ICT Perspectives of Productive and Sustainable Development for 21st Century Higher Education Institutions

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Abstract:

21st-Century higher education around the world aims to sustainable productive living standard of society through quality education and research. Productive transformation of teaching, learning, and evaluation processes in HEI is progressively possible by full-fledged implementation of breakthrough-technologies in 21st-Century HEII. ICT, Artificial Intelligence and Augmented-Virtual Reality are opportunity and challenge as well for rural and remote areas in developing and underdeveloped countries. HEII leadership's responsibilities of promoting ICT-integrated pedagogy, staff-training and up-grading infrastructure are discussed. Prevailing trends, approaches, hurdles, and future requirements of ICT-infrastructure, usage and trainings are presented based upon analysis of data collected through qualitative survey research conducted in India for a population of 583 multidisciplinary respondents. 89.7 percent of respondents are highly qualified with research degrees having experience of 12-35 years. Results motivate policy-makers for enhancing sustainable productivity of society by promoting ICT-digital technologies. Authors discovered lack of motivation, willingness, trainings, and facilities for adopting ICT at HEII.

Keywords:

Higher Education Institutions (HEII); Leadership; Information Communication Technology (ICT); Sustainability and Productivity; 21st Century.

Introduction:

Students, teachers, society and industry demand full-fledged technological innovations and academics from 21st Century higher education institutions. Leadership of institutions of higher learning can expect the stakeholders to deliver productive outcomes provided they are facilitated with state-of-art ICT infrastructure, periodic trainings and high degree-of-freedom to earn and learn new paradigms of knowledge ((Dwivedi, V. J., and Joshi, Y. C. 2020 a). Questions to implement ICT, provide infrastructure and facilities at par global standard for 21st century become more critical, when it comes to HEII located in rural and remote areas, especially in developing and underdeveloped countries like India (Dwivedi, V. J., and Joshi, Y. C. 2020 b). Dwivedi & Joshi's (2019) Model for higher education describes the ICT condition of HEII and leadership roles to implement ICT for day-to-day processes including teaching, learning, evaluation, administration, purchase, and research. The alarming barriers are ICT skill of staff members in HEII, preparedness of the leadership to facilitate teachers and other staff members for their training, ICT enabled campus culture, data security issues, audio-video recording and storage, and Internet broadcasting speed, and maintenance of ICT devices (Dwivedi, and Joshi 2020 b).

Breakthrough technology is a boon when it involves innovative knowledge, sharpens skills to promote and raise earning a standard living-hood, contentment with calmness-happiness in society, and enhancing protection of natural and manmade environment (Mojgan, Kamariah, Wong, Bahaman, & Foo Say 2008). HEII leadership, policy makers and far-sighted visionaries believe that on-line ICT enabled governance and academic affairs would enhance productivity of society provided the resources are provided and opportunities are created unanimously for all from facilitator to students. Read M. (2010) through deep discussion on ICT benefits favours strong long term collaboration of HEI not for narrowed down community but entire society worldwide in innumerous domains of research, infrastructure development, employability and entrepreneurship due to specialized resource sharing.

Virtual platforms in e-science and integrated technology (Mills, Tincher 2002) such as cloud computing, Augmented Virtual Reality (AVR), Internet-of-Things (IoT), Artificial intelligence (AI) are effectively leading tools and ICT environments to help worldwide leadership, facilitators, and learners for quick, effective and healthy interaction. This blended learning ensures integration of sustainable growth of socio-professional life and strengthens economic productivity. Hypothesis is that these dreams can only be fulfilled when data on distributed shared networks are fully secured, cost effective and safe for all time. Willingness and intention of top leadership and administrators to transform the HEI, its employees and society into ICT-savvy and users by exceling their individualized competency (Attaran, VanLaar 2001). Considerable highlights in the literature on ICT, Artificial, Intelligence, IoT, AR and VR can improve effectiveness of learning, wider reach of education, cost effectiveness are available in Attaran,

VanLaar 2001, Schiller, 2003, B. P. Sanjay 2015, D'Amico, T. 2019, Kalam, and Rajan 1998, NPE 2019, Ning, H. and S. Hu., 2012, William A. 2020.

HEII leadership has major responsibility, though critical for initiating and implementing use of ICT to facilitate simple to complex decisions about its integration with real practice of learning and teaching which effectively can improve and change the HEII system (Schiller, 2003). 21st century ICT platforms such as AI, IoT, MOOC, SWAYAM, AR and VR sharpen critical thought process of learners and researchers and answers all questions of how, why, when, where, who and what for enhancing sustainable productive leadership in HEII as described in Figure 1.
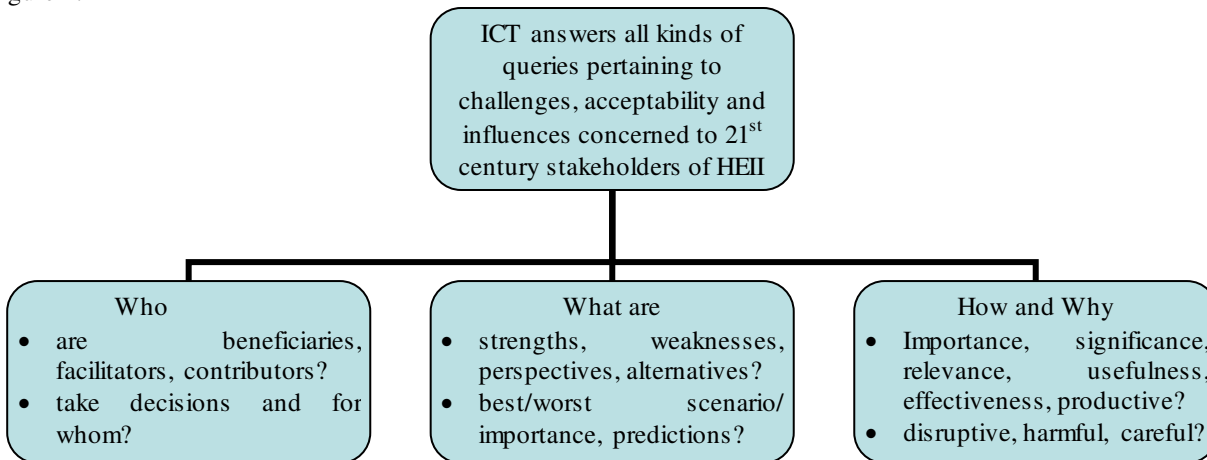

Figure 1. Imperatives of critical thinking towards full-fledged implementation of ICT in 21st century HES (Source: https://globaldigitalcitizen.org/critical-thinking-skills-cheatsheet-infographic?mc_cid=52493675a1&mc_eid=8e298c6ee6)

ICT and digital technology facilitate quality education, provide good study material and better learning opportunities to students who are located at geographically remote and rural places. These learners and researchers have meagre or nil accessibility and availability of direct learning resources. Impacts of Massive Open Online Courses (MOOCs) and Small Private Online Courses (SPOCs) are well appreciated as they promote skill-based learning to unlimited number of executives and students as well in all streams of knowledge. Implementing the innovative strategies into practice opens doors to enhance learning, earning and raise economic standard of living-hood in the society at fast rate compared to traditional (face-to-face) education, especially for the citizens and learners of less resourced under developed and developing country.

HEIIs are quite serious to adopt the technologies having more sustainable, adaptable, and productive approaches initiated by all stakeholders and society at large due to tremendous quantitative increase in number of HEII and students' enrolment. Hence ICT implementation at HEII has developed as key factor to attain cost effective highly performing solutions and productive sustenance of HEII with help of digital technological education services (Burch, Good 2014). Public and Private Universities are '*under more pressure than ever to buy digital services and products*' for various reasons such as online lecture delivery, examination and assessments, showcase improvising impact on students' performance, increase enrolment, and all that with less expense. On other side, scholarly debate focuses the barriers on implementation challenges as lack of ICT infrastructure, skilled human, training the needy, internet connectivity related facilities, students' interest, adults' rigid nature for non-adaptability towards new learning. Burch and Good (2014) highlight on requirement of careful and equal scrutiny in all aspects related to transparency in policies, curriculum, data, and culture of formal and informal digital education. Focused attention of higher education community claimed MOOCs as revolutionary and course centric novel approach to the world of innovations for developing and learning entrepreneurial skill/s in future (Sean 2017). MOOCs has potential to reshape higher education economics but as an explosive threat provided not implemented in full swing in HEIIs for all with great financial and cultural loss. Hence, MOOCs woven into all disciplines of STEAMMMSSH (Dwivedi, Vedvyas J. and Joshi Y.C. 2019) at graduation and under graduation would make higher education economically more productive and convenient.

Moving from traditional to on-line ICT oriented blended education generate multi facet challenges with limitations for 21st century HEI and learners as well which have been discussed here in this article. Authors studied importance of these breakthrough technologies which are significantly useful for sustainable productivity of 21st century higher education. Authors review relevant literature on leadership and ICT in HEI to explore significance of ICT in IHES, discusses

research methodology in which qualitative survey was conducted, presents findings on efficacy of our expectation and ground reality prevailing in HEII, summary of research and discussions for future research scopes and limitations. At the end, potential research contributions in reference are enlisted for future aspirants and policy makers.

Literature Review

B. P. Sanjay (2015) argues that being aware of significant role of ICT in our life, especially in educational activities, HEI authorities should be wise enough in implementing the strategies to empower ICT in supporting the teaching and learning processes in classroom. Producers, contributors, and facilitators in international digital technology market have core responsibility to reaffirm continued efforts in harnessing ICT for improving living standards and conditions in small to medium scale organizations globally (Hagsten, E. and Kotnik, P. 2014). Empowering and trusting an employee encourages organizational efficiency and effectiveness that transforms the employer into an emperor of the world of ICT equipped HEII enriched with evergreen entrepreneurial culture and emotional quotient for self-improvement and assessment (D'Amico, T. 2019), flexible work environment, brand building experience towards encouraging excellence (Kalam, and Rajan 1998). Socio-professional life engineering, enjoying employer's company, entertaining new changes, educating sustainable equality, retention sensitization, transparent policy, awareness and carefulness, establishing and strengthening brotherhood, reshaping spirituality with easy execution for happiness and contentment are expected by-products of ICT in IHES for total-humanity Dwivedi-Joshi Rural-HEII (DJRH) Model (Dwivedi, V J, and Joshi, Y C, 2020 b). S. Jeelani (2020) reports 30 percent shortage of teachers in centrally funded HEII, 35 percent in State funded, 40 percent in affiliated colleges and similar in self-financed private universities too. Government of India aims to raise GER from 25 to 50 percent by 2035 under these miserable conditions is a dream without ICT, AI, AVR and IoT. NPE (2019) suggests revamping, revolutionizing and reenergizing IHES and by implementing technically ICT skilled multidisciplinary approaches. AISHE (2017-18, 2018-19) in its analysis endorsed no teachers in remotely located rural colleges which severely damages integrity and reflects segmentation and fragmentation. Socio-economically disadvantaged areas lack facilities, expert human resources and learning environment, whereas the rapidly developing e-learning platform of IoT creates advanced level of technologically interactive and innovative opportunity for HEI leaders to introduce it in regular curriculum and practice (Ning, H. and S. Hu., 2012). ICT connects classrooms, laboratories, libraries and monitors outside campus activities, help completing assignments, projects, train the students and their continuous evaluation (Gubbi, J. *et al.*, 2013). ICT based e-learning through Moodle, Coursera, SWAYAM, NPTEL, edX, MOOC and Udemy is sophisticated virtual classroom learning like innovative opportunity '*anytime and anywhere for everyone*' (MHRD, 2019; NEP, 2019) while HEI leadership has received relatively less attention.

William A. (2020) discusses importance of ICT for satisfactorily and productively working from home (WFH) because social distancing reduces infection transmission rate up to 37 percent, 46 percent American businesses implemented WFH-ICT policies over past few weeks and ICT is found establishing trust, ensuring accountability, and fostering good collaboration. ICT doing good to become great with reduces stress while counterpart that 16000 employees were set free from job. WFH-productivity challenges and pitfalls due to ICT are loss from full-fledged connectivity resulting into loneliness, re-building the trust once lost because of mistake-friendly-culture, and so organizational economic productivity will plummet (Gorlick, A. 2020). Nicholar Bloom, '*WFH actually could generate a worldwide productivity slump and threaten economic growth for many years.*' Bloom N.'s (2015) research on 1000 employees of Ctrip (a tour company) highlights extolling benefits for WFH-ICT showing rise in performance by 13 percent and drop in employee-quit rate by 50 percent that resulted into Ctrip to roll out working of the whole firm WFH; while in Corona crisis time it's totally different due to four factors children and family members, separate space, privacy, and priority-choice (Nunes, A.A., Delicado, A., de Almeida Alves, N., and Carvalho. T. 2014). WFH-ICT suffers from multidimensional difficulties such as office-like space, environment, internet connectivity, and hence '*face-to-face meetings and collaboration are essential for developing new ideas to keep staff innovation motivated and focused so FWH in long run is nonproductive*' (Bloom, 2020). Employees on WFH through ICT feel isolated, lonely, frustrated, and depressed that kills productivity and builds up mental health crisis that need regular medical check-ups etc. ICT based telecommuting in the US alone has experienced 159 percent increase between 2015-17 with plethora of benefits such as employee flexibility, unparalleled agility but many challenges for those having no ICT experiences (Anon 2020). ICT in conducting classroom for encouraging student-teacher collaboration as TLE processes in HEI is relevant and imperative for world ranking, positive outcomes for NBA & NAAC accreditation, and self-paced impactful learning that would improve productivity and efficiency (Mustak, A. 2019). Interdependent parameters namely, quality, cost, expectation, and intention change role of HEI that influence ICT blended e-learning opportunities, level of competence, upskilling and re-skilling

needs, and outcomes on long run (Wheeler, S. 2015) where necessarily required skills for 21st century are enlisted in Fig. 2.
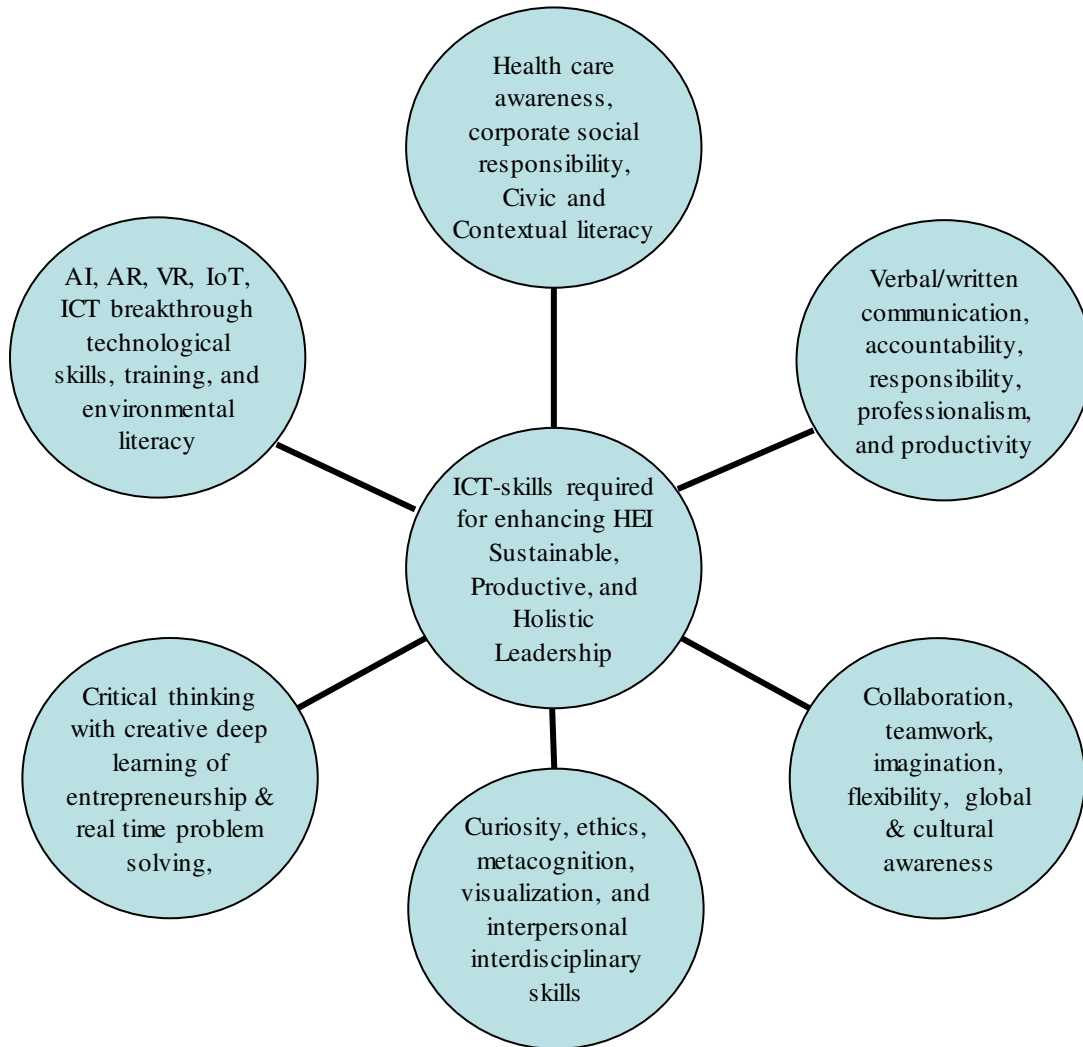
Fig. 2. Skills required to be learned and earned for productive and sustainable leadership of 21st century Higher education institutions and society
(Source: https://iite.unesco.org/wp-content/uploads/2017/09/Futures_for_Higher_Education_and_ICT.pdf

Challenges are many to implement integrate ICT with HEII like Wi-Fi connectivity, Security and Privacy of data of students or HEII, Infrastructure as IT equipment and devices, costing, professional ethics, quality of digital courses and delivery modes as audio video, and necessary fundamental and advanced trainings (Dwivedi, V. J., and Joshi, Y. C., 2019). Transformation and survival of personal to professional life has become dependent on ICT and digital environment e.g. health, sports, tourism, research, entrepreneurship, transportation, fashion, entertainment, automobile industry and automation or education (Sharan, N. and Khosla, T. 2018). Business or education leaders, politicians, and community are seen interested in developing their conceptual understanding of ICT usage and applications, and hence it is essentially relevant for 21st century HES (Saavedra, A.R., and Opfer V.D. 2012). Science of e-learning addresses holistic learners and mobilize social support system with metacognition and creativity applicable for 21st century HES transforming from irrelevant to a relevant one because an irrelevant methodology leads to lack of motivation and thus decreases conceptual interdisciplinary learning (Huffman, J.B.,

Olivier, D.F., Wang, T., Wang, P.C., Hairon, S. and Pang N. 2015). It also develops lower and higher order thinking skills simultaneously and enhances applied understandings without tradeoff of breadth and depth. ICT explores hidden set of expectations, opens avenues of healthy debates and brainstorming discussions (Joshi, Yogesh C., and Kurulkar R. 2004) with more deliberations and engagements. More learning less teaching would reshape and develop as measurement of intelligence level in 21st Century (Glenn L. 2015) constructs and better peer indicators. Critical thinking, problem solving, collaborative communication skills and synthesizing reliable information, and creating valuable cognitive ability to motivate social and individual sustainable productive progress in schools (Weinstein, J., & Hernández M. 2015). HEII's operational efficiency improvement by 21 percent with interdepartmental communication, reduction in operational cost by 7.5 percent and improvement in students' engagement by 19.5 percent (Ahmad, M. 2019). Digital technology and AI facilitates with anti-cheating features with help of photo-snapshots, question security, IP address binding; remote assessment video engagement and question & answer shuffle with multi language support to perspective learners and teachers (Jing L. 2009). It is featured with maintaining data for research publication and its performance, organizational collaboration, digital campus placement, privacy and confidentiality, no physical travel to HEII, and real time dashboard for outcome-based learnings with track records (Annon. 2019, Shokeen 2019).

HEI are incorporating digital ICT technologies to ensure exciting, promising, productive, and sustainable progress and these strategies for 21st century would enhance innovative capacity (D. P. Singh, 2019). Exploring full potential of latent talents of learners using ICT framework bring and facilitate transparency (NAAC, 2018) and comparability in initiatives throughout HES to progressively deepen their engagement with digital learning and teaching pedagogies (MHRD, 2019). Also, to help enable policy makers and governance of HEI to re-design, implement and evaluate with effective integration of ICT-digital learning technologies (Kampylis, P., Punie, Y., and Devine J. 2015). Based upon Walmart's digital strategies, McMillon and Ignatius (2017) opined, *'all employees will need to be tech savvy, and strategy is happening on a much faster cycle time'*, which is fully applicable for all stakeholders of an HEI of 21st century. Leadership's research attitude for learning and re-learning from everyone would enrich ICT skillset for this 21st century, the era of innovations and ICT. Wherein prescriptive guidance and strategy for policy makers is immediately needed to manage the competition, complexity and uncertainty in higher education service-sector units equipped with eight key trends to *'embrace an entrepreneurial mind set to expand interactions and value co-creation'*. (Francesca, P. and Kalpan, A.M. 2016).

Covid-19 crisis made us rapidly learn digital platform such as ICT based remote learning, earning, and working (ICT-LEW) with blend of better and bitter tastes of experiences worldwide. HEII that invest in remote work infrastructure will be uniquely positioned to address risks and challenges, change attitudes of work-life balance, invite transparency and flexible working which has grown to 91 percent over last ten years (Nicky, D. 2020). Research study, Nicky (2020), endorses that, above 80 percent U.S. workers would turn down their job if did not offer flexible hours and conditions like ICT, 74 percent willing to quit jobs to work ICT enabled remotely, by 2030 the demands for ICT-enabled LEW will increase by 30 percent, and 85 percent of businesses increased their overall productivity as a result of greater ICT-enabled flexibility. Stanford University found 13 percent performance increase due to ICT-enabled flexible working policy, cloud-based digital ICT tools have become more intuitive and aligned to cut down time spent with good on psychological well-being and work satisfaction as less time in traffic, more time with families, fewer sick day leaves with a surprising outcome that 75 percent improved their work-life balance, 71 percent felt more happy than 55 percent on-site employees, 36 percent retirees got opportunity to LEW, 40 percent found themselves not-at-all-stressed while 57 percent admitted improvement in their morale (Bloom, N.A., Liang, J., Roberts, J. and Ying, Z.J. 2013). Therefore, ICT- LEWFH brings more productivity, happiness, satisfaction, work-life balance and cuts-down the expenses by stating the benefits of learning effects by adopting and practicing ICT enabled modern management (Koh C. 2015).

Wilmore and Betz (2000) opines, *'Successful implementation and integration of ICT in HEI-processes completely depends upon its leadership, policy and decision makers, their support and facilities such as ICT enabled infrastructure, training, interests, and adaptability in process of change'* which is possible when leadership team is aware of and understand significance of ICT-LEWFH principles (Hope, Kelly and Guyden 2000). Gibson (2002) opined that HEII leadership must focus on existing practices relating re-designing curriculum and staff proficiency that encourage and explore novel TLE-Methodology and productive management and innovative quality performance (Dinham S. 2005), and facilitating sustainable change, and intervention of strategies in TLM (Schiller 2003), (Koh C. 2015).

Research Methodology Design of the Study
This study explores how sensitive is the HEI leadership to implement ICT in academics and administration of the campus, training the faculty and staff members, establishing and providing infrastructure, creating awareness and their seriousness for adapting ICT enabled education towards 21st century. Also, sub-questions relating this theme have been raised and their actual findings are presented here where in total 583 participants were surveyed through interviews. All respondents were Ph.D. degree holders having at least ten years of experience in various fields of knowledge and industry located in India wherein respondents having experience of working in India. Many of them have worked or working in Indian and overseas countries. The qualitative category of male and female learned respondents includes Vice-Chancellors, Deans, Professors, Heads of Departments, and Experts from industry say engineers, managers, scientists, trustees and other authorities, research scholars and practitioners. The questionnaire questions addressed needs and demands of ICT, preparedness, and requirements of leadership for implementing ICT, scope and limitations of ICT, and awareness of pros and cons of digital tools and technology (Jing L. 2009).
The responses were measured using a five-point Linkert scale from 1 (Strongly disagree) to 5 (Strongly agree). These responses are analyzed using frequency and percentage to determine what extent the HEII leadership is prepared to adopt ICT enabled higher education and its administration. Based upon mean score and the level of each respondent's experience and understanding findings are recommended here. Respondents are highly qualified, experienced, and learned, therefore their opinion written by them in their response have also been summarized in authors' words here neutrally. Demographic variables as qualification, gender, experience, and current designation are quantified. Target population was considered pivotal to the study, descriptive statistics is used to describe and summarize properties of the mass of data collected from the noble respondents.

Results, Findings and Summary of Research:

Frequency analysis of respondents:
Frequency analysis for respondents of this research was carried out to understand its quality, significance, impact, and potential. Results and findings are summarized here int his section. In total 24 questions have been designed to ask the respondents to respond which address relevant issues and implementation related challenges towards ICT-enabled higher education. Mostly, all 583 respondents selected here for this research survey are very highly qualified, skilled, learned, and ICT-tech savvy in leadership role models in their fields of specialization. The population quality and esteemed respondents comprise of 12.9 percent Vice-Chancellors, 24.9 percent Deans, 12.2 percent Heads of departments, 38.4 percent Professors, 11.6 percent other experts such as senior scientists, engineer-technocrats, managers of organizations, directors of various campuses, and trustees of various education institutions. That is, 88.4 percent of respondents are very highly skilled, experienced, and responsible in leadership roles in academic institutions. The respondents chosen are not only from STEM but from all fields of knowledge such as Science, Technology, Engineering, Management, Medicines, Mathematics, Social Science, Spirituality and Humanities (STEAMMMSSH) (Dwivedi, Vedvyas J., and Joshi Yogesh C. 2020 a). Of the respondents, 79.8 percent are males while 20.2 percent females, making an approximate ratio of 4:1. Above 89.7 percent of respondents are highly qualified with having research degrees of Ph.D. and M.Phil. and 10.2 percent had Post Graduate degrees, and all respondents are having more than sixteen years of healthy experience for professional working. It is found that more than 66.8 percent respondents have experience of working in more than two organizations, while 81.6 percent worked in more than one organization, and 31.9 percent have experience of working in one organization only.

Analysis of the Responses
All twenty four questions related to ICT have been responded by all respondents wholeheartedly. Good to state that rarely, we have seen a question or two un-responded. Optimistic hypothesis that ICT is backbone of 21st-Century institutions of higher learning, research, and teaching, is found proving true through analysis carried out, the summary of which is presented here under serial number a. to w.

a) Importance of Implementing ICT

   96.57 percent respondents opined that existing teaching learning methodology can be made more productive by implementing ICT and using it for academic improvement in curriculum design, making education less theory more practical, more autonomy and enhancing quality of teachers too. 95.71 percent agreed that existing traditional TLE methodology are not as productive as expected by international top ranked HEII of 21st-Century which can be transformed with more use of ICT facilities.

b) ICT enhances sustainable adaptability

88.51 percent respondents opined that ICT itself is student centric self-learning methodology that opens doors to enhance sustainable adaptability, which supports the authors' statement. "*Adoptability and adaptability of student centric teaching-learning-evaluation processes through innovative teaching methods with extensive use of ICT helps to meet with new curricular requirements and 21st-Century industry demands*".

c) ICT brings more autonomy

Above 52.80 percent respondents admitted that admission to evaluation processes in research courses are truly fair in existing IHES, while 47.06 percent opined differently. Authors' recommend and suggest that ICT-oriented innovation brings autonomy in academics, research, entrepreneurial and employability skills for raising sustainable productivity of HEII of 21st-Century. Also, ICT will bring more transparency and growth through ICT based interaction and delivery, both vertically and horizontally in and out the HEII system.

d) Overall societal growth and standard of living can be synergized if ICT is implemented in full-fledged manner in all HEII of type I, II and III in rural to urban zones uniformly. 93.66 percent strongly recommend and opined.

e) ICT balances interdisciplinary productivity

Inclusive education helps to enhance overall productivity of HEII provided it is promoted through implementing and adopting ICT since beginning of the course curriculum in all disciplines of STEAMMMSSH. 90.57 percent respondents favoured this statement.

f) 90.23 percent respondents strongly agreed that lack of quality in HEII in socio-economically disadvantaged rural areas and remote villages have meagre ICT facilities and internet connectivity, along with ICT training and exposure. The rural HEII are in miserable conditions from ICT perspectives though more than 64 percent of population resides here.

g) Implementation cum execution of 'Memorandum of Understanding (MoU), and Global-local Collaboration' in 21st-Century HEII can support fund raising, improve quality of TLM and boost employability and global ranking through 'ICT-Only in reality'. 4.81 percent did not respond due to no-experience otherwise 92.46 percent opined enthusiastically in favour.

h) 62.43 percent respondents opined that most of the HEII have not paid special attention for ICT resources and training the teachers and students for SWAYAM, MOOC or other on-line M-learning available in various languages, and hence have not facilitated them for accessing educational portals. While the beneficiaries have taken initiatives at their own to up-skill themselves through various personal means and methods.

i) One of the most burning issues affecting HEII productivity found int his qualitative research survey was non-maintenance of teacher cadre ratio, and student teacher ratio as per UGC and / or council norms to meet with the requirements of world class education system. 64.83 percent respondents agreed fully that implementing and adopting ICT in HES will surely help controlling the worsening-effect on quality of higher education because resource sharing would become easy for all students without travelling to accredited HEII located far distant from their home institutions. Also, these on-line available expert resource persons can teach as guest faculty.

j) The other biggest headache is students' drop-out ratio in HEII responsible for reducing its productivity. 91.43 percent respondents strongly agreed that ICT will improve admission process, managerial and administrative affairs, and teaching-learning-evaluation methodology that can apply brake on rising drop-out ratio.

k) HEII are very much strict and focused on undergraduate courses while rest of the world has comparatively liberal system and process from admission to convocation at bachelor level. UG curriculum must encourage learners by reducing unnecessary pressure and focus on life-long productive and innovating learning. 90.74 percent respondents agreed that 21st century breakthrough technologies such as AI, IoT, AR, VR and ICT will help demonstrate this concept and help raise national economic productivity at fast rate.

l) 87.14 percent respondents agreed that 21st century is not an era to impress by HEII's state-of-art building or physical infrastructure but by adaptable world-class ICT infrastructure and on-line TLE facilities helpful to create good reputation and enhance enrollment, and attract quality faculty.

m) 94.68 percent respondents replied that quality of non-teaching staff in 21st-Century HEII needs to be improvised for hands-on experience, learning and practices to ICT which cannot be neglected. Non-teaching staff is equally important but truly, colleges do not give them importance.

n) 90.57 percent respondents opined that alumni are remembered and invited for financial charity, training, internship, or job placements and not for recognizing them as honour of institution, that results into making HEII less productive. Implementing ICT enables HEII and alumni co-operate and get associated with each other more closely without much financial expense such as travel allowances by flight or overseas as well.

o) 95.19 percent respondents clearly recommended that prevailing evaluation and assessment process and methodology of accreditation needs tremendous improvements to enhance productivity of both, HEII and stakeholders. Implementing ICT will shorten the delays in various processes from initial application to final accreditation, experts' physical visits, and requirements of bundles of hard copies etc.

p) Enhancing attitude of entrepreneurship and self-employment amongst students in 21st-Century HEII. Transparent and clear Policy required such as Collaboration. Awareness, trainings, and hands-on exposure to industry through ICT based learn-earn-work from home (LEWFH) entrepreneurial development programmes for faculties and students (EFS-DP) on regular basis. This innovative theme was strongly supported by 94.34 percent respondents.

q) 93.82 percent respondents agreed, '*General trend in HEII is that students perceive themselves as possessing innovative skills to enhance their employability while confusion amongst students create non-productive environment and so students put their efforts for their career and so productivity decreases*'. ICT-enabled learning is cheapest methodology and tool to upgrade one's employability and capability.

r) 96.1 percent respondents agreed that implementing ICT compulsorily in HES will raise its existing productivity and standard of learning. While 64.4 percent disagreed that the leadership of existing HEII have started preparing to facilitate ICT based learning for all stakeholders of 21st-Century that is buying, installing, commissioning, and establishing ICT tools, technological infrastructure, devices, studio, and software. 67.4 percent respondents agreed that ICT enabled education and learning is a good productive supplement but not replacement to face-to-face learning and teaching in HEII.

s) 66.3 percent respondents agreed that ICT based on-line portals for all HEII have been made a mandate is a good initiative while they disagreed that most of the HEII transparently adopt this mandate with utmost priority as a method of enhancing efficiency.

t) 65.7 percent respondents disagreed with the fact that proper training and re-training the stake holders (i.e. teachers, staff, and students) at HEII are being incorporated in the system while they agreed that anytime learning is possible with help of ICT portals for enhancing the quality and productivity of higher education at HEII.

u) 64.9 percent respondents disagreed with the theme to electronically versatile groups within class / program being used to make announcements and to arrange for meeting or discussions among the stake holders as a methodology to enhance HEII productivity. Its disappointing fact that only 29 percent HEII have adopted ICT in their administrative proceedings.

v) It's found as an excellent sign of optimized usage of ICT in 90.9 percent of HEII where frequency of non-professional interaction amongst all stakeholders has increased for minute-to-minute issues and matters for purpose of sharing formal and even official information and messages quickly, which avoids delays and this act increases efficiency of the group and department. On other hand, 53.2 percent respondents denied that HEII are aware with the fact that ICT helps to clarify their doubts to understand the concepts as innovative methodology for 21st century learners and researchers.

w) It was perfectly encouraging to know the great in-depth understanding of 69.80 percent respondents that data, information, and learning contents available and uploaded on higher education related portals and social media are blindly not reliable.

Conclusive Discussions

This research article presented and discussed various issues, challenges and opportunities related to ICT, AI, AR, VR, IoT, On-line, ICT-LEWFH implementation, preparedness, willingness, and trainings to staff and learners in higher education institutions in India like developing and under developed countries. Prevailing trends, situation and conditions, tradition and mindset towards adaptability has also been discussed based upon the research survey questions analyzed for 583 respondents, most of them holding PhD degrees having at least ten years of experience who have worked or are working in India or overseas. Leadership roles to transform existing HES into a sustainable and productive HEI are crucial and important in India like geographical and economical perspectives where overall internet connectivity, ICT infrastructure and ICT skillset is below average and very poor. ICT enabled HEI trying to create culture for WFH though ICT facilities for recoding videos and uploading and storing them is still a big issue and concern due to data security and cyber-crime. Leadership and policy makers must have knowledge, skills, and attitude to implement ICT in HEII. They must be aware of its norms, policies, upgrades, demands and effective administrative management to avoid the negative consequences such as misuse, malpractices, and level of transparency. Moreover, leadership in HEII must understand characteristics and elements of current and futuristic emerging ICT forms, related concepts and sufficient knowledge of technological licensing and processes, methodology to collaborate and integrate ICT for enhancing productivity of HES. Hence, there is an immediate need to train the leadership concerned for their up-skilling so that they can raise their personal productivity and understanding for best utilization of ICT, flexibility, adaptability to inculcate and motivate LEWFH online culture.

All kinds of circulars, notices, advisory and rules of various councils, and approving, recognizing and accreditation bodies of Government of India, State Level Departments of Higher Education such as UGC, MHRD, NAAC, NBA, AICTE, PCI, NCTE, INC, MCI, BCI and Architecture council, issued during April-May 2020, advocate to support ICT usage and on-line education, leaning and research in HEII. They address encouraging on-line, blended, and mobile learning, teaching, evaluation, admission, internship, projects, research, administrative and managerial activities as such, and WFH trends to set for future generations.

Limitations and Future Scopes

No system is perfect. Our research questions were designed, and survey started before Covid-19 Pandemics in India, when ICT was not that much popularly been in used. Respondents started sending responses during March-April 2020 when it was a high alarm condition and simultaneously respondents had started using ICT at their personal level much more intensely than before. While HEII campuses were locked down. All 583 respondents are highly experienced, qualified, and responsible and hence they based upon their previous experiences of before ICT boom period, they responded which are quite relevant and useful for future framework, motivation and key decision making. Results of this highly qualitative research on ICT adoption, implementation, and integration in prevailing HEI culture surely encourage and enhance sustainable productivity of the HEI located in developing and underdeveloped countries.

One-line recommendations:

Based upon this qualitative research carried out for HEI located in developing and under-developed countries, authors of this article recommend and suggest their opinion under following points.

- Realigning the HES in accordance with ICT (i.e. IoT, AI, AR, VR) requirements to meet demands and expectations of 21st-Century society.
- Promoting and creating ICT based earn-learn culture, infrastructure, and facilities through their governance and management framework with full-fledged transparent willingness and policy.
- Strengthening long-term collaboration and MoU for ICT-resource sharing through on-line networking worldwide.
- Digital ICT facilitating LEWFH in HE has contributed unthinkable which is not a '*replacement but supplement*' to enrich and strengthen face-to-face TLE and research.

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