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Revolutionizing Indian Higher Education through Knowledge Management and Information and Communications Technology: A Conceptual Model

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Abstract

The progress of a nation largely depends on its education system, which in turn has the potential to do justice if it can make available the right knowledge at the right time so as to enable one to take the right decision.

The above statement calls for an appropriate Knowledge Management (KM) technique in education system. As far as Indian universities are concerned, none of them featured in the year 2018 top 200 list of World University Rankings prepared by the Times higher education group. Surprisingly there are only 30 Indian institutes in the global 1000, which is one less than last year's (Nanda PK, 2017). This dismal situation owes to a deficiency in teaching and learning process in developing countries which is due to outdated curricula, lack of teacher training, obsolete pedagogy and the absence of engagement with the course content. Under such circumstances, Indian universities must apply KM in the right spirit to make an impact on the global platform. If done efficiently, KM can lead to improved teaching, research, innovation, industry income, internationalization and skill development. In this endeavor, Information and Communications Technology (ICT) can act as a catalyst for reducing spatial and temporal barriers and improving access to knowledge. In fact, if latest ICTs are used to their full potential, it can revolutionize the teaching-learning process.

The objective of this paper is to examine the role of KM through ICT in the improved performance of Indian Higher educational institutions. To achieve this, the paper identifies the various KM processes, KM practices and ICT tools impacting the various institutional performance parameters. The paper finally attempts to establish connections between KM and Institutional performance using a conceptual model.

Keywords: KM (Knowledge Management), Information and Communication Technology (ICT), KM processes, Conceptual model, Education system.

Introduction

The role of Higher education system in India's growth does not need any overemphasis. India has a young and vibrant population, huge qualified, semi-qualified, skilled and semi-skilled workforce which has the potential to facilitate its emergence in the global knowledge economy. However, there are various challenges ahead too, which are mentioned as under-

India's Gross Enrollment Ratio (GER 18-23 years) in higher education is about 23% compared to 86.7% in the US, 56.5% in the UK, and 39.4% in China (MHRD, 2016). India produced

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around 8,900 doctorates which is still a fraction of the number from US and China (Cyranoski et al., 2011). Less than 1% graduates opt for doctoral studies in India. A substantial number of Indian students prefer to go abroad and earn foreign degrees (Planning Commission, 2014). A chronic shortage of faculty is another problem. Around 30-40% of faculty positions are vacant. The student-teacher ratio is high in India at 24 as per AISHE report 2014-15, while it is 14 in USA and Russia. This situation occurs due to the lack of infrastructure, adequate teaching staff and pressures to accommodate more students in a class. The problem is further accentuated due to obsolete pedagogies and assessment focus on rote learning. Students have little opportunity to develop essential skills like critical thinking, logical reasoning, problem-solving and collaborative working (British Council, 2014). All this has resulted in graduates with low employability. There also exists a separation of research and teaching. The number of patent applications filed by Indians was only 0.3% of the world total. It is a very disappointing figure for a country with 17% share of the world population (Mint, 2016).

Under such circumstances, higher education institutions have "significant opportunities to apply KM practices to support every part of their mission," (Kidwell et al., 2011). KM initiatives can benefit education institutes tremendously in quick decision-making capabilities, curriculum development, research, and cost-efficient academic and administrative services. The emergence of Information and Communication Technologies (ICT) in the last decade has opened new avenues in KM in meeting the current challenges related to sharing, exchanging and disseminating knowledge in the higher education sector.

Talking about the originality of this paper, it is understood that there is still a scarcity of literature to understand how and what might be the contributions of KM practices in the growth of higher educational institutions.

The objective of the paper is to examine the role of KM through ICT in revolutionizing the performance of Indian higher education. To achieve this objective, a conceptual model is devised (see fig. 1) that studies the effect of KM constructs on Institutional performance. KM constructs are identified as KM processes (see table 1), KM practices (use table 2), KM tools (use table 3) and ICT tools (use table 4). Institute performance is measured through performance parameters (PP1 to PP10: table 5).

This paper is organized as follows. First, KM constructs have been identified and defined followed by a discussion on each of them. Subsequently, the effect of KM constructs i.e. independent variables on the performance of institutions i.e. dependent variable has been hypothesized. In the concluding part of this paper, the directions for further research in this area have been suggested.

Literature Review

Knowledge and Knowledge Management

Knowledge starts with data (raw facts), figures and numbers. Information is data put into context after appropriate processing. Knowledge is information which can be acted on. It incorporates experience and judgment which enables efficient decision making.

"KM is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers" (Duhon, 1998). KM means making right knowledge available to the right person at the right time so that he can apply that knowledge for the benefit of the organization. According to B. Gates (2000), "KM is a very clever term to describe a very simple subject.

Many of us simply do not think in terms of managing knowledge, but we all do it. Each of us is a personal store of knowledge with training, experiences, and informal networks of friends and colleagues, whom we seek out when we want to solve a problem or explore an opportunity". The concept of KM exists for decades, but most organizations accept it only as theory and have not put it into practice correctly. Educational institutions do engage in knowledge transfer from teacher to students, but only some of them contribute to knowledge creation, knowledge acquisition, and knowledge documentation. No attempt is made to capture the tacit knowledge (knowledge that resides in mind) of the teachers who retire or resign and even the students who pass out. Even if the information is captured, it may not be well documented, which may lead to knowledge loss. Even many institutes do not have an open knowledge sharing culture. Knowledge is regarded as the valuable resource of an organization; thus, it requires proper management.

Research Synthesis

Several papers studied the relationship between KM and organizational performance. Most of the studies established a significant positive relationship between KM and organizational performance. Lee and Choi (2003) in his study on 58 firms, found that KM enablers and processes positively affect the performance of the firm. Another researcher, Wang (2007) conducted a study in 20 training centers in Taiwan in 2007 and found that right KM environment within the organization improves the core competencies of staff which further improves the job performance of employees. Nasser et. al (2011) in his study in Egyptian organizations proved that KM capabilities had a significant positive relationship with organization performance. However, cautioned that KM could improve performance if attention is paid to organization characteristics. Similarly, Donate and Canales (2012) proposed that an integrated knowledge strategy could improve business performance. In the same year, Oluikpe conducted a case study in Central Bank of Nigeria and found that if the staff is provided knowledge relevant to their task, it will enhance the efficiency of business processes and ultimately the firm will benefit. Again, Rasula et al. (2012) in his study on 329 companies concluded that KM practices measured through information technology positively affect organizational performance. Gholami et al. (2013) examined the influence of KM practices i.e. knowledge acquisition, knowledge storage, knowledge creation, knowledge sharing, and knowledge implementation on organizational performance in small and medium enterprises and found that they share positive relation with organization productivity, innovation, financial performance and staff performance. Thus mechanisms to collect knowledge from customers, suppliers and other stakeholders helped the organization to overcome challenges and improve performance.

Some other studies could not establish a direct relation between KM and organization performance. The most important of the one by Masa'deh et al. (2017) who researched in Jordan university reporting limited influence of KM on the job performance of staff. The authors reasoned that KM is not well organized at the University of Jordan and no consolidated efforts to facilitate knowledge sharing are made which might have resulted in such a situation. The same author in 2013 also could not find a direct relationship between knowledge sharing capability and firm performance. Similarly, Mills and Smith (2011) reported that while some knowledge resources, e.g., organizational structure and knowledge application bear a direct relation to organizational performance, others like technology and knowledge conversion do not. Similarly, Ferraresi et al. in his survey of 241 Brazilian companies in 2012 failed to find a direct relation between KM and business performance. He, however, noted KM affects business performance through a strategic orientation that prepares the cope up with market changes. Choi and Lee in 2003 noted organization performance depend highly on KM style. While dynamic style is effective, passive style is not.

From the above analysis, it is proposed that KM can improve business performance only if KM is applied in true spirit taking care of the other important organizational characteristics. Organizations must be prepared to face the challenges in KM implementation otherwise the desired results may not be obtained. Only right KM strategy can provide the right outcome (Li-An-Ho, 2008).

Research Gaps

Several papers studied the relationship between KM and organizational performance, but very few studied the relationship in the context of the educational sector. The current paper is an attempt to fill this gap. Very few higher educational institutions actively research or produce new knowledge. Mostly deal with knowledge transfer. Only a small number of unversities apply KM practices and tools for effective decision making and problem-solving. Thus, there is an urgent need for change management in higher educational institutions, due to the rising expectations of various stakeholders like enterprises, government and the society in the wake of increased access to knowledge through ICT, technical innovations, globalization, competition and the emergence of Net- generation.

Methodology

The methodology undertaken in this study is basically an extensive review of literature and discussions with the academicians and experts of the field to propose a conceptual framework. Independent variables KM processes, ICT tools and KM practices have been identified by systematic review of the literature using content analysis approach. The dependent variable i.e. KM performance parameters as Ranking (PP1), Publication (PP2), Placement (PP3), Internship (PP4), Higher studies (PP5), Collaboration (PP6), Patents (PP7), Rewards (PP8), Innovation projects completed(PP9),Student performance (PP10) were selected based on various credible national and international rankings benchmarks. The viewpoint of the experts was noted. Finally, a conceptual model has been proposed identifying these relationships. A prospective set of articles were drawn up from popular databases as ProQuest, Ebsco-Host, Emerald, Web of Science, Elsevier, Science Direct, and Google Scholar/books. The researches undertaken in different countries at different time periods were incorporated. Only English literature was referred. The following terms were used for searching the databases above:

"KM, ICT tools, KM tools, knowledge processes, KM practices, institute performance, technology."

To ensure the quality of papers, cases having low academic rigor (not published in peer-reviewed publications) or having an inadequate discussion about the theme were discarded from the sample after the first level of screening the abstract, review process and number of citations. Initially, 120 research papers were downloaded, but after pruning about 100 papers were chosen for the analysis. The constructs, their definitions, and sources are summarized in the literature table.

Conceptual framework

This paper intends to theoretically investigate and map the identified KM constructs with the performance of educational institutions. The goal is to determine the KM constructs (independent variables) that affect the performance of institutions (dependent variable). The paper also discusses the role of ICT in the proposed model.

Using a systematic literature review approach, the research identifies independent variables i.e. KM Processes (Knowledge Creation (KC), Knowledge Storage(KS), knowledge Transfer(KT) and Knowledge Application(KA) (refer table 1), KM Practices (KMP1 to KMP6: table 2), KM tools (KMT1 to KMT6: Table 3) and ICT tools (ICT1 to ICT8: table 4) on the key dependent variable

i.e. Institute performance measured through ten performance parameters (PP1 to PP10: Table 5). The paper later proposes a KM conceptual model (please refer figure 1) which seeks to find the effect of KM constructs on institute performance.

Table1: Identification of key KM Processes with their indicators

Processes	Operational Definition	Determinants/ Indicators	Source
KC Knowledge Creation	"Organizational knowledge creation involves adding new components or replacing existing components within the organization's tacit and explicit knowledge."	**KC1**: There is adequate corporate- academia interface. **KC2**: Opportunities for international collaboration are provided. **KC3**: My institution facilitates the further education of the faculty. **KC4**: Innovation and creation of new knowledge is encouraged. **KC5**: Resources for undertaking research and development activities are provided. **KC6**: Workshops	Pentland,1995 Lee and Choi, 2003 Chang Lee, Lee and Kang, 2005; Lin and Huang, 2008; Shim, J.,2010; Omerzel, D.G. et al, 2011;
KT Knowledge Transfer	"The exchange of knowledge between and among individuals, teams, and organizations."	**KT1**: Regular meetings are conducted to provide valuable information in my institute. **KT2**: Cross-functional teamwork is adequately used for problem-solving. **KT3**: Organizational members are willing to share knowledge possessed by them. **KT4**: I am willing to share knowledge with other organizational members. **KT4: I feel sharing knowledge with colleagues broadens my horizon.** **KT5: Sharing knowledge improves my credibility.** **KT6: Conferences and seminars**	Yew W.K . and Elaine Aspinwall, 2005 Chou, 2005 Chow and Chan, 2008 Luiz, A and Bernardo, L. 2009 Shim, J.,2010 Masa'deh, Ra'ed, et al., 2017 Turyasingura, 2011 Paulin and Suneson, 2012
KS Knowledge Storage	"It includes knowledge residing in various forms, including written documentation, databases, and tacit knowledge acquired by individuals and networks of individuals."	**KS1**: Database of employees, their expertise and achievement are regularly updated. **KS2**: There exists databases, repositories and IT application to store knowledge for easy access. **KS3**: Several written devices, notice boards, and publications to store and disseminate the captured knowledge exists.	Tan et al., 1999 Yew Wong, Kuan, and Elaine Aspinwall, 2005 Chang Lee, Lee and Kang, 2005 He, Qiao and Wei, 2009 Turyasingura, 2011
KA Knowledge Application	"The capability to transfer and use knowledge for realization of its value."	**KA1**: Institute website is regularly updated. **KA2**: Curriculum is regularly updated on the basis of recent developments. **KA3**: My feedback is considered. **KA4**: My institution recognizes and rewards people who create and share knowledge.	Alavi and Leidner (2001), Gold et al. (2001) (Chong, Chin Wei, Pei and ArnifaAsmawi, 2012) (Masa'deh et al., 2017)

Source: Compiled by the author

KM PRACTICES

Besides KM tools, there are specific KM practices which affect the performance of an institute. To realize the maximum benefit from KM conducive KM environment must be present. According to Rasula et al. (2012) organizational culture highly contributes to KM. This is so because "culture determines the basic beliefs, values, and norms regarding the why and how of knowledge generation, sharing, and utilization in an organization." KM success relies heavily on the trust, teamwork, creativity, motivation, and collaboration among employees. Innovation, intrinsic rewards and co-workers support also positively affect knowledge sharing practices. Sharing knowledge generates capabilities that lead to a better firm performance (Wei, 2012; Ipe, 2003; Kogut & Zander, 1996). Wong and Aspinwall (2005) proposed Critical Success Factors, i.e., leadership and support; culture; information technology; organizational infrastructure; strategy; processes and activities; motivational aids; resources; training and education; and human resource management to form the basis for KM adoption in the SME sector. They emphasized that successful KM require proactive top management support. The leaders can contribute to an environment in which knowledge creation, cross-boundary learning and knowledge sharing can

Table 2: KM Practices with their brief description and source

Practices	Brief description	Sources
KMP1: Culture	"Culture determines the basic beliefs, values, and norms regarding the why and how of knowledge generation, sharing, and utilization in an organization." Culture determines the level of trust, risk-taking behavior, tolerance of mistakes, idea sharing and innovation in the organization	Davenport et al. (1998), APQC(1999), McDermott and O'Dell (2001), Stankosky(2001), Wong and Aspinwall (2005), Mills and Smith (2011), Rasula et al. (2012) and Frost (2014)
KMP2:Management leadership and support	Top management acts as a role model and they determine the objectives of the organization. Their support is es sential to employee motivation , behavior and action.	Wong and Aspinwall (2005), Chong (2006), Akhavan and Jafari (2006), Foot and Hook (2008), Zack et al. (2009), Lee et al. (2011), Andreeva and Kianto (2012), Frost (2014) and Zeinalnezhad et al. (2014)
KMP3:Motivation, rewards, and recognition	Employees can be motivated to contribute to KM. It can be done by providing monetary incentives, or non-monetary incentives like praise or recognition.	Davenport et al. (1998), Liebowitz (1999), Yahya and Goh (2002), Al-Busaidi and Olfinan (2005), Wong and Aspinwall (2005), du Plessis (2007), Prieto -Pastor et al. (2010), Rasula et al. (2012)
KMP4: Training and education	Training and other educational programs are designed to impart relevant knowledge, skills, and abilities to the employees. Training can be both on-the-job and off-the-job.	Davenport et al. (1998); Holsapple and Joshi (2000), McDermott and O'Dell (2001), OECD (2003), Wong and Aspinwall (2005), Chong (2006), Bozbura (2007), Kianto (2011) and Palethorpe (2014)
KMP5: Benchmarking, Best practices	Exemplary practices followed within and outside the organization are documented so that they can be replicated or provide motivation for future tasks.	Drew (1997), Moffet et al. (2003), Hung et al. (2005), Chong (2006), Xu et al. (2010), Andreeva and Kianto (2011) and Zeinalnezhad et al. (2014)
KMP6: Autonomy and Employee involvement	Autonomy empowers knowledge workers to make decisions and gives them control over the pace of work	O'Brien and Crauise (199 5), Ward (1997), McCune (1999), Ryan and Prybutok (2001), Moffett et al. (2003), Kianto (2011) and Appelbaum et al. (2014)

(Source: adapted from compiled Sinha et al., 2015)

flourish. Similarly, Lee et al. (2011) found that collaboration, learning culture, top management support, and IT support affect the knowledge process capabilities. However, Mills and Smith (2011) in their study showed that though organizational structure, knowledge acquisition, knowledge application and knowledge protection were significantly related to organizational performance but technology, organizational culture and knowledge conversion did not have a significant impact.

Table 3: KM Tools with their application area of KM

KM Tools	Application area of KM
KMT1: R & D centers	The research and developmental activities enhance innovation and thereby knowledge creation, which is the source of competitive advantage for the firm.
KMT2: International collaboration	Collaboration builds alliances which permit exchange of ideas and creation of knowledge through brainstorming.
KMT3: Communities of practice	Communities of practice are small informal groups made by members voluntarily to discuss and share knowledge, ideas and insights on a topic of common interest. The members may meet face to face or online.
KMT4: Workshops	Workshops entail activities and discussion that enhance learning.
KMT5: Conferences and seminars	Conferences and seminar facilitate knowledge creation and dissemination through intensive discussion and viewpoints of experts on a particular subject.
KMT6: Cross-functional teams	A cross-functional team refers to a group of people with different functional expertise working towards a common goal. It may include people from finance, marketing, operations, and human resources departments. Generally it includes employees from all levels of an organization.

Source: Compiled by the authors

After discussing the KM practices and KM tools, we would like to discuss ICT tools. The following table presents the important ICT tools that have developed over a decade and their contribution in KM of the institute. Besides the most commonly used tools like power point, wiki, video conferencing, search engine, social networking, and apps; the table also states the latest technology like Internet of things, artificial intelligence, 3D printing and Massive Open Online Courses that are getting popular.

Table 4: ICT Tools facilitating KM in Higher Education

ICT tools	Application area of KM	Authors and year
ICT1: Database management system,Data warehouses, data mining, and virtual reality modeling	Team collaboration and groupware, natural language queries of data, sharing information on best practices and anytime/anywhere online learning	John H. Milam (2004)
ICT2: Use of Blogs	Blogs for knowledge sharing purpose	Jeremy B Williams, Joanne Jacobs (2004)
ICT3: Virtual communities, Personal Blogs and mental maps	An Environment for Knowledge Management in Scientific Research and higher education centers	Jonice Oliveira, Jano M. de Souza, Rodrigo Miranda, Sérgio Rodrigues (2005)
ICT4: Videoconferencing, K Portal, search engine,	Management of knowledge for student courses, to improve internal document management, to increase the level for information and knowledge dissemination	Ruslai Abdullah (2007)
ICT5: Web 2.0 tools like Dropbox, Google Docs, wikis, GoogleApps, PDA	Web 2.0 applications as a means of bolstering up Knowledge Management	Thomas Bebensee, Remko Helms and Marco Spruit (2009) Frank Nyame-Asiamah(2009)
ICT6: Massive Open Online Courses (MOOCs)	Life-long learning	New York Times (2012), Dasarathy et al. (2014), Baturay (2015)
ICT7: Virtual classroom webinar	Blended learning Flipped classroom	Power and Jacques (2014), University of Queensland (2016)
ICT8: Artificial intelligence, online - simulations, 3D imaging, cloud-based education, gaming, Internet of things	The future of higher education Technology changes in the Past, Present and Future I-Campus, I-lab, x-tutor	Ahmad (2015) The Millenium Project (2006-07) Brandeis University (2015) MIT (2016) Gupta and Jain (2017)

Source: Toro and Joshi, 2013 and Gupta and Jain, 2017.

Institute Performance Parameters

To measure the performance of educational institutes, different parameters were used by authors like learning, innovation, productivity, customer satisfaction and other financial parameters. The current paper uses objective criterion from national and international rankings benchmarks which have not been used as yet in the literature.

Table 5: Institute performance parameters (dependent variable) derived from NAAC, NIRF, Times Higher Education and QS report, 2017

KM Performance	Benchmarks			
Performance Parameters (PP)	**NIRF**	**NAAC**	**World University Ranking (Times Higher Education)**	**QS Ranking Methodology**
PP1: Publications	**Parameter 2** Research and professional Practice	**Criteria 3** Research, Innovations and Extension	**Parameter 3** Citations (research influence)	**Criteria 4** Citations per faculty
PP2: Placement	**Parameter 3** Graduation Outcome	**Criteria 5** Student support and Progression	---	**Criteria 2** Employer Reputation
PP3: Internship	**Parameter 3** Graduation Outcome	**Criteria 5** Student Support and Progression	---	**Criteria 2** Employer Reputation
PP4: Higher studies	**Parameter 3** Graduation Outcome	**Criteria 5** Student Support and Progression	---	---
PP5: Collaboration		**Criteria 3** Research, Innovations and Extension	**Parameter 5** Industry income (knowledge transfer)	---
PP6: Patents	**Parameter 2** Research and professional Practice	**Criteria 3** Research, Innovations and Extension	**Parameter 2** Research (volume, income and reputation)	---
PP7: Teaching and learning	**Parameter 1** Teaching Learning and Resources	**Criteria 2** Teaching-Learning and Evaluation	**Parameter 1** Teaching (the learning environment)	**Criteria 1** Academic Reputation
PP8: Innovation projects	**Parameter 2** Research and professional Practice	**Criteria 3** Research, Innovations and Extension	---	---
PP9: Industry income	---	---	**Parameter 5** Industry income (knowledge transfer)	---
PP10: Student performance	**Parameter 3** Graduation Outcome	**Criteria 2** Teaching-Learning and Evaluation	**Parameter 1** Teaching (the learning environment)	**Criteria 1** Academic Reputation

Source: NAAC, NIRF, Times Higher Education and QS report, 2017

Conceptual model:

Based on the discussion above, a conceptual framework (use Fig. 1) has been proposed based on the linkage between KM constructs comprising KM processes, KM practices, KM tools and ICT tools that impact the performance of educational institutes.

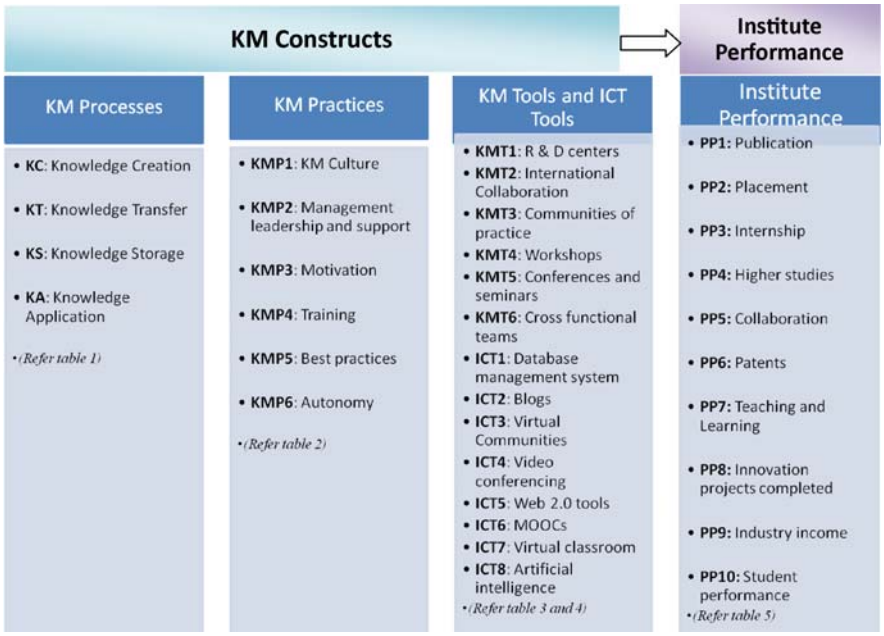

Figure 1: Conceptual model
(Source: Compiled by the authors)

Based on the review of the literature, a conceptual framework (use Fig. 1) has been proposed which establishes the linkage between KM and institute's performance. It has been found that KM tools can improve the performance of institutes by creating core competencies in the human capital. Wong and Aspinwall (2005) and Oluikpe (2012) noted that training, development, seminars, and workshops could provide the staff with the knowledge relevant to their tasks. Likewise, KM practices provide a favorable KM environment. If there is trust, collaboration, top management support and risk-taking culture, then staff will be motivated to innovate and share new knowledge for the benefit of the organization. ICT tools provide the necessary infrastructure to enable efficient KM. A rich database, archives of best practices, online support will enable knowledge acquisition and transfer by reducing spatial and temporal barriers. Finally, the proposed model helps us better understand the performance parameters of educational institutions which have been derived from national and international rankings framework. These parameters act as a guide to educational institutions and help them in achieving the global standards. Thus, the model that talks about raising the performance of educational institutes through KM and ICT opens up a plethora of future direction.

Limitations

The model has limitations on several counts. The variables and their relationships have been illustrated based citations in the literature. The model is built conceptually, suggesting further empirical studies to validate the findings. This paper can also be considered a working paper and there can be numerous studies in various domains.

Future Scope

The scope of this paper is limited and can be extended using real-life case studies. Further empirical studies can also be conducted to validate the proposed model. A comparison of public and private universities can be made identifying the penetration of ICT and KM and thereby impacting the institute performance. Similarly, a comparison of Indian and foreign universities can be made. Finally, the challenges in raising the quality of education can be identified, and suitable steps can be suggested to overcome them.

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