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Transitional Challenges in Technology Adoption among Academic Communities in Indian Higher Education Institutions

Elangovan N

Christ University, elangovan.n@christuniversity.in

Guydeuk Yeon

Christ University, yeon@christuniversity.in

SEBASTIAN PERUMBILLY

Southern Connecticut State University, perumbillys1@southernct.edu

SARAH HORMEILA AWUNGSHI

Christ University, sarah.awungshi@res.christuniversity.in

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Transitional Challenges in Technology Adoption among Academic Communities in Indian Higher Education Institutions

Cover Page Footnote

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TRANSITIONAL CHALLENGES IN TECHNOLOGY ADOPTION AMONG ACADEMIC COMMUNITIES OF INDIAN HIGHER EDUCATION

Elangovan N

(Christ University)

Guydeuk Yeon

(Christ University)

Sebastian Perumbilly

(Southern Connecticut State University)

Sarah Hormeila

(Christ University)

ABSTRACT

Due to the lockdown and remote working practices, academic universities around the world have been forced to adopt new technology. Online courses and exams enabled the use of new applications. During the pandemic, innovative technological adoption became faster, overriding the usual diffusion time lag. The transition was so fast that it presented a slew of new challenges to India's academic communities. An open-ended online survey was used to gather data from faculty members, students, and non-teaching staff at higher educational institutions. Several concepts about transitional challenges emerged from the qualitative data analysis. The results revealed the significant commitment needed to implement modern online technologies, the lack of necessary resources, and the obstacles that participants' home environments presented for teaching and learning. There were also questions about the effectiveness of online learning as well as anxiety and stress could cause. Participants' suggestions unraveled the importance of flexibility and change needed for the appraisal and evaluation methods employed in higher education. The results expanded the notion of the rate of adoption under the diffusion of innovation theory. The study results shed light on how academic institutions could create successful technology adoption procedures for remote learning policies.

Keywords: Technology; Adoption; Challenges; Indian Higher Education Institutions; Qualitative study

INTRODUCTION

Many higher educational institutions (HEI) had adopted e-learning and online teaching methods as early as 1990; however, the use of technology had not been widespread (Palvia et al., 2018). In 2020, academic institutions were forced to close temporarily but immediately due to the sudden and unplanned lockdown caused by the Covid-19 pandemic. After the initial shock, educational institutions began to adopt online tools for work-from-home. Though technologies were available, traditional methods of teaching and learning were more prevalent. The use of technology in classroom delivery was usually limited to specific programs such as re-skilling and online certification for working professionals and those offered through university collaborations (KPMG & Google, 2017). Infrastructure for live broadcasting of classes was only available in large institutions (McDougall, Young & Apan, 2003; Meyer & Barefield, 2010). However, during the Covid-19-related lockdown, the HEIs had to adopt commonly available video conferencing technology accessible to every user, such as Google Meet, Cisco WebEx, Zoom Meetings, Microsoft Team and BlueJeans Verizon for delivering classes and online proctoring applications for examinations. Though these tools were already being used for meetings and recruitment tests in business organizations, their use was rare in academic contexts (Hughes, 2020). Due to Covid-19 campus closures, teachers and students in the traditional educational systems had to adopt the new technology abruptly to catch up with the academic calendar. The unprecedented transition from traditional to online education posed many challenges to online technology adoption by educators and academic institutions.

This study has used a qualitative research method to explore the transitional challenges in the innovation and adoption of technology by teachers, students, and non-teaching-staff of India's HEIs. This study was conducted during the extended lockdown when the academic community had already started using technology.

The study highlights the themes around the transitional challenges faced by the members of academic institutions. The study contributes to the policy-making towards technology adoption in academic institutions. The University Grants Commission (UGC) contemplates the regularization of the online program delivery (GOI, 2018; UGC, 2020). Theoretically, the study is based on innovation diffusion and adoption in the context of mass obstruction for academic delivery.

THEORETICAL BACKGROUND

Innovation and Technology Adoption in HEI

There is a transformational agenda for the HEIs to integrate technology into the academic processes. Though not fully integrated, technology and face-to-face teaching are adopted, known as 'Blended learning.' Its impact is felt at the "micro-level of the classroom, meso-level of the program administration and the macro-level of higher education institutions" (Antwi-Boampong, Freeman, & Muat, 2019, p. 621).

Technologies have revolutionized education but need to be assessed for their strengths as well as weaknesses. PowerPoint replaced overhead transparencies, the Internet brought distance learning together, and web 2.0 interactive virtual learning and social networking led to the future of learning. The folksonomies add a tail of information created by a group of users by tagging a particular content that provides broader learning. With the development of technology, the Synchronous Online Learning Environment (SOLE) is a reality. The policies need to be modified to accept them as a face-to-face class for accreditation (Jones & Harmon, 2011). Echeng and Usoro (2016) found that use of web 2.0 technologies in higher education institutions among students and teachers enhanced the learning experience.

HEIs have been known for being slower in adopting new technology. This stereotype has been broken, and technology is being used in "business and administrative processes, for research, and improving teaching and learning" (Nworie, 2011, p. 308). However, the adoption of technology is not consistent across campuses due to "integration approaches, resistance, budget allocations, institutional priorities, shifting student demographics, organizational cultures, institutional and technology leadership issues, change management abilities, and failure to apply systemic approaches to adoption, among others" (Nworie, 2011, p. 308).

The 21st century has seen a perfect storm in HEIs due to internal and external factors. Among them, technology plays a crucial role. Digital natives have already entered academics. HEI will need to be a place where new knowledge is generated with the responsibility to empower individuals and build a strong nation and world.

Faculties have to provide leadership to leverage technology (Rasmussen, Davidson-Shivers & Savenye, 2011).

Adopting technology for educational institutions has significant advantages because multimedia and interactive animations provide better visual learning. Even digital learning products augment traditional teaching during the ordinary course of delivery. In addition, it is easier to implement technology-enabled learning because students are familiar with many of them used for teaching and learning. The engagement of students, therefore, becomes more manageable. However, faculty need to be trained to create a learning environment conducive to student engagement and participation (Botha-Ravyse & Blignaut, 2017).

Academic organizations have been forced to innovate and offer programs virtually due to the pandemic's challenges. Apart from providing digital resources, the use of social media to disseminate information, offer services via multiple channels, conduct instructions, and virtual research parties via Zoom or Microsoft Teams have all grown in popularity (Metha & Wang, 2020).

During Covid-19, there was the widespread adoption of technology in Indian HEI. The faculty members use various platforms such as Zoom, Google Hangouts, Skype meetups, Google classrooms, Learning Management Systems (LMS), Information and Communication Technology (ICT), and YouTube. Adequate training was given to the faculty. Even more technical subjects on analytics were delivered quickly, using online tools. Many socializing activities were conducted virtually to make students engage in online classes.

Teachers' experiences and feedback on adopting technology seem to be mixed. Many feel that it is more advantageous to teach online. However, some are skeptical about the effectiveness of learning processes (Shenoy, Mahendra & Vijay, 2020).

Innovation and Technology Adoption Theories

Rad, Nilashi and Dahlan (2018) researched the trend of technology adoption theories and their future directions. They identified 21 theories on Information Technology (IT) adoption. Innovation Diffusion Theory (IDT) (Rogers,

Diffusion of Innovations (DOI), 2003) and the Technology Acceptance Model (TAM) (Davis, 1989) are the most used theories to explain the spread and use of new technology. Many researchers have tried to integrate the adoption theories to

explain technology better. The TAM model was built from the Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB). TAM, further extended by including social influence and cognitive factors, was known as TAM-2. Based on similarities and differences among eight models that looked at the adoption of information systems, Venkatesh et al. (2003) developed a Unified Theory of Acceptance and Use of Technology (UTAUT) (Taherdoost, 2018).

Task-Technology-Fit (TTF) and UTAUT models are integrated to develop a Technology-Organization-Environment (T-O-E) taxonomy of technology adoption (Awa, Ojiabo, & Orokor, 2017). Effects of orientation, pressure and control on innovation adoption intentions were studied by Unsworth, Sawang, Murray, Norman, and Sorbello, (2012). Institutional theories, including strategy, structure and environment, explained the adoption of innovation. Pressures from suppliers, customers, competitors, technology diffusion agencies, government departments, professional associations and universities have been identified as critical factors impacting technology adoption (Rajendran & Elangovan, 2012). Financial resources, organizational readiness and perceived innovation control, explained the control over the new technology (Unsworth et al., 2012).

Technology adoption and diffusion models are used in many contexts. Some researchers have even tried them beyond the information technology domain. One such example is adopting wood-based technology in the construction industry (Barrane, Karuranga, & Poulin, 2019). In educational technology, the Diffusion of Innovation (DOI) theory was used by Grgurović (2014) to investigate blended language learning. Sahin (2006) listed many studies that had used the DOI model in educational technology, such as instructional purpose (Isleem, 2003).

DOI theory is the base on which most technology acceptance models rely. Developed from the S-shaped diffusion curve, the DOI defines diffusion, innovations and communications.

The innovation diffusion theory has multiple elements such as adopter characteristics, innovation-decision process, and adoption rate (Tarhini, Arachchilage, Masa'deh, & Abbasi, 2015). In addition, diffusion is defined as the communication process by which innovations spread to social system members over time. Rogers (2003) characterizes adopters as innovators, early adopters, early majority, late majority, and laggards. Similarly, he defines the characteristics of innovation as relative advantage, compatibility, complexity, trialability, and observability.

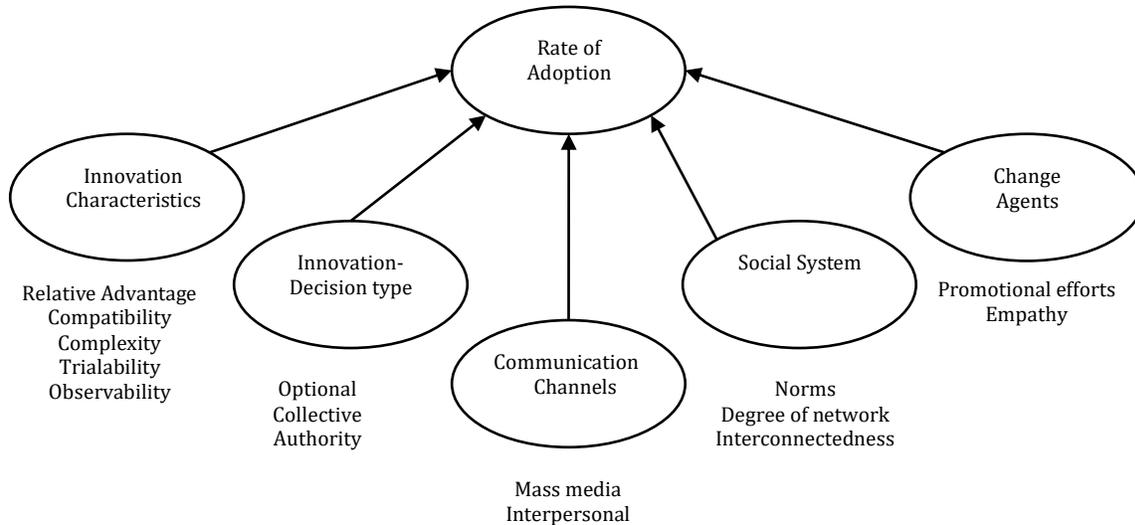
Finally, the innovation-decision process is a sequential stage of knowledge, persuasion, decision, implementation and confirmation (Rogers, 2003).

Though Rogers (2003) proposed five innovation characteristics, many other features are being used in research. Cost, security, communicability, business process re-engineering, scalability, organizational productivity, critical mass, demonstrability, divisibility, social approval, strategic decision aid, task variety, organizational support and perceived risk are some of the variables used innovation characteristics. In IT adoption, relative advantage, compatibility, cost, observability, and trialability are strongly related to IT innovation adoption. However, complexity was not associated with IT innovation adoption (Hameed & Counsell, 2014). Valier, McCarthy and Aronson (2008) studied the attributes of innovation during the prediffusion stage.

Changing Pace of Technology Adoption

The rate of adoption is one of the elements proposed by Rogers (2003) in DOI theory. The rate of adoption is "the relative speed with which members of a social system adopts an innovation" (Rogers, 2003, p. 221). It includes the number of members of the social system that have adopted the innovation for some time. The adoption rate is influenced by innovation characteristics, innovation-decision type, communication channels, social system and change agents.

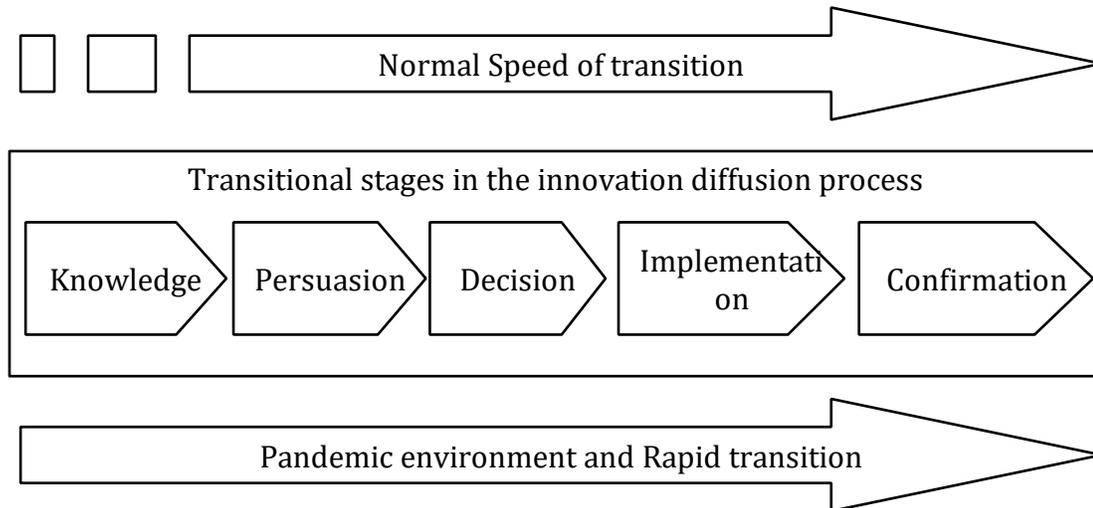
Sahin (2006) argued that relative advantage significantly impacts the rate of adoption among the innovative characteristics. Among the innovation-decision type, the organizational and collective innovation decisions are slower than personal or optional innovation decisions. The author claims that faculty members will adopt new technology while facing new demands and seeing their instructional value. Providing helpful experiences for faculty and their students will enable the successful integration of technology with education. Pickard, Angolia & Drummond (2019) on the contrary found that the rate of adoption is slower when there is no immediate relative advantage

Figure 1. Factors Influencing Rate of Adoption (Rogers, 2003)

Technology adoption has become faster these days. For example, landline phones took 64 years for 40% penetration, whereas Smartphones took only ten years to reach the same level (McGrath, 2013). Wilson (2020) claimed that the pace of change will not be as slow as today and speed up. Technology adoption would also keep up with the exponential growth of the pandemic.

Arrison (2011) presented the facts in the context of medicine and healthcare, explaining that life-extending technologies are available to the general consumer at much lower costs to demonstrate that the distribution of new technology is speeding up. The theory of the technology adoption life cycle thus does not hold. Instead, studies have found that the rate of adoption is influenced by knowledge spillover and a heterogeneous absorptive capacity. In an industrial cluster, institutional forces' effect and perceived innovation characteristics on technology adoption are mediated by the absorptive capacity created through the knowledge spillover (Elangovan, 2016).

Figure 2. Transitional Challenges in Innovation Adoption during a Pandemic Environment (Source: Developed by Authors)



Transitional Challenges in Adoption

Speed of adoption poses many challenges, with additional financial, psychological and social costs. Slower introduction speed is required for deeper penetration of technology into the social system. If the introduction speed is higher than usual, only a small portion of technology can permeate the social system (Nowak et al., 2013).

Rof, Bikfalvi, and Marques (2020) looked at the tensions and solutions that emerge from digital transformation in HEIs. Building capabilities related to new technology, cost and resistances due to process and structural changes, no standardized processes, protocols, '24-hour accessibility' syndrome, managing work and personal areas, and new partners are identified as tensions among value creation under the business model innovation. Uncertainty of new offerings, limitations in expanding, regional focus limitations, infoxication, spamming and missing social media strategy are tensions under the value proposition innovation.

Reduction in old revenue sources and difficulty in capturing new ones, competition, cost escalation, technological dependence, free business model, and reduction in old sources of cost are identified as tensions under value capture innovation.

Oh and Park (2009) found that heavy workload, lack of motivation and no financial support are barriers to adopting blended learning. Radif, Fan and Mclaughlin (2016) found that lack of experience in using the technology, absence of technical support, pedagogical training, and appropriate educational software tend to impact the faculty's BL adoption. Additionally, Ocaik (2011) found that instructional process, technical and faculty community concerns emerge as the main inductive categories. Furthermore, the instruction's complexity and lack of planning, organization, effective communication, enough time, institutional support, changing roles and difficulty in adopting new technologies added to the faculty's adoption complexities. Rahim et al. (2018) found that ease of use, university encouragement, flexibility, attractiveness, new technology usage, university policies and learning aids are factors that facilitate technological adoption. Institutional supports, right from choosing a common platform for the entire institution and making resources available to support online teaching, are crucial. Institutions need to reframe policies to encourage innovators to enhance teaching as well as learning using technology (Botha-Ravyse & Blignaut, 2017). HEIs do not have a business continuity plan in case of an emergency. They are challenged by the sudden change in teaching from face-to-face classes to online lectures and working from home (Izumi, Sukhwani, Surjan, & Shaw, 2020).

METHODOLOGY

The study was designed as a qualitative approach, as there is no previous theoretical background on the transitional challenges in innovation and technology adoption in an extreme situation like a pandemic. An open-ended questionnaire was developed, asking respondents to narrate their experiences, enhancements, and challenges in personal, academic, and professional lives because of work/study from home during COVID -19. Also, questions on the support they expect and the suggestions in managing the situations were included. As the survey had questions on their personal impact and the traumatic experiences because of work from home, Institutional Review Board (IRB) clearance was received from the University. The online survey was launched through the SurveyMonkey® tool because of its HIPAA-compliant features. Members of the HEI academic community, including students, faculty and staff, served as the study's unit of analysis.

We randomized at the institutional level, as there was no database for randomizing at the respondent level. We chose the institutions from the Association of Indian Universities (AIU) members list (<https://www.aiu.ac.in/member.php>) using a random number table. The survey link was sent to the heads of the randomly selected institutions with a request to distribute it to their faculty, students, and non-teaching-staff. A total of 653 respondents attempted the survey in May 2020. However, only 341 responses were completed with a few missing items. The completed surveys were imported into the MAXQDA software and coded under the major themes of technology adoption challenges. The codes were validated by one more rater. The themes and their frequency were presented in the following section and further discussed. The challenges of technology adoption during the Covid-19 were analyzed from the open-ended responses.

In the first round, by reading through each statement, the keywords reflecting the challenges were tagged. At this stage, the nodes were not forced into a common theme. Instead, the themes were named with terms that highlighted words very close to the responses through a free-flowing thought. In the second stage, the themes were reworked to club the redundant tags and semantically similar tags. These were stored as the sub-themes. Finally, in the third stage, the sub-themes were grouped into major themes.

RESULTS

Table 1 presents the sub-themes and identifies the major themes presented and arranged with the most recurring theme at the top. Work-family conflict is the most commonly occurring challenge in technology adoption during the pandemic because of the work-from-home requirements. The quicker adoption has increased the workload and time pressures. The research participants reported poor technology infrastructure at home and the Internet network challenges as the major hindrances in adopting newer technology.

Table 1. Themes of Transitional Challenges

S. No	Themes	Sub-themes	Description	N
1	Work-Family Conflict	Balance work-family Family time reduced Diminishing boundary Setting priorities Overlapping React on family Family demand Family disturbances	Adopting technology during work from home is affected by work-family conflicts. The barrier between office work and family time is blurred. Work gets jumbled, and there is a difficulty in the division of time. Irregular, unplanned and long working hours also affect the balance. The work suffers due to wholehearted participation.	58
2	Workload	Longer work hours Late hours of work Unnecessary work Increased work Multiple assignments Added meetings Training Fatigue	During the transition from the traditional system to a new one, work pressure is being felt. During the period, the working hours are extended, and the job is no more a nine-to-five one. Completing tasks demands more effort and consumes more time than usual. The work requires multi-tasking and is so hectic that it becomes stressful. Faculty and staff felt that there are too many meetings and training sessions. It was also felt that the effort required for a quicker transition would be more.	35
3	Time pressure	Timely completion Segregate time Time management Irregular schedules Unchanged deadlines Time-consuming	When the adoption is needed abruptly, many crucial yet related activities are to be completed. There would not be sufficient time to complete the task, and it would be challenging to meet deadlines. Meetings or training sessions are called suddenly without notice, bringing about sudden changes in the agenda. It becomes challenging to keep up the routine, segregate and manage time.	31
4	Network Issues	Connectivity Weather conditions Slow Internet Affordable bandwidth Power interruption	Network-related issues were a massive challenge in fully adopting the technology. There are poor Internet connections with a sudden drop in the speed or frequent disconnections. The technology used for delivering classroom teaching and proctoring requires continuous video and audio transmission and there is a lack of bandwidth to support it. Therefore, the meetings are held with the video switched off so that at least the audio can be heard. However, during training or lectures, the teachers find it difficult because they will have to compulsorily beam their videos, whereas students will be switching them off. This leads to a poor connection between the teacher	29

			and student and a lack of control. Rural areas even have severe network issues. There is an increase in the consumption of the Internet, more than normal household usage. Typically, a person would consume 1.5 GB to 2 GB per day, which is the ISP’s standard package offered. However, more than one GB of Internet per hour is required due to work-from-home requirements. Internet at a higher speed gets exhausted, and users are limited to FUP speed, which is very low.	
5	Working alone	Collaborate Interact Share	Peer learning is an effective way of learning, catalyzed by peer competitions, social learning, and mimicking. Learning new technology and adapting it requires sharing of ideas and experiences. However, due to the pandemic, the person-to-person interaction has been limited, and everyone had to work almost alone. The social and human needs required for learning were missing for clarifying doubts, working together as teams, close guidance and supervision. As virtual collaboration was also part of the innovative technology to be adopted, discussion among team members and group tasks involved in using the technology was difficult. Adopters found it difficult to interact, mainly because of screen fatigue. Research supervision, project guidance, peer interaction between researchers, students and colleagues were also missing.	28
6	Compatibility	Impracticality Difficulties online	Though technology solutions are found for various academic activities, not all tasks can be completed online. It is difficult to disseminate skill-based courses that have practicals and are required to handle physical equipment. Conducting exams online, even with proctoring, does not provide an easy way out. The applications are sometimes complex and not compatible with traditional systems. Student-teacher interactions, internships, projects, discussions and research activities conducted virtually do not provide complete learning. Teachers find it difficult because there is a lack of feedback during the classes. Due to the poor Internet, students cannot connect through video. The teacher has to take classes without seeing reactions and responses, such as encouraging	21

			nods and quizzical expressions when they do not understand something or their lively chatter. It is not easy to make out whether students are learning or not. Whether the teacher is satisfied or not in making the students understand and learn is not clear.	
7	Motivation	<p>Lazy Disconnect Unmotivated Procrastinate</p>	<p>During the lockdown, movements have been restricted, and the daily routine cannot be followed. The mind is preoccupied with the worries of finance and the availability of essentials. The chaos demotivates people and discourages them from engaging in the training and learning process or trying new technology. Idleness in the initial stages has also brought about laziness, lethargy, complacency and disorderliness. The lack of accountability and procrastination prevents people from adopting new technology. The pressure and discipline to engage with technology are also lacking. There is no peer encouragement to finish the work on time and meet deadlines, which usually happens in a physical, academic setup. There is also a negative attitude towards technology usage, while academic purposes also stand in the way of adoption.</p>	21
8	Home environment	<p>Working space Privacy Distractions Facilities Disturbances</p>	<p>The working environment that includes an office setup with cubicles and workstations that provide a professional support system cannot be expected at home. There are concerns about space and privacy at home. People in tiny homes, which are already congested, cannot afford space for office work.</p> <p>Work from home is a great challenge because of disturbance from family members. Being at home triggers off demands from children, spouses and the elderly, children playing around and intruding during virtual calls, meetings and classroom sessions. People being around your workplace at home create distractions and prevent you from focusing or concentrating on work. During technology adoption, more work and training forces a person to sit in front of the system, while family members feel detached, creating conflict in the family. Work pressures turn into anger over family members.</p>	20

9	Resistance	Traditional is best Negative attitude Missing normality Hesitant	Many have responded that they miss the work environment, personal meetings and lively workplace interactions. They feel that the experience of a virtual environment leaves out the human touch. They hope to return to normal soon. Emerging from the conventional method is a challenge. The feeling of comfort with the traditional method and its more productive and effective attitude creates resistance towards new technology.	18
10	Options	Online mode Digital resources	Everything has to be done in the online mode only, and everyone is hooked to the computers. There are no alternative methods. Respondents miss being human and feel that it is tiresome to be next to the phone or laptop all the time. All required materials for academic purposes are also needed in the digital format only for easy sharing. Meetings are very lengthy and slow because of the online method, which drains out much of the energy. The interaction or participation is reduced due to screen fatigue. Since there is no other option than online classes, research scholars are trying to undertake complex research and studies. Because there are no alternatives, students dislike sitting before the system for long hours and lack physical movement.	17
11	Learning difficulty	Lack of interaction Grasp Confusion	The basic application of innovative technology during the pandemic is for teaching and learning. However, online learning is felt to be not effective. Students find it challenging to grasp the content and learn the tools as well. Online classes lack interaction, and doubts cannot be cleared quickly. Traditional teaching and learning processes have declined, and teachers find it difficult to handle the classes effectively and clarify because they are not trained in the pedagogy for online teaching.	13
12	Infrastructure	Common infrastructure Computer systems/devices Internet availability	Technology adoption for academic transactions requires a good computer system and the Internet. Students who are from poor backgrounds and remote areas have difficulty in getting good Internet services. In addition, a major problem is uninterrupted power at every home. There is no parity among students and research scholars. Technological dependency to access educational	13

			material and awareness among the less privileged ones would hinder the implementation of new technology in academic institutions. Even if they get low budget devices and low-speed Internet, they would face many difficulties in accessing materials like their peers and would be at a disadvantage. Moreover, the challenge during the transition is the availability of the devices and other requirements because of the closure of shops and non-delivery by e-commerce sites. The availability of webcams and audio systems cannot be immediately sourced during the lockdown.	
13	Technological challenges	Failures Understanding Requirements Adapting	Challenges during a quick adoption of technology include complexity, compatibility with existing devices, technology failures, and understanding of the technology.	12
14	Physical resources	Books Teaching aids Lab equipment	The non-availability of some of the resources challenges the completion of tasks. Many are not available in digital form. Access to materials available online are not free either. Books that are out of print and those that are high priced are difficult to access. In addition, the non-delivery of e-commerce platforms has made many physical resources unavailable.	12
15	Distraction	Concentration Distractions Less Focus	Being online every time creates a huge distraction, while regular mails, pop-ups and notifications make one waste time and hinder one's focus on the task. Moreover, thinking about difficult situations, happenings around one, anxiety regarding the future and the family environment affects one's concentration.	10
16	Effectiveness	Slow progress Ineffective Less productive	Adopting technology for work from home is not effective and productive. Though it is a period of transition, both learning to use technology and fulfilling tasks is essential. The delivery of services cannot be compromised and needs to happen within the schedule.	8
17	Psychological impact	Anxiety Stress Trauma	Covid-19s sudden impact on lives and the anxiety around the situation and the future, trauma surrounding the pandemic because of death of near and dear ones, stress due to management of family requirements, work pressures and deadlines, and the monotonous routine create a huge challenge for motivating people to adopt new technology quickly.	6

18	Digitization	E-content Presentations	A transition from the conventional method to the online mode requires that resources be converted to the digital form. More time is required for detailing the content for online purposes. However, the time available to prepare those resources is limited. Additional learning and training are required to create digital content.	5
19	Quality	Completion of scope Diminished output Reduced quality	Though new technology is being used for a task that was being done in a conventional method, the expectation of quality has not changed. Maintaining the same quality in a new environment, despite all the challenges, is difficult.	5
20	Communication	Communication gap Miscommunication	The responses highlight the miscommunication and chaos that is created. There is a communication gap, and online interaction requires much more effort in communication than face-to-face meetings.	4
21	Prior skills	Knowledge and skills	Prior digital skills and knowledge are a prerequisite for a faster transition to new technology. Lack of basic knowledge of digital tools, such as operating a computer system, generic word processing, spreadsheet tools, Internet and browsing capabilities, installing and removing software applications, configurations and customizations would be a considerable challenge. Rather than training to adopt new technology, preparing the users on the basic operations would not help transition quickly.	4
22	Gender roles	Working mother Spouse	The challenges of working from home and adopting new technology are not the same for both genders. Women find it challenging to balance both family and work requirements. Even students and scholars who are married or mothers find time to engage in the adoption of technology.	3
23	Effect on health	Mental toll Machine behaviour Hooked to technology	A quick adoption will require long hours spent in training, learning and using the technology. Online technologies require sitting before the computer for a long time, which would lead to dry eyes and blurred vision.	3
24	Maintenance	Repair	Rather than the availability of the technology, another challenge for technology adoption during the pandemic is the possibility of service and maintenance during the lockdown. Problems with computers, peripherals, routers, and wifi devices	2

			required to be maintained for smooth work from home are a challenge due to the lockdown. There are no service centres open during the lockdown.	
25	Lack of Support	Peer support Family Support	Lack of professional environment and cordiality among the staff challenges the availability of support in the task or learning new technology.	2

Results reveal several challenges related to working from home: unsuitable environment, distractions, lack of infrastructure, other physical resources, gender role expectations and demands, digitization requirements, maintenance and support unavailability. Due to the stress and anxiety caused by the pandemic, participants reported further challenges to technology adoption due to problems associated with their motivation, overall physical and psychological health. The teaching and learning in the digital environment had problems of compatibility with academic activities, difficulty in learning, lack of alternative options, the effectiveness of the tasks performed, and the quality of the outcomes. On the personal front, working alone from home without social interactions, gaps in communication, and possessing prior skills in operating the hardware and software were other challenges.

Table 2. Distribution of the codes among the demography

	Total	Age				Role				Gender	
		21 to 30 Years	31 to 40 Years	41 to 50 Years	51 and above	Student	Scholar	Faculty	Staff	Female	Male
N (Documents)	380	223	83	50	25	157	63	112	48	251	129
Work-Family conflict	15.26	13.45	14.46	20.00	24.00	15.92	14.29	14.29	16.67	18.33	9.30
Workload	9.21	6.73	14.46	10.00	12.00	7.64	4.76	12.50	12.50	9.56	8.53
Time pressure	8.16	9.42	4.82	8.00	8.00	8.92	6.35	5.36	14.58	8.76	6.98
Network issues	7.63	8.07	8.43	6.00	4.00	8.28	4.76	6.25	12.50	4.78	13.18
Working alone	7.37	8.07	6.02	4.00	12.00	7.01	7.94	7.14	8.33	7.57	6.98
Compatibility	5.53	6.28	3.61	6.00	4.00	7.01	9.52	2.68	2.08	6.77	3.10
Motivation	5.53	9.42	0.00	2.00	0.00	8.92	7.94	1.79	0.00	6.77	3.10
Home environment	5.26	4.04	9.64	4.00	4.00	3.82	4.76	8.93	2.08	3.98	7.75
Resistance	4.74	4.04	8.43	4.00	0.00	3.82	7.94	4.46	4.17	3.98	6.20
Options	4.47	4.04	7.23	4.00	0.00	2.55	7.94	6.25	2.08	3.98	5.43
Learning difficulty	3.42	4.93	0.00	0.00	8.00	5.73	1.59	1.79	2.08	3.19	3.88
Infrastructure	3.42	3.14	3.61	2.00	8.00	3.82	1.59	2.68	6.25	2.39	5.43
Technological challenges	3.16	0.90	7.23	4.00	8.00	0.64	3.17	7.14	2.08	1.99	5.43
Physical resources	3.16	3.14	3.61	4.00	0.00	3.18	1.59	4.46	2.08	2.39	4.65
Distraction	2.63	3.59	1.20	2.00	0.00	3.82	3.17	1.79	0.00	3.59	0.78
Effectiveness	2.11	3.59	0.00	0.00	0.00	2.55	4.76	0.00	2.08	2.39	1.55
Psychological impact	1.58	1.35	1.20	4.00	0.00	1.27	1.59	1.79	2.08	1.59	1.55
Digitization	1.32	0.00	1.20	8.00	0.00	0.00	0.00	4.46	0.00	1.59	0.78
Quality	1.32	1.35	1.20	2.00	0.00	0.64	1.59	0.89	4.17	1.59	0.78
Communication	1.05	0.90	1.20	0.00	4.00	1.27	0.00	0.89	2.08	1.20	0.78
Prior skills	1.05	0.90	1.20	0.00	4.00	0.64	1.59	0.89	2.08	0.80	1.55
Gender roles	0.79	0.45	1.20	2.00	0.00	0.64	1.59	0.89	0.00	1.20	0.00
Effects on health	0.79	0.90	0.00	2.00	0.00	1.27	0.00	0.89	0.00	0.80	0.78
Maintenance	0.53	0.45	0.00	2.00	0.00	0.64	0.00	0.89	0.00	0.40	0.78
Lack of support	0.53	0.90	0.00	0.00	0.00	0.00	1.59	0.89	0.00	0.40	0.78

*Values are in percentage against the number of documents under each category of demography

The themes are further analyzed according to the category. Age, gender and academic roles are considered as the criteria, and the results are presented in Table 2. Work-family conflict and time/schedules and deadlines as challenges were mostly mentioned by the women, staff members, and older age group members. This shows that family responsibilities were high, and they found it challenging to spend time for the adoption of new technology. At the same time, the women and faculty in the age group of 31 to 40 years were saddled with more work and were exhausted with the demands from the family because they had to take care of young children and older adults at home. Also, like the faculty, they are required to spend time on the preparation of online classes. Staff members are challenged with network issues because they did not require such facilities during normal days.

Women, staff members and people from the older age groups were challenged with No peer/collaborative work/personal contact followed by research scholars. This is a group of people who require more contact-oriented assistance for their tasks. Research scholars also found it challenging due to the lack of hands-on and practical work. The online mode could not be used for all their tasks. Men, research scholars and those from the age group of 31 to 40 years are reluctant to adopt new technology and resist. They like to stay in their comfort zones.

Women, students and the younger age groups were not motivated to adopt new technology. This implied that they were not serious about change, nor did they take the responsibility or compulsion to put their efforts into change. Men had too many household responsibilities and underwent more disturbances from family members. Researchers require a higher focus on learning new technology and adopt them effectively for their research purposes. Also, the 31 to 40 years age group had many dependents at home and was more disturbed.

Men, students and older people found it difficult to learn online. Faculty and older people felt challenged by the infrastructure, technology, health effects and lack of a work environment. The faculty was required to adapt to technology for various purposes, such as online classes, digital content preparation, online quizzes and pools, chats, whiteboard and proctoring. They also found that there could be better space at home for taking online classes. The faculty also found that lack of physical resources, preparing for online and service problems could pose challenges. Reference books, white/blackboards and peripherals for various purposes to handle online classes are usually not available with the faculty.

Older people and faculty had technological challenges. Many were comfortable with the conventional system. They faced difficulties with new technology. In addition, they had adults at home with their own need for online dependency, who did not have an exclusive workplace. Researchers were challenged because there were no alternatives available except for the online mode, and they found the technology productive and effective but did not find support for their various issues. Older and younger respondents were also highly distracted and lost focus. They required knowledge and skills, faced communication challenges, anxiety, and trauma reported from respondents in the age group of 41 to 50. They also reported health effects and gender challenges.

DISCUSSIONS

The study setting has two contexts. One is the pandemic situation, and the other is the rapid adoption of technology. The adoption cycle is usually a lengthier process with multiple stages of transition from awareness to usage. Before Covid-19, innovation and technology adoption in HEIs were happening at a much slower phase than in other domains (Sharomsah, 2020). However, the pandemic has created urgency and forced educational institutions to innovate and adopt new technologies quickly. The study reveals rapid adoption-related transitional challenges. The pandemic has forced HEIs to innovate and use video conferencing and meeting tools for almost all their practical operations. Faculty, students, and non-teaching-staff had a shorter time to learn and start using such technologies. Though there were transitional challenges in innovation even earlier, the COVID-19 related campus closures brought about unique challenges.

The above discussion necessitates the classification of challenges into two categories: Those arising due to situations created by the pandemic and those emerging due to the pressures to adopt the technology quickly. From the literature, we identify that technology and human factors are also challenges. Following the deductive categorization (Mayring, 2015), we classify each challenge according to the four categories (Table 3).

Table 3. Classification of the Challenges on the Context (deductive categories)

Pandemic Situation	Speed of Adoption	Human Factors	Technological Factors
Work-family conflict Working alone Home environment Infrastructure Distraction Gender roles Lack of support Maintenance Communication	Increased workload Time pressures Effect on Health Prior skills Effectiveness Quality Learning difficulty Digitization	Motivation Resistance Psychological impact	Compatibility Options Network issues Technological challenges Physical resources

Work-from-home raised unique challenges such as family-work conflict, distractions, unsuitable home environments for academic or office work. The limited infrastructure and space exacerbated the challenges at home. Respondents commented as follows:

"Work from home is easy, but distractions are many in a home atmosphere. We may lose attention from our work. In addition, it lacks a professional environment and cordiality among the staff".

"Better time and flexibility pertaining to work. However, work pressure has increased from my employer. It's no more a 9-hour job".

"Taking care of my family members and too much work makes me tired, and hence I can't concentrate on working".

"It's difficult to maintain a balance between work and personal life. Sometimes they don't get why I am always with the computer".

"Please consider the timings. Working for 18 to 22 hours per week is very physically, mentally and emotionally challenging. I request you to please note that we are not working face-to-face, but are working from home. And that too we are working with mobiles and laptops, the prolonged use of which may have an impact on one's health".

Surrounded by family members, women participants found it more challenging to spend time on office tasks beyond certain hours. Taking care of people at home and simultaneously engaging in official tasks becomes challenging, specifically when some children and older adults require attention. It is evident from the following quotes from the respondents:

"My biggest challenge is to engage my five-year-old daughter and simultaneously complete my office work. So balancing is the biggest challenge. Hence I cannot concentrate on any kind of development."

"It is difficult to keep focus since the living space is the same as work and with ageing parents, I tend to keep checking if they need something, or if I need to finish some housework before I sit for my work."

Some of the unique challenges associated with work-from-home experience during campus closures were the limited peer socialization and peer support. Institutions and offices have hierarchies and teams with a combination of skill sets required to complete tasks. Top executives may have secretaries and assistants preparing most of the records. However, working from home does not provide such support, and executives have to do all the work.

Workplace environment and team dynamics provide opportunities for learning beyond their scope. Respondents reported the following concerns:

"The main challenge is interaction and meeting people for better exposure and experiences. But this is somehow not letting us develop at the same pace as we were used to when we interacted with people and managed a lot of things physically".

"I did not have people to sit around and work with. I enjoy the company of people. It is a silent companionship while working. To fix this, I video-called one friend, and we worked together, but it was not the same experience".

"Physical-human interaction, which seems to be a social and human need is missed. It feels like living alone"

"Sitting alone and working made me consume more time than usual".

The challenges related to work-from-home are similar to Butler and Jaffe (2020). The lockdown and restrictions had challenged even procuring the necessary equipment or service and maintenance when the equipment became faulty.

"Initially we faced difficulty w. r. t. resources. Laptop was not functioning. Nobody was there to repair".

"Internet connectivity, laptop has crashed and no repair shops open.

The pandemic environment had already had a psychological impact due to fear, anxiety, and trauma affecting near and dear ones. The innovation and technology adoption within such an environment has led to even more demotivation and resistance.

"Professionally, I am worried about the economic situation that we have to bow to and face. Overthinking has caused my mind to be weighed down, and some crisis is going on through my mind".

"I am unable to concentrate on studying at all due to constant stress, anxiety and disturbance at home".

"The institution should work towards trying to understand every level of the current situation right now. Many are affected by the pandemic and are going through different

kinds of mental trauma caused by events of the past few months; many cannot access the Internet, some have to only think about basic survival, some do not even come from well-to-do, loving homes and are facing a great deal of grief and anxiety. I personally feel that being overburdened with work does not always give a good result (as effectively and successfully) because it will only lead to the deterioration of one's mental wellness, and will not bring out the best outcomes".

During campus closures, speed of learning and adopting new technology along with fulfilling their regular tasks increased the workload. Though the services had to be continued on new virtual platforms, there was no compromise on delivery or quality. They kept up with the schedules, managed time for various tasks and escalated the pressure. People who had digital and other related skills underwent an easier transition. However, sitting for long hours using technology to deliver tasks and learning to adopt technology negatively impacted participants' overall health.

"Continuously sitting in front of the laptop makes my eyes very dry. Very often I have blurred vision".

"Work has been really stressful and time-consuming".

"I would have appreciated things more had the institution given/allowed more breathing time for completing the tasks assigned".

"There is a lot of work and everything is online, which completely restricts movement".

"Looking into the laptop for long hours has increased the frustration level in daily life".

Between the speed of adoption and the technological requirements, challenges such as compatibility with available resources, digitization of content and information, and alternate solutions majorly affected the transition.

"I got more frequent with technology but everything can't be done online".

"Availability of some of the resources challenged the completion of tasks".

"Not everyone (faculty and students) has uninterrupted internet service, a quiet space to attend classes for more than two hours or WiFi. Many are using mobile data, which runs out quickly. Those living in remote areas/villages have very bad networks and can usually hear almost nothing. There are also many technical glitches on certain platforms. When taking a class, others in the home may not be able to use the WiFi so that the speed does not slow down".

"The lack of on-hand experience is a major bane. There are things that cannot be learnt from a zoom call or the Google classroom".

The challenges associated with necessary infrastructures, such as network issues, technology challenges, and physical resources available, could be inferred as not specific to the Covid-19 campus closures, but even during regular times

"India is a vast country. I am personally able to do most of the things (professional and educational) online because I am staying in a city and I'm fortunate to have some essential gadgets with me. But 80 percent of Indian students and teachers do not have access to these things. If I'm not able to provide equal opportunity for education and wellbeing, my efforts are wasted. I wish research should focus on social problems and solutions to them".

"Internet connectivity has been a challenge. The Internet is slow. Power problem: At times, I do have frequent power cuts".

"Having low Internet service in the house has really been challenging. When one hovers around the Internet only to

have the other struggle with low bandwidth, it has really been challenging".

Participants identified several challenges associated with technology transitions because educational institutions continued to use the pre-Covid-19 norms to evaluate the work/study performance. Participants argued that it is critical to revise norms and expectations in light of Covid-19-related changes.

"...too many administrative meetings, which also go too slowly, because they are conducted online."

"Less accessibility but challenged to maintain the same quality of work as before".

"I find work to be more productive, while at the University (the atmosphere itself pushes me to work hard and there are fewer distractions), so working from home has many limitations, which dwindle the level of productivity".

"The fact that things are very slow when there are other people involved with the work."

The technology adopters also felt difficulty communicating, understanding, and learning a new skill, posing individual challenges during transition.

"I had to face a few situations in which miscommunication created chaos."

"It is not just challenging. It is tiresome to be there next to a phone or laptop all the time".

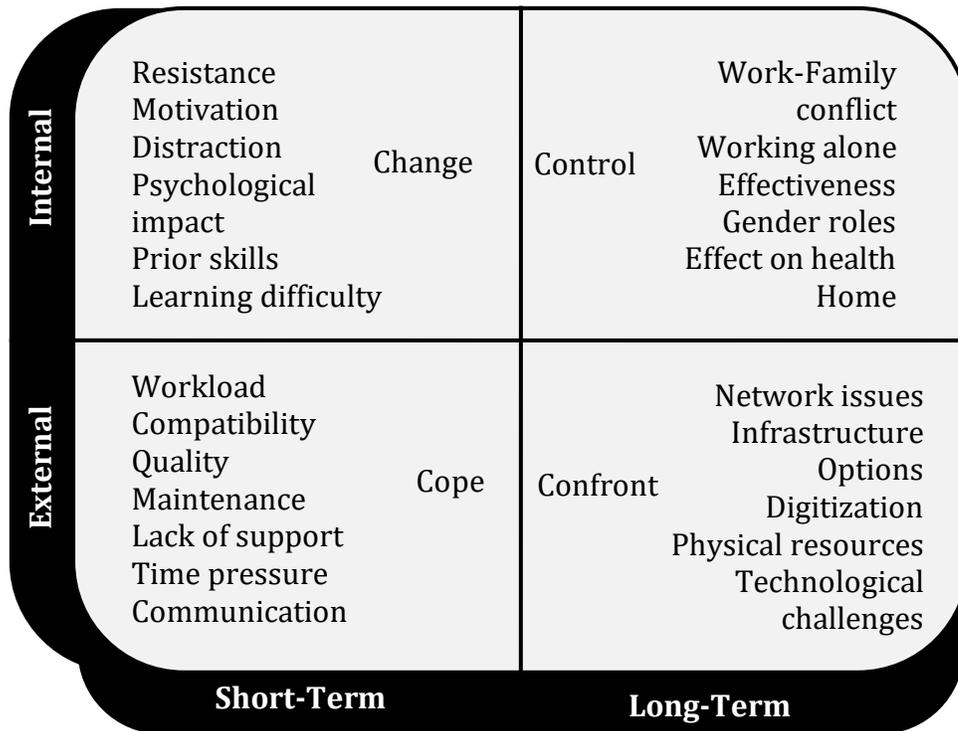
"Due to work from home, our official commitment is throughout the day. We are constantly checking mail, Whatsapp for official information. Adequate notice is not given before imposing official work".

Wilson (2020) argued that faster adoption of new technology is essential for organizations when moving towards work from home. He suggested that future

systems must be elastic and resilient to cope with the sudden changes. Workers are also included in the elastic digital places to be able to move with the changing technology. This is true for academic institutions also.

To understand the transitional challenges in a holistic manner and to frame strategies to manage them, the key factors are analyzed on a matrix with the source of challenge on one side (internal vs external) and the time period on the other (short-term vs long-term). Challenges were classified into internal and external based on Rotter's Locus of Control theory (1954). Minor challenges are temporary and can be mitigated in a shorter time by building capacity or mobilizing resources. Major challenges are either permanent or require a longer time to mitigate. Figure 3 presents the strategies for managing the transitional challenges. Stanisławski (2019) compared various models of coping strategies. His work provided a basis for identifying the ways of mitigating the transitional challenges in technology adoption. We identify that the challenges can be mitigated by changing, taking control, coping with them, and confronting them. To change is to acknowledge one's role in the problem and take the responsibility to correct them. To control is to regulate the feelings, situation and responses. To cope is to take active steps to increase efforts and attempt stepwise to overcome challenges. To confront is to face the challenges and alter the situation aggressively.

Figure 3. Managing Transitional Challenges (Source: Developed by Authors)



The challenges such as resistance, motivation, distraction, psychological stresses, prior skills, and difficulty learning are concerned with individual and short-term issues. That means that the individuals need to change their attitude towards technology use and adopt the change. The challenges such as work-family conflict, working alone, effectiveness, gender role, health impact, and home environment are also essential and will stay a longer-term. Hence, they need to be controlled. Workload, compatibility, quality, maintenance, support, time pressure and communication are external challenges to the individual or involve others. They are also short-term and may change over a period. These factors need to be dealt with. Factors such as network issues, infrastructure, options, digitization, physical resources, and technological challenges are external to individuals and are out of control. It will take longer to get these factors supportive of technology adoption, yet they need to be confronted.

The open-ended responses also contained some suggestions to enhance technology adoption during the pandemic. Respondents suggested that educational institutions need to be compassionate during difficult times and not pressurize or push targets. Flexibility over time should be allowed in completing tasks.

The outcome needs to be assessed in alternative ways and not by using regular appraisal or evaluation methods. While forcing the adoption during the pandemic, institutions need to consider providing required resources, infrastructure, and financial support. Dissemination of information should be taken care of, and there should be clarity in the communication. Even though most of the time was spent on training, since the time available to internalize and provide an efficient delivery was not there, the service consumers felt that the providers were not adequately trained. Though gender equality was considered on service performance, the social differences between the genders were not considered. This posed an additional challenge to women participants.

One respondent suggested, "Had college taught us e-learning and e-examination concepts earlier, the teachers and students would have found technology effortless and friendly by now". There were also comments such as "office hours should be followed even when we work from home/or should have consistency/predictability" and "stick to working hours, just because we are available at one call or text doesn't mean the same should be abused. The 9 to 5 work-life has turned into 7 am to 11 pm work-lives. The same is annoying and destroys work-life balance".

CONTRIBUTION

This study contributes to a deeper understanding of specific transitional challenges due to faster technology adoption during pandemic situations. Lockdowns and work-from-home can be a norm during a pandemic. Such situations trigger innovations and force technology adoption to continue with regular activities. The study informs the HEI about the challenges the members face and suggests ways to better plan while adopting technology for contingency. Institutions must consider the specific contextual challenges of their members (i.e., faculty, students, and non-teaching-staff) under non-normative situations and develop flexible and realistic policies related to their members' work/study/job performance while planning for the adoption of newer technology for academic activities. Policymakers may also consider this study's outcome while taking decisions on online classes or exams delivered to the students' remote locations or the preparation and requirements of the faculty. Though the study was done in HEI, the results may be suitable for other

domains such as corporate training and teleservices. The study can be further validated through a quantitative method.

CONCLUSION

The Covid-19-related demands for accelerated technology implementation have presented new obstacles to India's educational institutions. This paper looked at the transitional challenges that faculty, staff, and HEI students in India encountered when they implemented newer technologies during the pandemic. Data obtained from an open-ended questionnaire survey of university academic participants showed that the environments at home and the numerous distractions hinder the learning, implementation, and use of modern technologies. This research also proposes many strategies for mitigating challenges during pandemics and accelerating technological adoption.

List of abbreviations

HEI	Higher Education Institutions
SOLE	Synchronous Online Learning Environment
LMS	Learning Management Systems
ICT	Information and Communication Technology
IT	Information Technology
IDT	Innovation Diffusion Theory
DOI	Diffusion of Innovations
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
TPB	Theory of Planned Behaviour
UTAUT	Unified Theory of Acceptance and Use of Technology
TTF	Task-Technology-Fit
T-O-E	Technology-Organization-Environment
IRB	Institutional Review Board
HIPAA	Health Insurance Portability and Accountability Act
AIU	Association of Indian Universities

Availability of data and materials

The data is not shared because of the declarations in the consent form that the data will not be disclosed.

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SURVEY INSTRUMENT

Impact of COVID-19 on the Technology Adoption and Coping of Faculty, Students and Staff in Indian Higher Education Institutions.

Research Participant's Consent For Participation

1. *** I have read the information above and agree to participate in this survey.

I AGREE to participate in this survey.

I DECLINE to participate in this survey.

*** (If the participant declines to participate, he/she would automatically be exited from the survey instrument)

2. *** I am at least 21 years old.

Yes

No

*** (If the participant is not at least 21 years old, he/she would automatically be exited from this survey instrument)

3. *** I am a faculty/staff/postgraduate student (enrolled in any of these degree programs—Masters, MPhil or PhD) of a university/college recognized by the University Grants Commission in India.

Yes

No

*** (If the participant is not a faculty/staff/postgraduate student (enrolled in any of these degree programs—Masters, MPhil or PhD) of a university/college recognized by the University Grants Commission in India, he/she would automatically be exited from the survey instrument)

NEWER PERSPECTIVES DURING THE COVID-19 CAMPUS CLOSURE

NOTE: The following questions seek your perspectives and thoughts related to the changes and transformation you have observed in yourself and your life due to technology use during the COVID-19 crisis.

4. In what specific ways has technology use related to work/study from home during COVID-19 has *enhanced your personal life and professional life*?
5. In what specific ways has technology use related to work/study from home during COVID-19 has *helped you* in your *academic/professional life and development*?
6. In what specific ways has technology use related to work/study from home during COVID-19 has *challenged you* in your *academic/professional life and development*?
7. What *support* do you need from your academic institution to be able *to study/work remotely from home*? Please make some suggestions that are important to you.
8. Is there anything else that we have not asked you would like to add here?

Part-II: Participant Demographics

9. What is your *age*? (Mark only one)
 - Between 21 and 30 years
 - Between 31 and 40 years
 - Between 41 and 50 years
 - 51 and Above
10. What is your *gender*? (Mark only one)
 - Male
 - Female
 - Other (please specify if you choose to) _____
11. Please identify *all* the *roles/capacities* in which you work in your university/college: (Mark only one)
 - Faculty
 - Research Scholar (MPhil/PhD Student)
 - Masters Student
 - Non-Teaching Staff
 - Other (please specify) _____