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Aggrandizing the ramification of online education: In the milieu of COVID-19 pandemic-a way forward

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Abstract: The outbreak of the COVID-19 pandemic has posed a recent threat to humanity that forced a global halt of social, academic and economic activities. This pandemic resulted in a tremendous revamp of traditional educational mode to digital platforms. To gain the acumen about favorable and unfavorable outcomes of the COVID-19 pandemic, 19 semi-structured interviews were conducted from top-tier leaders (vice-chancellors, rectors, deans, chairman, directors, head of departments, etc.) of public and private higher education institutions across Pakistan. Interpretative phenomenological analysis was adopted to analyze the qualitative data (includes perceptions, thoughts, feelings and experiences) about crisis-response migration to online education. Research verdicts demarcated the visionary initiatives of the higher education sector by transforming potential academic challenges into sustainable opportunities. It entails the provision of an online learning experience to novice and seasoned learners and faculty, overcoming the continuous academic distortion, and subsequently ensuring the renewal of educational procedures. The findings reported numerous challenges faced by academicians in crisis-response migration to online education. This research enriched the literature of online education/emergency remote learning in the era COVID-19 pandemic. This study also presented the way forward of educational digitalization for governing bodies and policymakers of the higher education sector.

Keywords: crisis-response migration; educational transformation and digitalization; Interpretative phenomenological analysis; online education; COVID-19

1. Introduction

An infectious virus, COVID 19 pandemic blew like thunder in a sunlit, discovered in China and spread all over the world that distressed friable balance of human life [1]. The devastation caused by the dreaded pandemic may take years to heal. On 11th of March, 2020, World Health Organization (WHO) declared COVID-19 as a pandemic that escalated the globe by affecting 223 countries over 114,315,846 confirmed cases and accumulated 2,535,520 casualties to date [2]. Initially, the blowout of the COVID-19 pandemic reported in Pakistan in late February 2020 snappishly reached 583,916 confirmed cases with 13,013 deaths till 3rd March 2021 [2]. The alarming speed of the COVID-19 pandemic split over the smashing obstruction to an already trembling economy despite unprecedented policy support. This pandemic has shaken the economy of Pakistan through perilous fall down of all array of sectors including manufacturing, trading services, etc. According to risk

analysts, Pakistan has lost one-third of its revenue and exports declined by 50 % due to the outbreak of COVID-19. The prediction about gross domestic productivity (GDP) for FY20 may reduce by 2.2 % and about 10 % (1.1 trillion PKR) economic loss will be observed in FY 2021- COVID-19 has effected has severely affected to Pakistan economy. It has turned the world upside down and the way we live. Businesses have been effected and resultantly employment has increased [3].

The continuous intensification of pandemic-infected cases urged the dire need for strategic alertness and prompt reaction to control the situation before its worst impact. Besides the pecuniary miserabilist situation, the global education system has incurred an unrecoverable loss. As per UNESCO statistics, nearly 63 million educationists are affected in almost 165 nations in which 850 million students (that is approximately exceeded the half of the world's student population) still face education disruptions [4]. Imposed confinement and a large number of contaminated cases force the global physical closure of educational institutions that raised the apprehension towards crisis-response migration to online education. The increasing number of Covid cases has forced the shutdown of many activities including educational activities. These crisis has forced educational institutions to shift from physical classroom setting to online educational platforms [5]. The delays in the educational transformation from traditional mechanism to digitalization disrupted the academic activities that led towards adverse socio-economic impact [5–7]. According to Human Development Index (HDI), in 2020 Pakistan is at 154th position out of 189 countries among medium human development, while the sixth-largest populous country on the world map [8]. In this regard, the government of Pakistan has imposed a smart lockdown and shutdown of education institutions to prevent the hostile effects of the disease. The formal academic activities were suspended and provisionally shifted to a virtual educational system to prevent and containment of the large-scale transmission of coronavirus. This virtual transition required approximately 47 million rupees for timely allocation of academic resources in order to continue the formal educational system [7,8]. Despite the financial burden, the government of Pakistan directed the Higher Education Institutions (HEIs) for crisis-response migration to online classes. To comply with the advisory of the Government of Pakistan, HEIs permitted staff to work from home amid COVID-19. It was ensured that academic standards should met and the quality of learning should not be compromised [9,10].

To control the destructive spread of COVID-19, it become dire need for academic institutions to transform convential educational system into online education [11]. Online education is characterized as a synchronized and asynchronized distance learning mode deemed as ancillary to traditional in-person education. The online education be may be synchronized or asynchronized [12]. The obligatory requirement of the Higher Education Commission for HEIs to use open-source online platforms of teaching like; Skype, YouTube, WhatsApp and google hangout for lecture delivery created many uncertainties [13]. Moreover, the financial crisis posed severe technological challenges for HEIs as they are deficient in Moodle, blackboard (teaching apps), Zoom and Microsoft team's software. These challenges are not limited to technology related challenges but also include lack of professional development and insufficient incentives [14]. It is worth mentioning that lack of

resources, IT infrastructure and related capabilities adversely affected educationists physically, mentally, socially, and academically [8,15].

Online education is not a new concept but it got popular in Pakistan during the epidemic. It opened new avenues of teaching and assessment to ensure conducive teaching and learning design. The instructors are supposed to employ online education and faced hitches in creating a constructive and supportive online learning environment for the students. These hitches are not different from what developing countries faced or facing, for instances, inter unavailability and scarce availability of resources to public at large [16,17]. Lack of IT competency, insufficient tec-training programs, absence of positive mindset among both sides, inadequate e-learning policies, stakeholders' concerns over e-learning and scarce technical infrastructure are proved as barriers to effective online education during an outbreak of Pandemic [18]. Despite all the above-mentioned challenges, HEIs started exploring the best possibilities of bringing efficient technology to the education system for remote teaching and learning during COVID-19 [19]. The shift toward online education and utilization of digital platforms during the pandemic also created opportunities for digital entrepreneurship in HEIs [20]. Digital entrepreneurship refers to starting and running new business venture by utilizing digital technologies and online platforms [21]. HEIs are putting special focus on technology transfer and spin off startups; thus universities can create an eco-system where online education and digital platform can facilitate both learning and earning opportunities. By integrating digital entrepreneurial skills into online education, HEIs can prepare students to create a source of income while working at their own pace. For instance; student can learn to design e-courses, can develop educational content for social media platforms, freelance coding and educational service and work as virtual tutors. These skills can help enrolled students along with graduates to play their role in the ever increasing digital economy. The job market of Pakistan is quite saturated as unemployment and limited job opportunities remain a major concern for economy. By learning the use of digital platforms youngsters can render their services to both local and international clients. In this way, online education becomes more than a teaching method and becomes a tool for economic growth and innovation [22]. Pakistan's employment outlook is very challenging and it needs major steps to be in this regards [23]. Therefore, this study argues that when strategically implemented online education can act as a launch pad for digital ventures. Such initiatives are aligned with SDG 8, dealing with economic growth and decent work opportunities along with SDG 9, that focuses on innovation, technology, and sustainable industrial development [24,25].

1.1. Research focus

An extensive review of the literature regarding the turmoil effects of the pandemic, it is found that there is a lack of research verdict about the challenges and opportunities created for the Higher Education sector in the context of Pakistan. It is concluded by some researchers that the sector can be significantly improved by aligning strategic opportunities with existing challenges [26]. This study aimed at the exploration of barriers and challenges faced by the academicians during the period of 'work from home' and suggest the way forwards to exploit the startling prospect of

academic excellence in the future. Universities can identify the academic deficiencies and speed up the process of educational restructuring from traditional mode to contemporary online mode through innovative educational design, futuristic technology and efficient management. The outbreak of COVID-19 forced the academicians to turn these challenges into opportunities to further promote boundary less education, an international collaboration that ultimately led them towards a global online education network.

Though several studies are available on online teaching opportunities and challenges, yet this study presents the comprehensive systematic meaningful insights of top-tier leadership (vice-chancellors, rectors, deans, chairman, directors, head of departments, etc.) of public and private higher education institutions across Pakistan. The findings of the study provided deep insights to the policy makers, governing bodies, administrative unit and HEIs who are planning to adopt and escalate virtual education as a regular activity in the future.

1.2. Review of literature

The literature on online education following the COVID-19 epidemic especially in developing countries like Pakistan is in scarcity. Hence, it is quite challenging to conduct rigorous literature rather than rely more on experts' opinions [27]. It is irrefutable to say that COVID-19 has put the education system in jeopardy without any discrimination around the globe. Since the early spring of 2020, universities have faced a colossal crisis-response migration from traditional or conventional learning to online or digital learning to mitigate the COVID-19 damages to education [28,29]. The pandemic adversely affected the learning structure of 850 million students across the globe. The rife pandemic, following the government's directives of 'continuous teaching and learning', forced the universities to transform the educational system. The challenge is accepted by the educational institutes to take benefit of asynchronous education that is best in form of digital format. The COVID-19 pandemic had badly effect the educational institutes across the globe. The closures of universities, colleges and schools have affected millions of students. It has forced the educational institutes to adopt technology for online learning process [30]. Within a short period, millions of global instructors started online teaching through zoom, skype, Microsoft team, google classroom, etc. and students attended their classes from home [31].

1.3. Education platforms in Pakistan

Till now, numerous research verdicts discussed the dynamics, challenges and problems of online teaching and learning during COVID-19 faced by the academicians (includes teachers, administration, regulatory bodies, and students as well). However, the comprehensive analysis of challenges faced by individual academic entities is miniature and required more attention to analyze the existing situation and upcoming possible opportunities for the development of the education sector around the globe [29,32]. Furthermore, online education is a manifest choice to continue education amid COVID-19 to ensure social distancing that ultimately assuage COVID-19 transmission. teachers have shown their utmost dissatisfaction towards their online teaching experience and online classes, assessments methods and students'

participation [33]. Further acknowledging that the online classes during the shutdown were an awful teaching experience. To achieve state-of-the-art quality in online classes remained an unrealized dream in Pakistan, as reported by (QS-ERA, 2020). Additionally, there are apprehensions about the abrupt division of digital infrastructure for online teaching in Asian countries [34,35].

Though having certain challenges, researchers argue that crises come with certain opportunities as well. The pandemic has pushed individuals and organizations to adopt digital technologies more quickly. This in the longer run has reduced the fear and cost of starting new business ventures [36]. In simple words, situation like covid acted as an impetus that forced people to adopt online tools and digital platforms. Studies reveal that during lock down many students, teachers and freelancers started small online business. As physical classes were suspended, many started online tutoring services, other started youtube channels, while some developed plugins for institutions and teachers [37,38]. This phenomenon is referred to “emergency-driven digital entrepreneurship”, a situation in which a sudden crisis creates opportunities in the digital market [39]. While there are some studies that examine the enablers and barriers to online education e.g. as internet access, technology issues, or student satisfaction, there is no full research that examines how online education encourages digital entrepreneurship. Therefore, this study fills this gap by examining how online education can become a source of digital entrepreneurial opportunities in emerging economies like Pakistan.

1.4. Challenges of online education in Pakistan

As Pakistan is already a financially distressed economy that requires continuous support to survive, is destructively affected the educational system as a whole despite unprecedented policies [31,40]. Although, the academic sector stood with the decision and directives of the Government to shut down the on-campus academic activities and go for the online classes following the ‘work from home’ policy. But it requires a lot of technical knowledge, IT competency, online teaching skills, strong IT infrastructure, time management for online course preparation and many more Online education requires a lot of expertise from the teachers. The effective use of technology enhance the online teaching experience [41]. To shift the teaching pedagogy, Pakistani teachers faced the challenge of lacking online teaching experience/early training, insufficient IT infrastructure and sustenance from IT teams. Additionally, the requirements of online assessment and evaluation shaped the challenging reality for the faculty members.

Additionally, their matching with the requirements of students is also disrupted. Another study by Yeh [42] narrated about the internet connectivity, lack of interaction, less attendance, lack of interest, lack of awareness and lack of training as primary encounters faced by course facilitators in the online teaching process. Apart from these basic level barriers there are high orders barriers as well. These barriers include parents’ and teachers’ beliefs, design thinking barriers and the classroom management barriers. Furthermore, in another study Durham [43] has shed light on the various academic concerns related to faculty training, students’ engagement, information overloading and fade technological usage in sustaining academic excellence during an epidemic of

the Corona virus. It is also important to note that the online practices and pedagogies are different from conventional pedagogy and planned adjustments are required for this transition. Furthermore, insufficient network resources/microphones, laptop configuration issues, lack of technical assistance during online sessions, bandwidth issues, failure of the computer system, and internet stability are also referred to as challenges of online education [44,45]. Similarly, it is asserted that COVID-19 pandemic has forced the teachers and universities for adopting online learning and teaching without required preparations [46]. Teachers did not possess adequate pedagogical and IT related training rather they learn the online class management gradually through videos and their personal knowledge. These all challenges fall under the umbrella of 'institutional support' that needs to be placed at the right time, place and pace. But unfortunately, faculty, staff and students are continuously complaining about the lack of management support to handle the uncertain and dreadful threats of the COVID-19 epidemic. The students showed their dissatisfaction regarding multiple issues e.g., power outage, connectivity issues despite expensive internet packages, home disturbance and insufficient communication. It is concluded that online education always faced challenges and issues [47]. These all above-mentioned problems put them in trouble especially old teachers who are not familiar and comfortable with digital technology. Especially the old teachers either they are interested in adopting new technology. As a result, they feel difficult to adapt to these modern technologies as compare to their younger colleagues [48]. Remotely managing students was the most difficult and exhausting task for the teachers that is characterized by the various undisciplined activities (playing games, eating, drinking, making noise, playing music) of the students during the session that ultimately lead towards teacher's demotivation and poor performance [1]. Additionally, faculty competence, hesitance and resistance towards IT adoptions are also proved as the barrier of academic excellence during pandemic widespread across the globe.

As a whole, the COVID-19 pandemic posed unlimited challenges and threats to the social, physical, psychological, economic, environmental factors [49]. However, the disaster of the educational sector is on the top discussed by numerous researcher during the last year [4,29,45,50–54].

1.5. Opportunities (way forward) of online education in Pakistan

Besides the appalling challenges, the COVID-19 pandemic created plentiful opportunities for the academic sector to herald the way towards digital educational transformation in order to revolutionize and make it ever sustainable. Not only the challenges but online education mode during the COVID-19 has also provided the wide range of opportunities and information for its stakeholders [43]. The visionary academic leadership of different universities across Pakistan introduced numerous innovative online teaching frameworks and models that brighten the prospects of the academic institution [55].

The imminent rise in the adoption and utilization of ICT brightened the future of academic institutes as the physical education system is going to transform completely into the distance-based learning system entitled hybrid institutions [56]. Hybrid institutions aim to cut down the direct and indirect cost of universities lead towards

the sustainable academic output. It discourages the physical presence and involvement of a large number of people and redirects them to the policy of ‘work from home’ The hybrid mode offers flexibility and efficiency at all levels of the educational institutions. It also offers a cost effective learning environment as compare to physical classrooms [57]. The mass enrolment has forced universities to look for other ways despite risk of academic quality. These universities may use multiple strategic policies for a better performance during the time of crisis [58]. Hybrid institutions promote the communication and interaction of online and physical attendees simultaneously The hybrid institutions are in a better position to promote the interaction of both physical and online participants simultaneously and as a result better communication is possible [59]. It coalesces traditional teaching system with online activities that reduces the resource consumptions on face-to-face instructional practices. Most of the class activities are performed online free from physical presence and on-site practice that ultimately lead towards sustainable academic activities [13]. Moreover, IT developments and advancements present the technical ground for educational reforms and innovation. It maneuvers the opportunity springboard for the HEIs having flexible learning mechanism/trajectory, easy information access, global reach, sound technical support and innovation, hybrid education programs etc., The higher education at Pakistan a transitional phase due to introduction of new technologies and digitalization. A sustainable future of higher education in Pakistan may be ensured through strategic investment in digital infrastructure, the responsible adoption and regulation of AI tools and sustainable governance [60]. The incorporation of artificial intelligence in academic activities highlighted the fact that online education and traditional education will go side by side to promote academic equity, equality and innovation [61–64]. In a nutshell, faculty and students become familiar and use to online education that will incline them towards upcoming flexible and advanced learning trajectories. After the extensive literature review and interview with subject experts, the following variables/key factors are identified and listed in **Table 1**.

Table 1. Identification of key issues through systematic review.

Sr. #	Key issues/factors	Category	Variables	References
1.	Institutional support	Challenges	V1	[30,41,45,52,53]
2.	Online teaching and assessments		V2	[65–67]
3.	Digital competence and technical difficulties		V3	[13,19,31,68]
4.	Hybrid Institutions	Way Forward/Opportunities	V4	[69–72]
5.	Advanced and flexible learning trajectories		V5	[60,61,73]

2. Materials and methods

2.1. Sample/participants

To explore the phenomenon of the educational model followed by Pakistani universities in the era of COVID-19 and to get deep insights into the academic challenges and opportunities posed by disparaging pandemics, this study is based on

a realistic school of thought to get their ‘lived escapade’. There is no fixed number/scale is given in the qualitative research approach as it depends on several factors e.g., sufficiency of individual cases, accessibility/readiness of informants, the context of research operations, eminence of the information and theoretical repletion [74,75]. Respondents were selected from the top-tier leadership of HEIs (private and public both) who were involved in planning, designing, implementation and evaluation of educational model/design across Pakistan. To get diverse viewpoints of academicians (includes vice-chancellors, rectors, deans, chairman, directors, head of departments, etc.), referral-based sampling was used to contact 42 informants (through email and phone calls) belonging to different universities of all the provinces of Pakistan. In referral-based sampling, informants are selected by the researcher with social contacts/references and a major focus on special characteristics of the population [76–78]. The contacted informants were from 3 central universities; 13 state universities; 4 deemed universities and 22 private universities across the region of Pakistan. All the interested informants were requested to give consent (written) for participation in the study to ensure their presence on the due date, time and venue [79–81]. Finally, 19 academicians (includes vice-chancellors, rectors, deans, chairman, directors, head of departments, etc.) agreed to participate in the study. Out of 19 selected informants; two were from central universities, three from state universities, four from deemed universities and ten from private universities who are involved in planning, designing, implementation and evaluation of novel educational model during COVID-19. **Table 2** presented the informants consists of 13 males and 6 females fall in the age group of 26–55 years. All respondents have more than 5-years teaching/administrative/research experience in HEIs of Pakistan. Out of 19 participants, 15 were having a PhD degree and only 4 participants were Masters/M.Phil. qualified. Utmost care was taken in selection of informants to well justify the objective of the study.

2.2. Instrument and procedures

Based on the qualitative research approach, semi-structured interviews and observation methods were found relevant and suitable to understand the phenomenon of educational practices, related challenges and opportunities during COVID-19 [66,82]. Therefore, semi-structured interviews were selected to get the viewpoint of top-tier leaders of HEIs (public and private both) of different provinces of Pakistan. Furthermore, observations were also made during the interviews to check the body language, pitch tone, expressions & words repetition of the informants and field-notes were also taken to strengthen the data collected from the interview [83–85].

In order to ensure the reliability and validity, the interview questions were verified from six experts and questions were modified according to experts’ opinions and suggestions. Furthermore, the modified draft of interview questions was sent to six academicians (non-informants of the study) to ensure the construct validity. Further data validation was made by using two methods i.e., IPA and ISM. Using personal contacts and referral-based sampling, respondents were contacted via email and telephone. Prior consent was taken before visiting respondents for interviews. Interview was taken on their prescribed schedule. As interview was taken during the

smart lockdown so semi-structured interviews and observations were conducted at their personal sites.

Table 2. Demographics.

Respondents	Gender	Work experience	Age
R1	M	18	40–49
R2	M	9	30–39
R3	M	8	30–39
R4	M	11	30–39
R5	F	5	20–29
R6	M	8	30–39
R7	M	17	40–49
R8	F	15	40–49
R9	F	11	30–39
R10	M	16	30–39
R11	F	16	40–49
R12	M	12	30–39
R13	F	10	30–39
R14	M	14	30–39
R15	M	11	30–39
R16	M	22	50–59
R17	M	9	30–39
R18	F	25	50–59
R19	M	10	30–39

2.3. Data analysis

From a methodological perspective, interpretative phenomenological analysis (IPA) was deployed to analyze the qualitative data provided by the top-tier leadership of educational institutions about the challenges and opportunities posed by the destructive outbreak of the COVID-19 pandemic. The interpretative phenomenological analysis is a nascent qualitative research approach based on the philosophy ‘to reconnoiter and appreciate the individual’s experience about a certain concept’ [86,87]. Interpretative phenomenological analysis facilitates in taking the deeper insight about the respondent’s views and unfolding it rather than narrating and extracting from grounded preestablished theories and already tested variables [88,89]. In the interpretative phenomenological analysis, the semi-structured interview has been subjective which creates a chance for the researchers to comprehend the observations of the members which they experienced by engaging in a precise segment of an incident [90,91]. IPA is a ‘participant oriented approach’ that allows the interviewees to express his/her life experience, feelings and emotions about the world without any prosecution and thereby interviewee was given lead during our interview [86,90,92]. Being IPA researchers, we were involved in ‘double hermeneutic’ whereby we use our knowledge and experience to make sense of respondent’s response. For having deeper insight we adopt the predominant role in analyzing and

interpreting the participants' experiences IPA is a concept of "double hermeneutic". Here researcher tries to make sense of participant while the participant tries to make sense of their live experience [93]. We followed hermeneutic circle model by enquiring surface meanings but deeper interpretation and connect 'part' (respondents' responses) with 'whole' (researchers' experiences) [86,94].

The rigorous method deployed through IPA encompassed a reiterative process including multiple stages namely; Stage 1: 'first encounter with the text'. Stage 2: 'Preliminary themes identified'. Stage 3: 'grouping themes together as clusters. Stage 4: 'tabulating themes in a summary format. In the first stage, data were obtained through semi-structured interviews (loosely structured pattern) where the interviewer established a 'prompt sheet' with a few main themes for conversation with the respondents. The loosely structured interview questions made were in alignment with research questions. In this study, interpretative phenomenological analysis was used to explore and understand the barriers faced by the academicians and opportunities created for the sustainable educational system in the form of innovative teaching pedagogies, new-fangled educational model during the era of COVID-19. On average, the duration of the interviews was 60 minutes and as a whole interview timing fluctuated between 40–110 minutes and all the interviews were recorded. In the second stage, after each interview, the recording is transcribed and to ensure scrupulous accuracy trivial effects for instance, break in proceedings, mis-hearings, deceptive mistakes and even speech connotations were noticed. The transcripts were analyzed using the original recordings and interview themes were established which might or might not in coincidence with the author's prompt sheet. After re-read the text, we wrote themes from within each unit of the transcript that were more manifest of that interview followed by developing probable connections between themes. In the third stage, an overall structure was made to the analysis by categorizing the known themes into 'clusters' to propose a hierarchical connection between themes. In the fourth stage, we made a 'master' list/ themes in a tabular format that widely clutch the participants expressions, feelings and experience on online education challenges and opportunities during COVID-19. In order to validate the obtained data and findings we adopted four procedures (trustworthiness, member-checking, triangulation, and auditing) given by Alase [95] as an instrument for measuring the authenticity of data gathering and analysis. As IPA researchers, we matched the alignment of our conclusions drawn from interviews with the findings extracted from multi sources for example; observations and document analysis. This study has used interpretive phenomenological analysis (IPA) verify the findings and analysis extracted from multiple sources [96]. We also took feedback from respondents to ensure the trustworthiness of the authors' account [97]. We reinvestigated our findings to remove the inconsistencies and anomalies. Disconformity cases were found and revisited where the individual's description or theme recognized were inconsistent with the other participants' views and diverge with emerging themes.

The organized first version master list of themes extracted from IPA analysis was used during ISM process for establishing relationships between several factors. We employed IPA for identifying themes in conjunction with ISM process to best capture the experts' opinions. We used more advanced technique of ISM to reaffirm the master list of themes identified through IPA. The ISM process comprised of following 1)

determination of key variables/factors; 2) establishment of an association between variables/factors by using SSIM; 3) development of reachability matrix by converting SSIM; 4) testing transitivity; 5) derivation of model levels by using reachability matrix; 6) translation of relationships and development of ISM model; 7) review and revision of inconsistencies accordingly [98–101]. The structural flow of the ISM process is depicted in the following **Figure 1**.

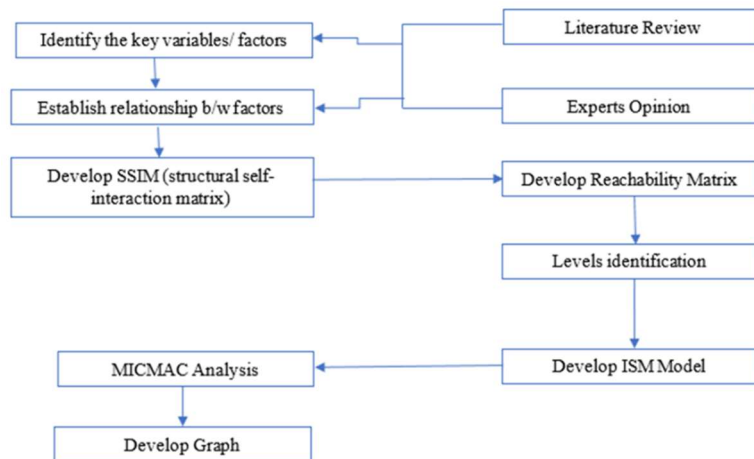


Figure 1. Structural flow of ISM process.

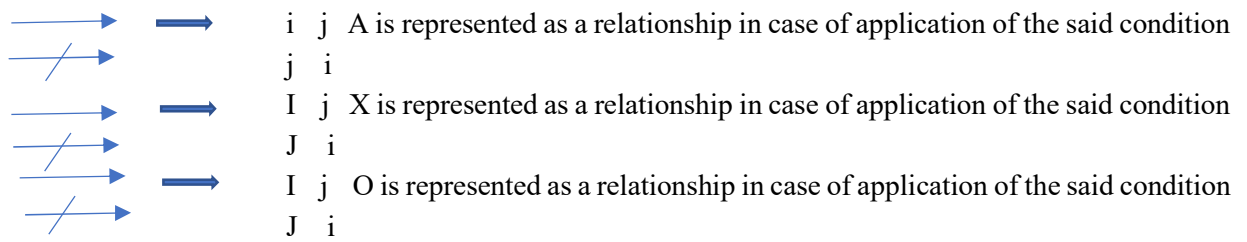
3. Results and discussion

In ISM methodology, Structural Self-Interaction Matrix, is represented as SSIM in which experts and academicians' opinion are considered as the significant and necessary mechanism to determine the relationship between proposed variables that ultimately lead towards objective(s) attainment. The concepts extracted from literature and related context were put forth in front of experts and asked them to give insights about the adequacy of the concepts. For this, SSIM matrix is presented in **Table 3** as following:

Table 3. SSIM matrix.

i j	V1	V2	V3	V4	V5
V1	1	A	V	X	V
V2		1	V	O	V
V3			1	V	V
V4				1	V
V5					1

Vaxo rule is applied to identify the direction of the relationship based on the dependence of two factors; i & j. The consideration of possibilities are given in SSIM **Table 3**;



The process is extended to the conversion of ISSM into a reachability matrix in which matrix is converted into binary codes (1, 0). E.g, *V*, *A*, *X* and *O* are changed with 1 and 0 by following VAXO rule to derive reachability matrix.

- In SSIM, if *i* & *j* are supposed as 'V', then replace *i* & *j* with '1' and then *j* & *i* with '0' in reachability matrix.
- In SSIM, if *i* & *j* are supposed as 'A', then replace *i* & *j* with '0' and then *j* & *i* with '1' in reachability matrix.
- In SSIM, if *i* & *j* are supposed as 'X', then replace *i* & *j* with '1' and then *j* & *i* with '1' in reachability matrix.
- In SSIM, if *i* & *j* are supposed as 'O', then replace *i* & *j* with '0' and then *j* & *i* with '0' in reachability matrix.

The development of transitivity set and its level identification are the next steps of the process which requires the matching of intersections and reachability columns (see **Table 4**). For this, the best matching is considered and named as level-1 and embrace the top level of the hierarchy and similarly up to so on. In the current case, V5 (advanced and flexible learning trajectories) is labeled as the level-1 of the ISM framework. After that, it requires to remove the V5 (advanced and flexible learning trajectories) in the next iteration of both columns that will lead to the next level until the attainment of level of each factor.

Table 4. Reachability matrix.

$i < j$	V1	V2	V3	V4	V5	Driving Variables
V1	1	1	1	0	1	4
V2	0	1	0	1	1	3
V3	0	1	1	0	1	3
V4	1	0	1	1	1	4
V5	0	0	0	0	1	1
Dependent variables	2	3	3	2	5	15

The structural framework is derived through a reachability matrix and set of intersections. The framework uses the criteria of *i* to *j* for demonstration of relationship (see **Table 5**). The following framework denotes that 'institutional support', denoted as V1, is the base factor that influences V3, 'digital competence and technical difficulties. V1 occupies the basic level in ISM hierarchy hence is the fundamental influencer to other variables. V5, Advanced and flexible learning trajectories' in ISM framework is denoted as a dependent factor that receives influence from all factors. Furthermore, V5 is the factor that does not influence other variables.

Table 5. Level identification.

$i \rightarrow j$	Reachability set	Antecedent set	Intersections set	Level identification
V1	1,2,3,5	1,4	1	Level five
V2	2,4,5	1,2,3	2	Level two
V3	2,3,5	1,3,4	3	Level four
V4	1,3,4,5	2,4	4	Level three
V5	5	1,2,3,4,5	5	Level one

3.1. MICMAC analysis

MICMAC analysis is utilized to categorize the factors through the application of cross-impact matrix. It is classified in two types of powers; a) Driving Power (represented on vertical axis) and b) dependent Power (represented on X-axis). Furthermore, it is classified into four main factors: Autonomous, linking, independent and dependent. Additionally, it is divided into four sections: Dependent, independent, autonomous and linked – based on their level of dependance and penetration [102]. **Table 6** and **Figure 2** is the depiction of the MICMAC analysis of the current study.

Table 6. Dependent and driving variables for MICMAC analysis.

Factors	Variables	Driving variables	Dependent variables
Institutional support	V1	4	2
Online teaching and assessments	V2	3	3
Digital competence and technical difficulties	V3	3	3
Hybrid institution	V4	4	2
Advanced and flexible learning trajectories	V5	1	5

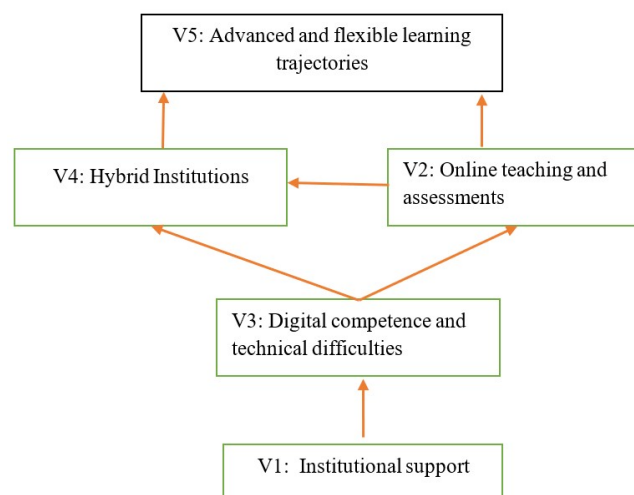
**Figure 2.** ISM model.

Figure 3 is the graph that shows that ‘autonomous’ cluster doesn’t possess any variable which depicts the weak driving and dependent power.

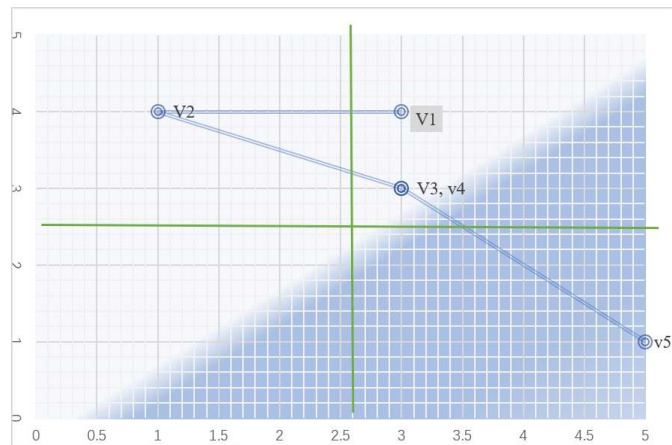


Figure 3. MICMAC analysis of the study.

1. 1st factor/variable named as ‘Institutional support’ lies in the independent/driving cluster that will ultimately lead to V2, V3, V4 & V5. The results indicate the urgency and need of institutional support for sustainable academic output.
2. The results depicted that total 3 variables (V2, V3 & V4) falls in ‘linking’ cluster which shows the strong association of these 3 variables with other variables lies in dependent cluster. The results portray the importance of these variables for an ultimate sustainable way forward of HEIs.
3. The dependent cluster of the graph showed that V5 (advanced and flexible learning trajectories) is part of this cluster. As, it is the dependent variable it is more sensitive in nature and institutions should make strong policies to strengthen this variable.
4. On the basis of robust analysis, a conclusive model is presented in **Figure 4**.

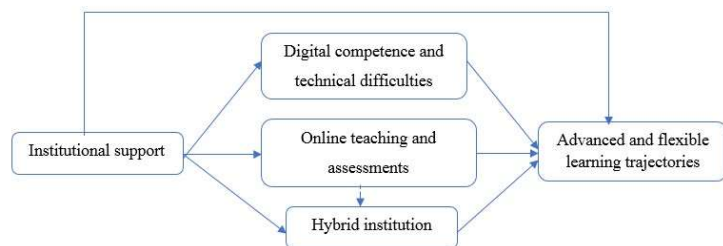


Figure 4. Conclusive online education (OE) model.

4. Discussion

Online education can indubitably propose a new paradigm shift about advanced and flexible learning environments that facilitate learning accessibility at lower cost across the globe [63,64]. One of the major contributions of this study in the identification of “digital entrepreneurship”, as an unplanned but important outcome of

online education. The findings reveal that several respondents (R1, R4, R7, R12) mentioned that students and faculty members, indulged in online freelancing and content creation, activities that mirror digital entrepreneurship; after getting used to the online education tools and platforms utilized to conduct virtual classes. Unlike conventional entrepreneurship, digital entrepreneurship requires minimal capital and ventures can be started from the home [103]. Therefore, the researchers argue that instead of utilizing online platforms for merely conducting virtual classes, HEIs shall deliberately make digital entrepreneurship training, a part of curricula. By doing this, HEIs can transform online education from a mere substitute of physical classrooms; into a permanent force behind self employment of youth and innovation directly supporting SDG8 and SDG 9.

The destruction created by the COVID-19 epidemic from last one year redirects the Government, HE officials, HEIs, investors and policymakers to uplift the technological infrastructure for the better future remote-learning opportunities. The damage caused by the COVID-19 has forced the policymakers to transform the current education system for an enhanced learning experience [104]. The unprecedented need for online education poses a bundle of challenges and threats to the academic stakeholders to continue non-stopped learning during the COVID-19 pandemic [105]. Teaching assessments and teaching pedagogies supported by in-person or through institutions get affected through bad internet connectivity or strain in using technology. To avoid such circumstances, a complete separated setup is required which is hustle free from external distraction and other family problems with basic facilities available to faculty members without any financial worries. Besides, another factor that can affect the performance of online education is institutional support. Zoom, Skype, YouTube, Duo, google meet are the freely available platforms to the teachers. There were certain which effected to efficiency of online education and the one of the biggest factors is technology related factors. The solution is entire separated setup exclusively for online education [106]. Other paid options are available to the institutions which they can make accessible to teachers and class facilitators such as; LMS, UMS, Moodle, Blackboard and Google meet paid version. The institutions with good financial backing utilize paid forms technologies without any delay and restriction but, vice versa institutions are in big trouble to use them due to some limitations in the software that is freely available and they eventually do not have any expertise to handle them. The transformation of moving to online mode of learning is always challenging for all the stakeholders involved in the process especially educational institutes which are one of the major stakeholder. Only a sound financial health is not sufficient for the purpose but there are other challenges which are required to be faced by them [107]. As matter of fact, due to good financial positions many institutions have already license of software even before broke of pandemic COVID-19. The teachers of these institutions were well trained, technically competent and have clarity of direction and purpose. On the other hand, the institutions that are weak in financial positions cannot afford licensed versions of online teaching technologies [71]. Consequently, teachers of these institutions' were also lacking proper training and technical assistance. Resultantly, they are apprehensive and unclear about teaching and assessing online. It is experienced that the teachers

facilitated with institutional resources and support are technologically trained and may perform better [101].

To summarize, it is found that the pandemic shattered whole spheres of lives especially in the education sector but, it is true that every dark cloud comes with a silver lining [73]. Based on an extensive review of literature and expert's opinion, this study attempts to seek the way forward for the HEIs. It is time for HEIs of developing countries especially Pakistan to shift their teaching mechanisms from traditional pedagogies to modern teaching pedagogies or hybrid institutional frameworks. It is an admissible fact that the technology can do marvelous in all functions of educational institutes rather than only in teaching. The findings of the study delineated five factors namely institutional support, online teaching and assessments, digital competence and technical difficulties, hybrid institution, advanced and flexible learning trajectories that played effective role in revamping the education sector. Moreover, the interrupted internet connectivity and un-availability of technology infrastructure across Pakistan are noticed as serious concerns. Universities are developing their own UMS and LMS where students and teachers can interact easily thereby lifting the quality of education, monitoring and evaluation upward.

4.1. Practical implications

This research study brings in significant implications and contributions to the HEIs and the body of knowledge by pointing out the potential challenges posed by pandemic and a way forward to uplift the academic quality and ultimately performance. This investigation was made in two phases; in first phase, extensive literature review is performed and in second phase semi structured interviews besides observation were taken. Literature viewed in phase one established a layout for phase two discussions. By doing so, systematic meaningful insights of the HEIs professionals, practitioners, policymakers and regulatory authorities who were directly and indirectly responsible for educational structure, policy frameworks and its implementation. They highlighted the fundamentals (such as, adoption of ICT, hybrid institutions, easy information access, global reach) required for moving effective online teaching and assessment. Challenges (such as internet connectivity, lack of training, students disengagement & institutional support) explored in the research also shed light that deliberate steps are needed for smooth distance learning. The findings are beneficial for academicians and especially teachers who are involved in online teaching, training and assessment related activities.

4.2. Limitation and future scope

The potential challenges and way forward/opportunities during the life-threatening era of COVID-19 were the main highlights of the research paper. Each of these opportunities and challenges would be benefited for further exploration. Due to the newness of the phenomenon, it was quite challenging to find sufficient literature related to the situation of HEIs during pandemics especially in the context of developing countries like Pakistan. Although this research accommodated much literature in the context of the developed world even then, it was insufficient or non-context. Another limitation came to existence about methodology. This paper is based

on interpretivism paradigms hence, accommodated a small sample size that can be enhanced and mold by future researchers. The respondents of this study were the top-tier leadership (vice-chancellors, rectors, deans, chairman, directors, head of departments, etc.,) of public and private higher education institutions across Pakistan while other stakeholders of the institutes can also be targeted in the future research work.

5. Conclusion

The outbreak of the novel COVID-19 pandemic presents a global closure of academic activities to ensure the social distancing and related restrictive measures. This dramatic prevalence of epidemic has distinctively given rise to e-learning thus shifting classroom teaching to remote teaching and learning mechanism. This study used semi structured interviews and observations to explore the barriers faced by the academicians and opportunities created for the sustainable educational system in the form of innovative teaching pedagogies and fangled educational system. Though the online academic activities cannot replace the conventional mode of teaching and learning but they steered the education system to become tech-savvy [63]. This study portrays the challenges faced by the HEIs during a pandemic and suggested a way forward to best fit the contemporary need of the era. The sudden transformation of the education system presented a bundle of teaching and assessment challenges that adversely affected the teachers' as well as students' performance [101]. It is evident that technology has made a crucial role in mitigating the effect of the pandemic on academic activities by proving itself a predominant medium for the education delivery and assessment. Since the investigation used a small group of top-tier leaders from HEIs for data collection, it is not wise to generalize its findings to all educational sectors. However as an exploratory study it does undoubtedly shed some light on the importance of technology together with organizational support to make online teaching and assessment effective. In a nutshell, the COVID-19 crisis raised a dire need to the reconsideration of special investment of HEIs to penetrate the new academic avenues e.g., the hybrid institution, online teaching, flexible learning trajectories for sustainable and effective academic solutions.

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