undergraduate level about the importance of translational research thus making it a continuous process intertwined in the curriculum. Students should be made aware that though publications, citations and patents are significant, they alone are not sufficient, and the need of the hour comprises marketable products and prototypes.

Currently, the career advancement for faculty members is based on publications, citations, and patents that are not adequate. Career advancement of faculty should be linked to the products developed by them that are useful to society. Like Academic Performance Index (API), the Product Development Index (PDI) needs to be framed to assess faculty performance. Creativity, ideation, conceptualization, design and development of new products should become an essential part of the curriculum. This can be linked to the assessment of students too.

MoUs for Collaboration

MoU with Mahatma Gandhi National Council of Rural Education for Entrepreneurship Development is in the anvil by University and 20 affiliated colleges have established Entrepreneurship Development cell. MoU with UiPath, Romania paved the way for training the faculty on Robotic Process Automation and the tool UiPath. MoUs with Institute of Company Secretaries of India, AIC-NIFT TEA, MoU with leading hospitals and research institutions in medical care lead to access to real-time data for postgraduates and research scholars studies.

Conclusion

Industry 4.0, its technologies and tools such as Internet of Things, Augmented Reality, Big Data, BlockChain, Artificial Intelligence, and Automation change the way people communicate and relate with each other. It also brings radical changes in the way we work, educate, and even live, thus disrupting every walk of life in this twenty-first century. Traditional skills are outdated and twenty-first-century skills like lifelong learning, creative thinking, can-do attitude, cognitive flexibility, and the like are required to survive in this Volatile, Uncertain, Complex and Ambiguous (VUCA) world. This article outlines the nature of jobs in 2030 and the sectors with more job opportunities since most of the jobs today will be replaced by

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(contd. from pg. 13)

new generation jobs. The disruptive trends and technologies driving the global higher education sector today are also discussed in detail. The article also discusses the courses that may have a place in the curriculum and emphasizes the role and contribution of industry experts and retired teachers to face this future arena of higher education.

Acknowledgements

The author acknowledges Prof. Dr. T. Devi, Professor of Research and Evaluation, Professor and Head, Department of Computer Applications, Bharathiar University and her team for being instrumental in the implementation of Industry 4.0 and data engineering towards NIRF India Rankings of esteemed Bharathiar University.

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