Technological Evolution of Indian Higher Education

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ABSTRACT

Indian higher education sector is transforming itself by leveraging the technological innovations to tackle the challenges prevailing in the education scenario of 21st Century. The growing use of Computer, Smart boards, Handheld computing devices, Educational Mobile Applications, Open Educational Resources (OER), etc. is playing a crucial role in improving educational processes and outcomes. Emerging and Disruptive technologies like Artificial Intelligence, Robotics, etc. and Educational or Instructional Technology (EdTech) like Custom Learning Experiences, Speech-to-text options, Cloud computing, Virtual and augmented learning experiences, 3D printing, learning analytics, etc. is redefining the operations and mechanisms of the higher education institutions.

The emergence of New Education Policy 2020 is further pacing up the use of technology both within and across higher education sector boundaries. Higher education has entered in a period of profound transformation due to these speedy and continuous changes. Reflecting on this, the present study identifies and addresses some recent trends and future perspectives for education sector in this technological era. It further offers certain recommendations on the basis of the critical observations from the review and present scenario of digitalization which may be useful for the growth and development of Indian higher education sector.

Key Words: Education Technology, Higher Education, NEP 2020, Digital India Technological Evolution of Indian Higher Education

1. Introduction

Indian higher education system is at the brink of transformation due to New Education Policy 2020 and growing use of digital technology in teaching and learning. The Global lockdown 2020 has taught the nation that intervention of Information and Communication Technology can decelerate the disruptions in the contact-intensive education sector of India and ensure the uninterrupted teaching-learning environment. The growing use of Computer, Smart boards, Handheld computing devices, Educational Mobile Applications, Open Educational Resources (OER), etc. is playing a crucial role in improving educational processes and outcomes. Emerging and Disruptive technologies like Artificial Intelligence and Machine Learning, Robotics, etc. and Educational or Instructional Technology (EdTech) like Custom Learning Experiences, Speech-to-text options, Cloud computing, Virtual and augmented learning experiences, 3D printing, learning analytics, etc. is redefining the operations and mechanisms of the higher education institutions.

The emergence of New Education Policy (NEP) 2020 is further pacing up the use of technology both within and across higher education sector boundaries. The Government is taking initiatives to set up 'Virtual Universities' to fulfil the objectives of NEP. 'Digital India' campaign of government of India,

which was instigated on July 1, 2015 to make the country a digitally empowered knowledge economy, is further promoting the use of technology in every sector of economy including education. This progression towards adoption of new technology and innovations are posing many challenges and offering many opportunities for education sector players and policymakers. Reflecting on this, the present study identifies and addresses some recent trends and future perspectives for education sector in this technological era. It further offers certain recommendations on the basis of the critical observations from the review and present scenario of digitalization which may be useful for the growth and development of Indian higher education sector.

2. Objectives and Methodology

Stating over the issue of digital technology and education sector in Indian context many studies such as Agarwal (2006); Senthilkumar & Arulraj (2011), Gupta and Gupta (2012), Thakran & Sharma (2016), Jena (2020) has declared some common and many differential versions to significance and use of technology in education sector. However, in the light of 'New Education Policy 2020', 'Digital India' program, and technological innovations, there is a need to identify and address the recent trends and advancements for education sector and to suggest some innovative practices for its improvement.

The vision of this paper is "Leveraging technological innovations to tackle the educator sector challenges is imperative for the creation of skill oriented, learner centric and an all-inclusive education sector". The objective of this paper is to trace out certain trends and future perspectives for education sector in the era of digitization. This study is conceptual in nature and adopts descriptive approach to carry out the research work. It employs secondary sources to collect data such as annual reports and press releases of Ministry of Human Resource Development, Economic Surveys, Media Reports, and Web resources.

3. Evolution of Indian Higher Education System

All the Institutions of Higher Learning (i.e. all institutions offering courses or programs of Study of a duration of 9 months or longer, leading to a Degree, Diploma or other awards) which includes

- Universities (Central, State, Private, Deemed) including Open Universities
- University Level Institutions such as Institutions of National Importance or Institutions established under State Legislature Act
- Colleges affiliated with Universities
- Stand-alone Institutions (not affiliated with Universities) e.g. IIMs, Polytechnics, Diploma Level Teacher Training Institutes, Nursing Institutes etc.
- Distribution of Degree-Level Institutions

The higher education in India has witnessed many folds increase in its institutional capacity since independence (Table 1). During 1950 and 2019, the number of universities has increased from 25 to about 911, colleges from 700 to 41,935 and the teachers from 15,000 to nearly 12.50 lakhs. Consequently, the enrolment of students has increased from a mere 1.00 lakh in 1950 to over 373.99 lakhs. The expansion in institutional capacity in terms of number of universities/colleges and teachers has provided greater access to the students to higher education.

Table1: Capacity Expansion in Higher Education

Institutional Capacity Indicator	1950	2018-19
Number of University Level Institutions	25	911
Number of Colleges	700	41,935
Number of Teachers	15,000	12.50 lakhs
Number of Students Enrolled	1 lakh	373.99 lakh

Source: Compiled from Higher Education in India at a Glance, UGC (2012) and Annual Report of UGC 2018-19.

Indian higher education system is characterized by greater presence of Government funded institutions as the share of private universities is only 40% (Table 2). By and large, Government is providing subsidized education to the needy and poor people through the State institutions.

Table 2: Distribution of Higher Education Institutions

	No of Institutes	Percentages
State Public University	371	38.57
State Private University	304	**31.60**
Deemed University-Private	80	**8.32**
Institute of National Importance	127	13.20
Central University	46	4.78
Deemed University-Government	34	3.53
Total	962	100

Source: Compiled from All India Survey of Higher Education 2018-19, August 2019.

There is a huge gap in graduate (79. 76), post-graduate (10.81), and research students (0.53) (Table 3). Improving the standards of research for development of Higher education demands due incentives to researchers. There is a very limited scope for publication of even successful researches. Proper funding and guidance should provide to the competent persons for research.

Table 3: Students Enrollment by Stages in Higher Education 2018-19

	Students	Percentage
Graduate	2,98,29,075	79.76
Post-Graduate	40,42,522	10.81
Diploma/Certificate	30,86,803	8.26
Research (Ph.D/M.Phil)	1,99,862	0.53
Integrated Courses	2,41,126	0.64
Total	3,73,99,388	100

Source: Compiled from Annual Report of UGC 2018-19, November 2019.

The access of higher education is also increasing as indicated by gross enrolment ratio which is increased from 0.7% in 1950-51 to 26.30% in 2018-19 (28.6% in Tertiary sector, UNESCO 2019).

4. National Education Policy 2020: Inclination towards digitization

Intervention of technology in Indian education sector can contribute to strengthen the fundamental pillars of NEP 2020 i.e. Access, Equity, Quality, Affordability and Accountability (Figure 1). The NEP 2020 is focusing on Skill Development (Teaching learning activities) and Attitude and Aptitude Building (Co-Curricular activities). Digitization of education system can contribute significantly in developing skill-based and value-based education. The NEP 2020 highlights that the relationship between technology and education at all levels is bi-directional and proposes to create a conducive digital ecosystem for all the stakeholders of education sector like students, teachers, and evaluators. The thrust areas of technological interventions pinpointed by NEP 2020 are:

- Facilitating Teaching-learning and evaluation processes

- Supporting teach preparation and professional development

- Enhancing educational access

- Streamlining educational management and administration

- Removing language barriers

- Extending greater access to Divyang students

The new policy aims to establish multidisciplinary universities by 2030 in every district, preferably in public private partnership mode and blended mode of learning. Along with it, due to the recent education policy provisions, foreign universities will be soon arrived in the country, which can pose new challenges to the higher education. The whole educational components required to be strengthened for facing the competition.

The NEP 2020 also points out that to attain 50% GER by 2035, total 3.5 crores new seats should be added in the higher education institutes. India is increasing percentage spending of GDP on education from current 3.5% to 6% in near future but to add 3.5 crore new seats a huge share of India's GDP should be spent on higher education. To fill this demand-supply gap Public-Private Partnership (PPP) Mode should be adopted widely and hassle-free approval should be given to foreign Universities in India.

NEP 2020 considers the importance of technology and creates a ***National Educational Technology Forum (NETF)*** with the aim to develop e-courses in regional languages and related virtual labs. NEFT has been created with the following aims (www.education.gov.in):

- To advice Central and State Government on use of technology in education

- To build intellectual and institutional capacities in educational technology

- To articulate new directions for research and innovation

A ***DIKSHA/SWAYAM platform*** has been proposed in NEP 2020, with the aim to develop teachers professionally and to act as a repository of teaching learning e-content. Suitable equipment has also been developed to integrate e-content into teaching learning practices. Educational software has been created in all major Indian languages for expending the horizons of the education sector. Many educational

software is also used to make the education accessible to divyang students. Considering the significant contribution of distance education with new information and communication technology (ICT) in higher education (Gupta and Gupta, 2012), distance and open learning programs need to be promoted extensively.

In addition to this, a ***National Research Foundation*** is proposed to establish with the aim to expend research activities in to the technology. This foundation is aimed to advance core Artificial Intelligence research and to develop application-based research. Now, higher educational institutions have to develop and deploy varied technology centric instructional materials courses and have to offer research programs in disruptive technologies such as Machine learning, Robotics, Artificial Intelligence, etc. It will be imperative to user in awareness on security, laws, privacy and ethical issues pertaining to disruptive technologies. Technology is based on interactive intelligence of many (Agarwal, 2006), so inter-disciplinary research should be promoted.

5. Digital Education and HEIs: The Way Forward

The goal stated in the National Policy of Skill Development and Entrepreneurship (NPSDE) 2015 is to of create a skilled workforce of 110 million people by 2022. Higher education institutions have to initiate creative programs focused on re-skilling and up-skilling. There are many key initiatives being taken by HEIs to face the challenges of Global lockdown. Some of the key initiatives towards online and digital education are (https://www.education.gov.in)

Figure1: Online and Digital Education: Key Initiatives

Source: NEP 2020 (https://www.education.gov.in)
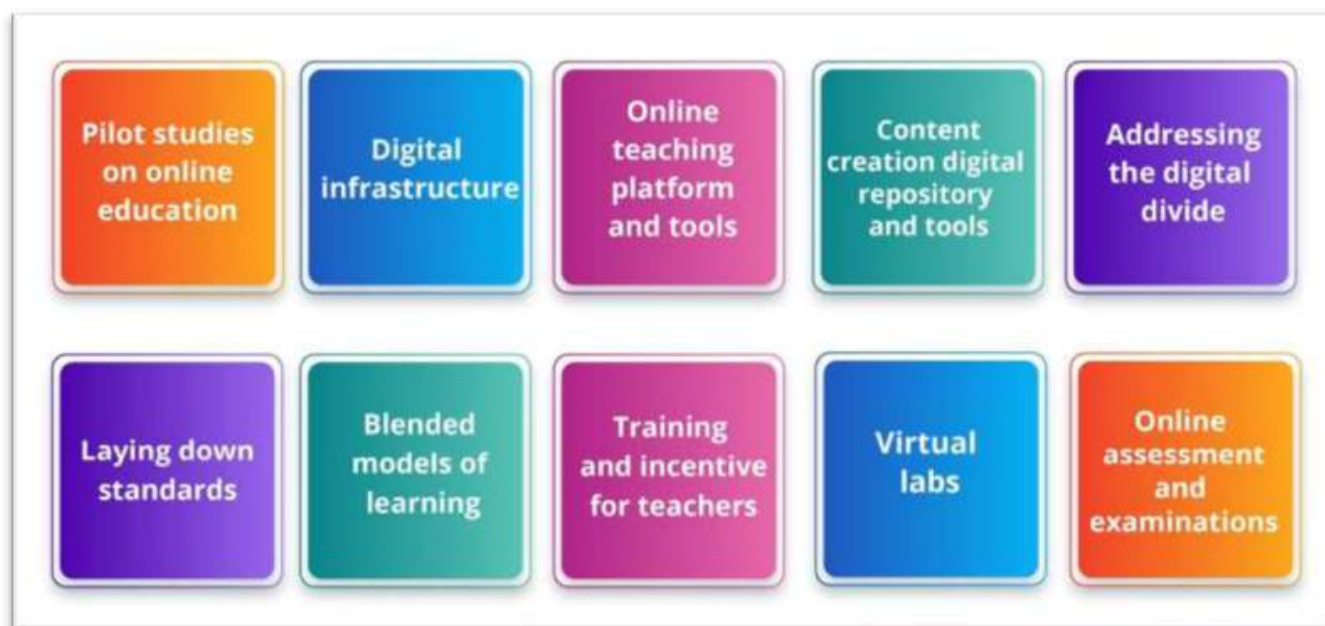
1. Blended learning approach with online and experiential learning
2. Creation of Virtual Labs and digital platforms
3. Faculty development initiatives and effective digital training to teachers
4. Pedagogical changes for online/digital education
5. Availability of multi-lingual educational programs 24/7

6.   Preparation for effective online assessment

Some of the digital initiatives of UGC & MHRD for higher education during COVID-19 are (Jena, 2020):

- e-GyanKosh (http://egyankosh.ac.in/)
- Gyandarshan (http://www.ignouonline.ac.in/gyandarshan/)
- Gyandhara (http://ignouonline.ac.in/Gyandhara/)
- National Digital Library of India (NDLI) (https://ndl.iitkgp.ac.in/)
- e-Yantra (https://www.e-yantra.org/)
- FOSSEE (https://fossee.in/)
- Virtual Labs (http://www.vlab.co.in/)
- e-ShodhSindhu (https://ess.inflibnet.ac.in/)
- Shodhganga (https://shodhganga.inflibnet.ac.in/)
- VIDWAN (https://vidwan.inflibnet.ac.in/)
- National Educational Alliance for Technology (NEAT)(https://neat.aicte-india.org/)
- SAKSHAT (https://sakshat.ac.in/)

There are many challenges of higher education in India, which range from geographical disparities in access to education, to shortages of trained and qualified faculty (Thakran & Sharma, 2016). Technological interventions are helping in addressing these challenges and in improving the quality of higher education available nationwide. However, HEIs are also facing many challenges (Figure 2) related to use of technology in education.

Figure 2: Challenges of Digital Education

Source: NEP 2020 (https://www.education.gov.in)
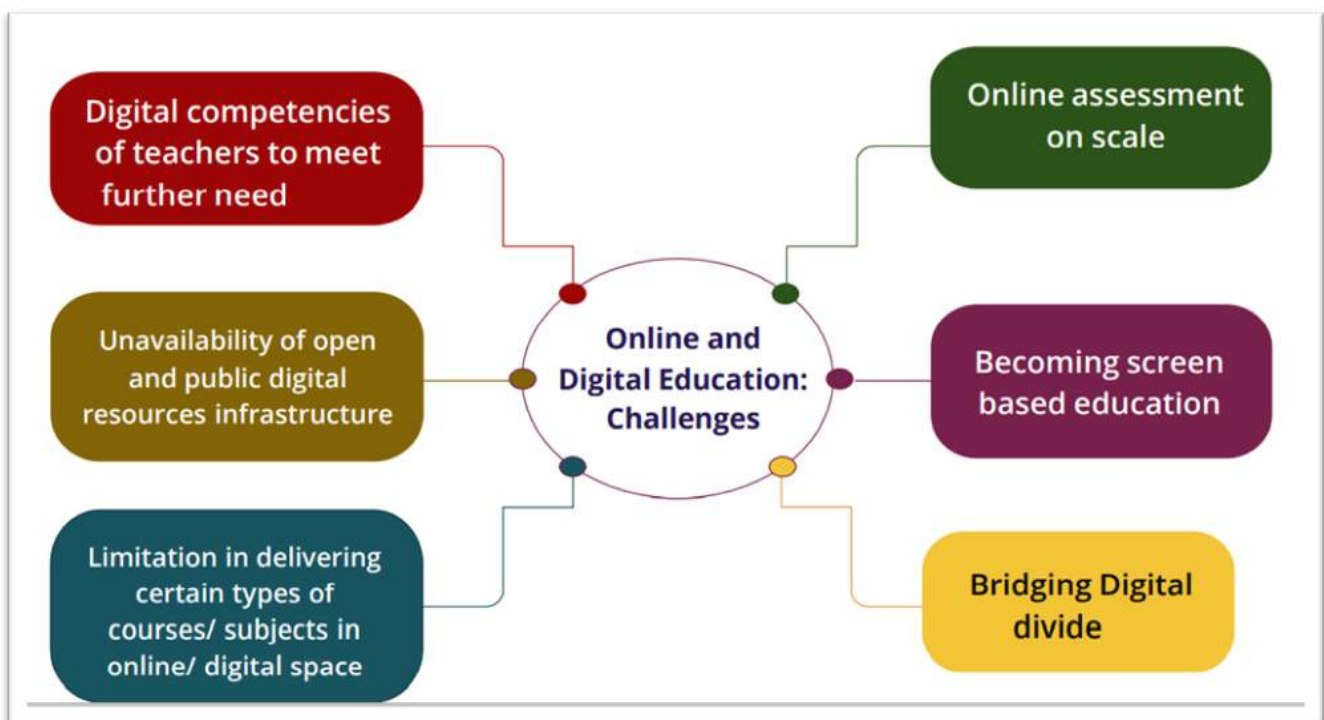
Research & Development (R&D) investment is a key input in innovation (Economic Survey 2021). The proportion contributed to Gross Domestic Expenditure on R&D (GERD) by higher education is similar in India as in the top 10 economies. India entered the top 50 (Rank 48) innovating countries for the first time in 2020 since the inception of the Global Innovation Index in 2007. India secured rank 45 on the parameter of University/Sector research collaboration, which is the strength of the country (Economic Survey 2021). However, improving the standards of R&D and innovation, especially in the field of disruptive technology, is still a huge challenge.

To face these challenges, HEIs have to perform the following tasks to

- Continuous customization of architecture of digital education platforms at national level inclusion portals, apps, labs as per the arising education needs.
- Conduct research on disruptive technology, new pedagogical and curricular structure, and effectiveness of training modules etc.
- Design, development and roll out MOOCs for students and teachers with appropriate policy evaluation, certification and credit transfer
- Dissemination of digital contents through multiple modes
- Collaboration and coordination with national and state level institutions for convergence of efforts
- Curriculum designing with special focus on Technology and vocational education
- Designing of training programs for teachers, trainers and evaluators

5. Recommendation

The use of technology in education sector is low in India due to lack of easy reach and high cost of technology. People are lacking in necessary e-skills and unaware of digital education benefits. The following are certain recommendation based on challenges related with the technology in education sector.

Adoption of technological innovations: Government should create an environment conducive for research and innovations in the country by higher education reforms, Industry-academia collaborations, improved patenting and trademark regulations, and more investment in scientific research. Educational startups based on innovative technology should be encouraged by providing concessions and incentives. Government should take Initiatives to ensure availability of affordable computing devices to eliminate digital divide and to offer inclusive education programs.

Investment in Digital Technology: Investment crunch is another major challenge. Education sector received 2.56% share of equity inflows into Services sector in 2019-20 and the FDI inflows are increasing substantially into this sector. However, to create sufficient digital infrastructure and to bridge the digital divide, FDI flow should be directed towards education sector. Government should provide various concessions, incentives and facilities to investors in education sector. Investment policy should be in coherence with other policies like Information technology policy, education policy, taxation policy, and foreign exchange policy.

Laws and regulatory framework: Technology has made it convenient for a learner to 'learn beyond boundaries.' Technological innovations are happening faster than related laws, policies and regulations. Application of these innovations in the education sector is a challenging task given the disintegrated laws and regulations in different countries.

Technology enabled Infrastructure: Even in the technological regime, there is a dearth of ICT infrastructure such as telephone lines, mobile cellular subscriptions, and internet facility in India. Policy makers should focus on creating ICT infrastructure for speedy delivery of information as well as services to learners. ICT enabled technologies should be promoted among public through mobile applications and social networking. Thus, more investment should be directed towards creation of open, interruptible, evolvable public digital infrastructure (NEP, 2020)

Faculty Development: Obtaining and maintaining satisfactory and satisfied digitally enriched faculty is another challenge. Government has initiated Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT) and open many Teaching Learning Centers (TLC) to impart the required e-skills and knowledge amongst faculty. Annual Refresher Program in Teaching (ARPIT) are being conducted through online mode. These programs should be strengthened by making an integrated strategy of e-skills creation, ICT development and diffusion, local networking, and cooperation projects. Experiential learning and training programs should be developed for faculty re-skilling, up-skilling, and updation of know-how, possibly with technological aids (Senthilkumar & Arulraj, 2011).

Learner Centric Pedagogy and Dynamism in Course Content: Adoption of appropriate learner centric pedagogy along with dynamism in course contents is a challenge. Courses should be designed in collaboration with industry and such courses be updated regularly, e.g., every year, according to need. Promotion of Open Educational Resources (OER) such as Consortium for Educational Communication (CEC) or resources by National Program on Technology Enhanced Learning (NPTEL) are offering distance education and open learning programs for learners. These can be effective in increasing access at modest costs, especially for the underprivileged groups that are usually poorly represented in university enrollments. They can also be designed with a regional or multinational approach.

Promotion of Innovation and R&D Activities: Monetary and non-monetary motivation should be extended to register patents and copyrights based on innovations in the field of disruptive technology.

Concluding Remarks

India will have the highest population of young people in the world over the next decade. So, our ability to provide high-quality educational opportunities to them will determine the future of our country (National Education Policy, 2020). The new global scenario post corona pandemic poses unprecedented challenges for the higher education system. The synergistic interaction between technology and education sector can bring revolutionary changes in the functioning of Indian education sector. Therefore, higher education ecosystem has to be more technology driven, vocational and skill based, learner centric, accessible, competitive, meaningful and purposeful.

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