Key Features of Research Portal for Stimulating Research in Institutions of Higher Technical Education

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Abstract

Problem Statement: The current higher learning institutions in developed countries have adapted to their changing role in a knowledge-based society It is time for developing countries like India to focus on Knowledge Management thus, the current study presents research undertaken in understanding the implication of Knowledge Management in the field of education in India. After analysing the need of Information and Communications TechnologiesICT for implementation of KM in Institutions of Higher Technical Education (IHTE) and identifying KM technologies, which academia felt could be leveraged to a greater extent, this study investigates the factors affecting the implementation and use of Knowledge Management technologies for enhancing research in IHTE.

Problem statement: Realizing the importance and value of KM, the researcher has identified the key features to come out of a viable KM portal for enhancing research Institutions of Higher Technical Education

Method: Data has been collected through a structured questionnaire given to 141 respondents covering 30 higher educational institutions in India, including both national as well as state level institutions. Designations of the targeted respondents in the IHTE have been categorized into two

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sections. The first one consists of management and senior academia, e.g. Professors, Associate Professors. These are considered to be the best addressees because they are the overseers of their institutions' operations and are likely to be the thought leaders of KM. The second section consists of assistant professors, lecturers, and research scholars who are using and also contributing to the KM system.

Findings and Results: The results highlight that the academia supports the need for KM portal for research in IHTE. Three components of portal design as identified by academia of IHTE are: Research Initiation, Research Facilitation, and Research Commercialisation. A regression analysis further highlighted that there is a positive relationship between perceived benefits of research and Research Facilitation and Research Commercialisation. Based upon the above results, the portal has been designed for facilitating research in IHTE.

Conclusions and Recommendations: The portal designed will facilitate the researchers in India as well as in other developed countries in identifying the new areas of research, avoiding duplication of research, and providing links of various funding agencies to support their research activities. Moreover, the portal will provide a platform for commercialising research. Thus, it is extremely important for IHTE to design a portal for simulating research activities, as research will not only enhance curriculum development but also help in enhancing the global image for the institution.

Keywords: Knowledge Management, Information and Communication Technologies (ICT), Institutions of Higher Technical Education (IHTE), Web-based technologies.

Knowledge Management KM) generally includes the gathering, storing, disseminating, and application of knowledge via the know-how and creation of work by the individuals in an organization (Miller 1999). KM principles recognize that it is important for organizations to "know what they know." All institutions inherently store, access, and deliver knowledge in some manner. Like water, this rising tide of data can be viewed as an abundant, vital, and necessary resource. With enough preparation, we should be able to tap into that reservoir and ride the wave by utilizing new ways to channel raw data into meaningful information. That information, in turn, can then become the knowledge that leads to wisdom (Alberth, 1995).

A common way to discuss knowledge is by dividing it into two dimensions: explicit knowledge and tacit knowledge. Explicit knowledge can be expressed in words and numbers and is shared in the form of data, manuals, copyrights, and patents (Nonaka, 1991; Smith, 2001). Furthermore, explicit knowledge is carefully codified, stored in a hierarchy of databases, and accessed with high quality and fast information systems. The advantage of this type of knowledge is that it is easily

accessible for other people and can therefore be reused to solve similar problems (Smith, 2001). Explicit knowledge is documented information that can facilitate action. Explicit knowledge can be easily codified, communicated, and transferred. It can be expressed in formal, shared language (Kidwell et al., 2000). Examples include formulas, equations, rules, and best practices.

Tacit knowledge is know-how and learning embedded within the minds of the people in an organization. It involves perceptions, insights, experiences, and craftsmanship. Humans are not always able to express all tacit knowledge, and as opposed to explicit knowledge, it becomes difficult to share it. Therefore, tacit knowledge is often seen as the iceberg below the surface of the water, i.e. unseen and embedded in our social identity and practice (Spender, 1996). Tacit knowledge is deeply rooted in actions and experiences as well as in the ideals, values, or emotions that an individual embraces (Nonaka & Nishigushi, 2001). Therefore it is hard to formalize it and difficult to communicate or share it with others. Due to this difficulty in formalizing tacit knowledge, it is often transmitted through face-to-face contact. Furthermore, tacit knowledge is technical or cognitive and is made up of mental models, values, intuitions, insights, and assumptions. Technical tacit knowledge is demonstrated when people master a specific knowledge like the one gradually developed by master craftsmen (Smith, 2001). Tacit knowledge is personal, context-specific, difficult to formalize, difficult to communicate, and even more difficult to transfer.

Most business actions require the guidance of both explicit and tacit knowledge (Kidwell, Linde & Johnson, 2000). Skilled business leaders have years of experience and therefore a wealth of expertise. Nevertheless, they often have difficulty in articulating the technical and scientific principles behind what they know. Higher Educational Intitutions are considered as if they have outlived their usefulness in the classic sense, because knowledge has acquired a more utility-oriented meaning today than culture-oriented (Kiziltepe, 2010). Colleges and universities move closer to private-sector behaviours and values as described by academic capitalism theory (Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004), which is an opportunity for the influx of business strategies into higher education institutions to increase.

Knowledge Management and Education
Although there has been a great deal of recognition in the business world that information and Knowledge Management can be a vital tool in organizations, now educational administrators and teachers have begun to look at how they might use Knowledge Management to assist in creating effective learning environment. As explained by Kidwell et al. (2000), higher education institutions have "significant opportunities to apply Knowledge Management practices to support every part of their mission

Being the powerhouse of knowledge in our society, universities and other higher educational institutions have immense knowledge. There are hidden, untapped reservoirs of intelligence that exist in almost every organization. There is a difference in ranking between any two universities with identical numbers of faculty, degree programs, expenditures, and enrolment as indicated by surveys conducted by U.S.

News and World Report (Milam, 2001). This suggests that the difference is often intangible value that is added by effective KM. In order to reach their goals and continue the ongoing learning process, universities, like other organizations, also need the effective use of Knowledge Management. In universities where research and development studies play an important role, Knowledge Management is of critical importance (Birol, Dağlı, & Silman, 2010).

Presently, educational institutions are facing intense competition because of emerging local and global educational institutions. So there is a need for the educational institutions to offer stakeholders, i.e. earners, to offer effective learning environments, state-of-art research, dynamic, and industry oriented curriculum, which can place them above par. Education portals create a common gateway to the data, information, and knowledge that people throughout higher educational institutions need to effectively share information and work together on projects. One of the main aims of Institutions of Higher Technical Education (IHTE) is to impart knowledge to the students in the most efficient way, meet the needs of the students more effectively, and improve the outcomes of the students. All of this can be accomplished by developing an ingenious curriculum.

Research in IHTE

Davenport and Prusak (1998) write, "Knowledge derives from minds at work. When employees use a Knowledge Management System, the best practices are stored throughout the organization, and each employee accessing the system has similar power as the best employee (Markus, 2002). As stated by Shariq (1997), knowledge increasingly becomes the key strategic resource of the future and helps to develop comprehensive understanding of knowledge processes for the creation, transfer, and deployment of this unique asset in a way that is becoming critical. In the face of globally expanding and highly competitive knowledge-based economies, the traditional organizations are urgently seeking fundamental insights to help them nurture, harvest, and manage the immense potential of their knowledge assets for the capability to excel at the leading edge of innovation. Schools (K-12), universities, and training organizations (traditional suppliers of knowledge); businesses; and knowledge-based organizations in the public sector (growing users of knowledge) are in need of an integrative discipline for studying, researching, and learning about the knowledge assets – human intellectual capital and technology. Just as businesses can improve the efficiency and effectiveness of their organizations through sound Knowledge Management, similarly, educational institutions can realize the potential of knowledge creation and the power of knowledge-sharing in order to enhance the learning of pupils, students, and staff (Sallis & Jones, 2002). This indeed may lead to enhanced research activities in IHTE. The need for universities to make better use of their information assets has been stressed by the National Committee of Inquiry into Higher Education (1977), which called for the development of communications and information strategies in every university in the UK by the turn of the millennium (McManus & Loughridge, 1999).
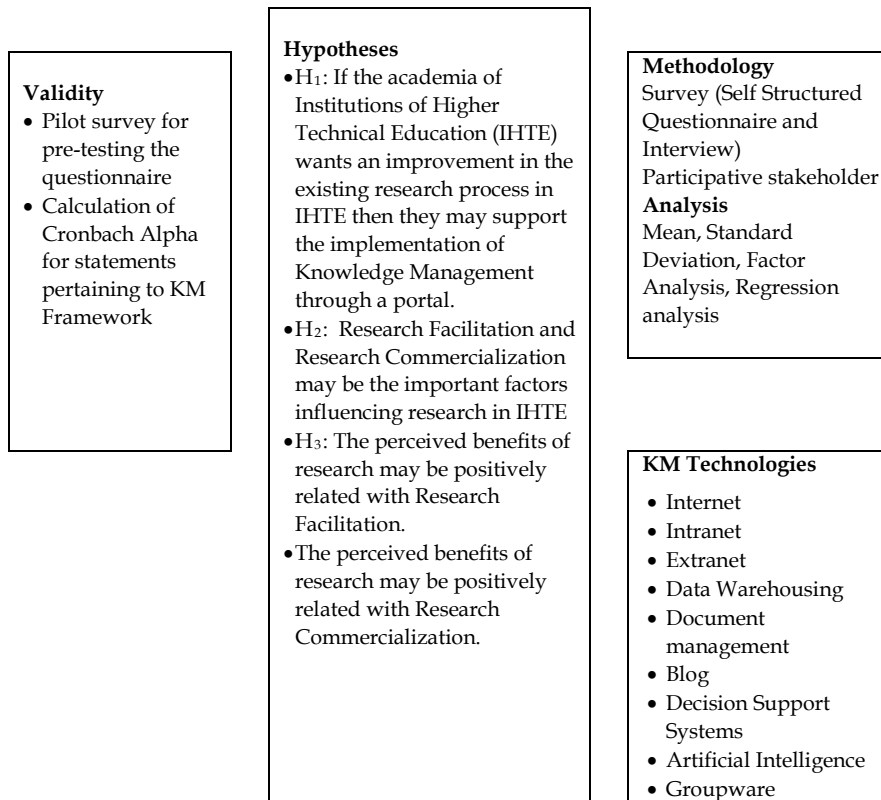
Validity
- Pilot survey for pre-testing the questionnaire
- Calculation of Cronbach Alpha for statements pertaining to KM Framework

Hypotheses
- H_1: If the academia of Institutions of Higher Technical Education (IHTE) wants an improvement in the existing research process in IHTE then they may support the implementation of Knowledge Management through a portal.
- H_2: Research Facilitation and Research Commercialization may be the important factors influencing research in IHTE
- H_3: The perceived benefits of research may be positively related with Research Facilitation.
- The perceived benefits of research may be positively related with Research Commercialization.

Methodology
Survey (Self Structured Questionnaire and Interview)
Participative stakeholder
Analysis
Mean, Standard Deviation, Factor Analysis, Regression analysis

KM Technologies
- Internet
- Intranet
- Extranet
- Data Warehousing
- Document management
- Blog
- Decision Support Systems
- Artificial Intelligence
- Groupware

Figure 1. Conceptual Framework

The objective of the present research is to propose a Knowledge Management portal for research processes in IHTE with a view to reap the maximum benefits of explicit and tacit knowledge in the IHTE. For designing the KM based portal, it becomes pertinent to understand the main factors for fostering research in IHTE. To achieve the above objectives the following hypotheses have been framed:

H_1: If the academia of Institutions of Higher Technical Education wants an improvement in the existing research process in IHTE, then they may support the implementation of Knowledge Management through a portal.

H_2: Research Facilitation and Research Commercialisation may be the important factors influencing research in IHTE.

H_3: The perceived benefits of research may be positively related with Research Facilitation.

H_4: The perceived benefits of research may be positively related with Research Commercialisation.

Method

Research Design

For the purpose of implementing KM for higher educational institutions, a structured questionnaire was designed to elicit the views of the academia. This questionnaire was used to find out which aspects, according to academia, are considered most relevant for inclusion in the KM portal for research. The study focuses on two categories of academia, i) management, senior academia, e.g., Professors, Associate Professors, also considered as thought leaders of KM; ii) Assistant Professors, lecturers, and research scholars — the important contributors to the KM system. The study uses a five-point Likert scale with 1 for lowest priority and 5 for the highest.

Sample

The data was collected from more than 141 respondents from 30 higher educational institutions in India in which both national, as well as state level institutions were included. An effort was made to cover selected Institutions in Engineering and Management from all over India, which were chosen from the best-ranked institutions as given by a survey conducted by AC Nelson in India Today (2010).

Research Instrument

The survey instrument comprises of four sections. Section I covers the need of ICT for the implementation of KM in IHTE; Section II deals with identifying those KM Technologies, which the academia felt could be leveraged to a greater extent; Section III of the questionnaire focuses on obtaining inputs and suggestions from academia for designing a portal for the research in higher educational institutions; and finally, the last section covers the potential benefits that can accrue after implementation of KM through a portal for research. From the identified list of measurement factors, respondents were asked to rank their opinion about these issues using a five-point Likert scale for each of the issues varying from 5 for 'Very High' to 1 for 'Very Low.'

Validity and Reliability The pilot study was conducted with 25 respondents covering five institutions. The pilot study consisted of two dimensions: first, to determine whether the respondents had difficulty understanding the key KM terms used in the survey. The other dimension was to determine whether the items used in the survey measured what they were intended to. The findings of the pilot study showed that questionnaire was reliable. The content was validated by a panel of experts from the field of education who worked in the area of KM. Based upon their comments, some questions were modified, and a brief description of some technical terms used in the survey was also added. Moreover, the researchers personally visited the institutions to get the responses, and any query into filling the questionnaire was handled there and then. The overall estimated item-wise reliability is given in Table 1.

Table 1
Item-wise Reliability

S. No.	Factor	No. of Items	Cronbach Alpha
	ICT and Knowledge Management Technologies	9	.819
	Knowledge Management and Research Repository	3	.843
	Knowledge Management and Research Portal	6	.897
	Knowledge Management and Research Benefits	9	.820
	Total	27	.832

Data Analyses

The study used overall score and factor analysis for identifying key factors for KM portal use for research and regression analysis for analysing the relation between perceived benefits of research and key factors of a KM portal. Based upon these results, the study proposes a KM portal for stimulating research in IHTE.

Results

Need of ICT for Implementation of KM in IHTE

ICT enables and provides the entire infrastructure and tools to support KM processes within an enterprise (Hendriks, 2001). ICT used in KM provide the potential for greatly enhanced access to knowledge combined with a challenge of how to manage the access (Hawkins, 2000).

Table 2
ICT in IHTE

S. No.		1	2	3	4	5	Mean	Std. Dev.	Score/ Total	Score %	Rank
1	ICT skills and applications are needed to keep the pace with world in the knowledge age	-	2	9	45	44	4.74	.46	431 /500	86.2	1
2	Educators can use the new technology to improve their teaching, give it more variety, e.g. power point shows, Web discussions, URL collections, websites.	-	1	15	38	46	4.54	.61	429 /500	85.8	3
3	The usage of ICT will improve knowledge sharing among educator and students.	-	2	15	38	45	4.55	.64	424 /500	84.8	2

The results depicted in Table 2 confirm that the academia strongly supports the use of ICT in education and believe that it will enhance knowledge sharing. All 30 institutions covered in the survey considered ICT very important for Knowledge Management. Regarding ICT status of IHTE surveyed, there was nearly consensus regarding ICT skills and applications needed to keep pace with the world in the knowledge age. This achieved the highest rank in the survey. The assertion that usage of ICT will improve knowledge sharing among educators and students was placed at second rank. There was difference of opinion regarding whether educators could use the new technology to improve their teaching and to give teaching more variety, e.g. power point shows, Web discussions, URL collections, websites. As most of the institutions were in the implementation stage of KM and hadn't switched to complete KM adoption, the levels of infrastructure at many IHTE hindered the adoption of KM.

Knowledge Management Technologies

In the age of technology, one has many options to opt from available ICT. The academia was asked to rate the following ICT according to their preference or usage in the IHTE:

- *Internet:* Internet is a worldwide system of computer networks - a network of networks in which users at any computer can, if they have permission, receive information from any other computer.

- *Intranet:* Intranet is a privately maintained computer network that can be accessed only by authorized persons, especially members or employees of the organization that owns it.

- *Extranet:* Extranet is an extension of an institution's intranet, especially over the World Wide Web, enabling communication between the institution and the people it deals with, often by providing limited access to its intranet.

- *Data warehousing:* Data warehousing is a large specialized database, holding perhaps hundreds of terabytes of data. Databases are specifically structured for information access and reporting.

- *Document Management:* Document management is the process of handling documents in such a way that information can be created, shared, organized, and stored efficiently and appropriately.

- *Blog:* Blog is a frequent, chronological publication of personal thoughts and Web links.

- *Decision Support System:* Decision Support System (DSS) is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions.

- *Artificial Intelligence:* Artificial Intelligence (AI) is the study and design of intelligent agents, where an intelligent agent is a system that perceives its environment and takes actions, which maximizes its chances of success.

- *Groupware:* Groupware refers to programs that help people work collectively while located remotely from each other. Groupware services can include the sharing of calendars, collective writing, e-mail handling, shared database access, electronic meetings with each person able to see and display information to others, and other activities. Groupware provides a mechanism that helps users coordinate and keep track of ongoing projects together.

The academia was asked to rate these ICT according to their preference or usage. The most popular technology turns out to be Internet.

Factor analysis was done on the collected data regarding KM technologies. The results highlight two factors – namely Web-based technologies and user based technologies. Both of these factors account for 61.207% of total variation as shown in Table 3.

Table 3

Factors for KM Technologies

Fac No	Factor Name	Eigen Value	Total % of Var.	Items	Item Loading	Mean	S.D.	Rank
1	Web-based Technologies	3.687	40.971	i. Internet	0.861	4.71	.494	1
				ii. Intranet	0. 860	3.71	1.208	2
				iii. Extranet	0.811	3.24	1.180	4
			Mean Score of Web Based Technologies			3.89		
2	User-based Technologies	1.821	20.236	i. Data Warehousing	0.655	2.93	1.316	5
				ii. Document Management	0.595	3.51	1.168	3
				iii. Blog	0.680	2.34	1.194	8
				iv. Decision Support Systems	0.681	2.49	1.192	7
				v. Artificial Intelligence	0.661	2.29	1.213	9
				vi. Groupware	0.656	2.56	1.288	6
			Mean Score of User-based Technologies			2.69		

Web-based technologies including i) Internet, ii) Intranet, and iii) Extranet, explain 40.971% of variation. The next factor one may see is user based technologies consisting of i) Data Warehousing, ii) Document Management, iii) Blog, iv) Decision Support Systems, v) Artificial Intelligence, and vi) Groupware. This factor explains 20.236% of total variation. Thus the academia chose the Web-based technologies, i.e. Internet and intranet, as the most widely used among the existing ICT. In terms of

mean, the score of Web-based technologies is 3.89 and is much higher than mean score of user-based technologies, which is 2.69.

Key Factors of KM Portal for Research:

Since many factors were considered related to research in higher educational institutions, such as pre-populated proposals, budgets and protocols, portal-funding opportunities, etc., factor analysis was performed, and the results are shown in Table 4. The responses were analysed through SPSSv 17.

Table 4

Key Factors For KM Portal for Research With Their Item Loading

Fac, No	Factor Name	Eigen Value	% of Var. Exp.	Items	Item Loading	Mean	S.D.
1	Research Initiation	2.680	33.500	i. Pre-populated proposals, budgets and protocols	0.719	4.16	0.77
				ii. Research funding opportunities	0.838	4.27	0.76
				iii. Research proposal routing policies and procedures	0.719	4.14	0.79
Mean Score of Research Initiation					4.19		
2	Research Facilitation	1.763	25.395	i. Contract and grant management policies and procedures.	0.794	4.18	0.76
				ii.Technical and financial report templates and policies and procedures.	0.792	4.25	0.79
				iii. Award notification, account setup, and negotiation policies and procedures.	0.761	4.16	0.71
Mean Score of Research Finances					4.20		
3.	Research Commercial isation	1.753	23.624	i. Dissemination of research results (where possible) and funding organizations (federal agencies, foundations, and corporations) with easy search capabilities.	0.893	4.32	0.82
			32.519	ii. Commercial opportunities for research results.	0.701	4.34	0.81
Mean Score of Research Commercialisation					4.33		
Mean score of all factors					4.24		

Inclination of academia towards the research portal was overwhelming, as is self-evident from the above findings. Principal component factor analysis with varimax rotation and Kaiser Normalization was applied. The results highlight that three factors, namely, i) Research Initiation, ii) Research Facilitation, and iii) Research

Commercialisation, account for 82.519% of the total variation. These factors are explained below:

Research Initiation

This factor emerged as an important factor explaining 33.5% of total variance. The major components of this factor include: i) Pre-populated proposals, budgets and protocols (.719), ii) Portal-Funding opportunities (.838), and iii) Portal-Proposal routing policies and procedures (.719). Research funding opportunities have a higher item loading and higher mean score than other two items.

Research Facilitation

This factor emerged as another important factor explaining 25.395% of total variance. The major components of this factor include: i) Contract and grant management policies and procedures.(.794), ii) Technical and financial report templates and policies and procedures(0. 792), and iii) Award notification, account setup, and negotiation policies and procedures(0.761).

Research Commercialisation

This factor emerged as another important factor explaining 23.624% of total variance. This factor includes two items, viz. i) Dissemination of Research results (where possible) and funding organizations (federal agencies, foundations, and corporations) with easy search capabilities (0.893) and ii) Commercial opportunities for research results (0.701).

The mean score of first factor, Research Initiation, is 4.19; the mean score of second factor , Research Facilitation, is 4.21; and the mean score of third factor , Research Commercialisation, is 4.33. Hence the hypothesis H_2, which was Research Facilitation and Research Commercialisation may be the important factors influencing research in IHTE, has been proved. Research Initiation, though important, has a lower mean as compared to other two factors. According to factor analysis, commercialisation of research is very important.

Relation between perceived benefits of research and factors influencing research

Perceived Benefits of Research: The dependent variable of the study is the perceived benefits of research. This has three items, viz. i) reduced turnaround time for research, ii) reduced administrative costs, and iii) minimized devotion of research resources to administrative tasks.

Three key factors for KM portal for research have been identified through factor analysis. These three factors are the independent variables of the regression model, which are: i) Research Initiation RF_1, ii) Research Facilitation RF_2 and iii) Research Commercialisation RF_3.

Table 5

Regression Results

Variable	B	SE B	β	T	P
(Constant)	0.426	.264		1.614	.009
Research Facilitation (RF$_2$)	1.245	.115	1.055	10.805	.000
Research Commercialization (RF$_3$)	0.332	.096	0.339	3.472	.001

Notes: R= .790; R^2 = 0.624; Adjusted R^2=0.618; S.E of Regression= .490; DW=1.790;

F-statistics=200.925 , Significance (F- statistics) < .001

Dependent Variable: Research Benefits

Predictors of Model: Research facilitation (RF$_2$) and Research Commercialization (RF$_3$)

Variables Removed: Research Initialization (RF$_1$)

The results of the regression depict that predictors of the model are Facilitation (RF$_2$) and Commercialization Opportunities of Research results (RF$_3$). These two factors explain 61.8% of variation. The results of step-wise regression highlight that the Research Initialization (RF$_1$) factor was removed, as it was not significant. The next hypothesis was H$_3$: The perceived benefits of research may be positively related with Research Facilitation. The results of regression support that perceived benefits of research are not only positively related with Research Facilitation, but that even the value of B is 1.245, which is high. Thus, this emerges as an important factor.

The next hypothesis to be tested was H$_4$: The perceived benefits of research may be positively related with Research Commercialisation. Here the regression results depict that the value of B for Research Commercialisation is 0.332, which is low, but it is positively related with perceived benefits of research. Thus, the above hypothesis has also been accepted. ANOVA results highlight that the value of F-Statistics is significant (P <0.001). Hence the regression model is good. Therefore, these results support that the model is significant, and both research facilitation and research commercialization emerge as important predictors of the model. Thus, although both research facilitation and Research Commercialization emerge as important predictors, Research Facilitation has emerged as a stronger predictor.

According to Kidwell et al. (2001), the KM portal can be a gateway to research on the use of teaching and learning through technology, professional development, policy development and review, and resource development. The above results of factor analysis, based on the perception of IHTE by academia, validate those ideas, and the KM portal for research will lead to reduced turnaround time and cost of research and administrative tasks. Thus, there has been overwhelming support from the academia for the implementation of KM in research, as seen from the results of the survey. Based on the above inputs, the study has designed a portal for research in IHTE, which is explained in the next section.

Knowledge Management Portal for Research Process in IHTE

By having a Knowledge Management portal, an organisation has the power to deliver information to the right person at the right time, and more importantly, create a virtual environment where individuals can collaborate, communicate, conduct research, and plan activities based on a common interest. "The portal is the interface, the place where information exchange and knowledge transfer takes place, but it is only one component of successful KM" (Cloete & Snyman, 2003).

On the basis of inputs given by the academia, it is possible to construct highly usable and intuitive interfaces, which will facilitate invention, sharing of knowledge and helping to avoid reinventing the wheel. It may be used as a framework, shown by Fig. 2, in developing a Knowledge Management portal for higher educational institutions.

Figure 2. *Developing a Knowledge Management Portal for Higher Educational Institutions*

At the home page, an institution can give the list of areas in which Knowledge Management has been implemented, e.g. research, curriculum development, and alumni services. From there the users can move over to research. To explore it in

detail, the user is given a list of all the departments to choose from. Accordingly, the users can move over to the field they want to use, whether it is Research Initiation, Research Facilitation, placing partial reports, or specifying an area of expertise for projects for commercialisation purpose.

*Research Initiation***:**

In this section, all the information regarding initiation of research in the particular institution is compiled. Research scholars can obtain direction/guidance from this section, while beginning new research. The list of all the projects undertaken by the research institution is listed in this section. The novice who wants to start new research can get an impression of work being done. Industry can see and sponsor the kind of research being conducted by the institution.

- *Pre-populated proposals*. Newcomers can have assistance drafting proposals from this section.

- *Research funding opportunities*. A list of all governmental and non-governmental agencies, which are willing to fund the research with their terms and conditions, is provided in this section.

- *Proposal Routing Policies*. All the administrative policies related to the proposal routing are encapsulated here, which can save precious time for an apprentice.

- *Research proposal routing policies and procedures.* This provides templates for routing project proposals. The entire procedures are also highlighted to enable researchers to initiate research, so that they can complete these processes in the least possible amount of time. This will enable an institution to enhance research activities by involving more new faculty into research activities.

Research Facilitation:

Universities play a key role in several aspects of the process of industrial innovation, and university-industry links and collaboration are crucial for the efficiency of that process. Orsenigo (2000) observed the fact that, while Western European countries do not lag behind the U.S. in basic research or in applied R&D, they are comparatively slow to transform research into innovation and ultimately into market success. He identifies the organization of the innovation process as a particular European weakness. Partly, he sees this as the result of a weakness of private firms, which have not developed sufficient 'absorptive capacity' (Cohen & Levinthal, 1990), and which are slow to re-organize into 'learning organizations.' The gap between industry and research institutes can be minimized by introducing KM, which facilitates the information.

- *Contract and grant management policies and procedures.* This describes how the contract can be placed and what procedures are to be followed. Negotiation policies and procedures undertaken by the research institution with funding

organisations are explicated. It puts light on the policies of obtaining grants for research and which course of action should be followed.

- *Technical and financial report templates and policies and procedures*. To save time and maintain the uniformity, technical report templates are provided by the institution, which will guide the researcher to prepare his or her report. The outline to prepare financial reports is given in this section. It saves a lot of time and helps a researcher make better decisions if he/she has knowledge of the above-mentioned areas. The information regarding finance can be facilitated to the researcher through the following interface:
- *Award notification, account setup, and negotiation policies and procedures.* The list and details of all the accounts and awards are notated.

Research Commercialisation:

To reduce the gap between research and commercialisation, there is an increase in the collaboration between the industry and IHTE to identify the pre-marked needs. According to Lichtenthaler (1995), Companies increasingly make use of external knowledge exploitation, i.e. the commercialization of knowledge assets, although they often perceive considerable difficulties in managing external commercialisation tasks. These difficulties are partly due to the imperfections in the markets for knowledge, which may be mastered by adequate management, as examples of various well-known companies show. In combination, these facts point to the need for research into external knowledge exploitation. In building capacity for research commercialisation and science-based entrepreneurship, Australia has adopted neither the Swedish top-down approach depending on government initiative, nor the American bottom-up approach depending on incentive systems related to university ownership of intellectual property and a highly competitive and entrepreneurial university environment. Instead, Australia has used a combination of government and university initiatives and support mechanisms (Harman & Harman, 2007).

This focuses on providing D-Space in institutions for storing research reports and also providing commercial opportunities to research.

- *Dissemination of Research results (where possible) and funding organizations (federal agencies, foundations, and corporations) with easy search capabilities.* Research in educational Institutions is often funded either by the research agencies or by industry. After conducting research, a report is prepared and submitted to the sponsoring agency. Now with the portal facility available, after receiving due approval from sponsoring agencies, the results can be shared. This is extremely important and helps new researchers proceed beyond what already has been accomplished.
- *Commercial opportunities for research results.* Research without any commercial application loses its sheen. Archives of previously conducted conferences and seminars are readily available for the researchers so that they can have easy access to the knowledge. This will help not only in enhancing research in IHTTE, but also in focusing on the key consultancy areas.

Cross, Parker, and Prusek (2000) observed that research has consistently shown that who you know has a significant impact on what you come to know, as relationships are critical for obtaining information (Simmel, 1950; Granovetter, 1973; Allen, 1984; Burt, 1992; Rogers, 1995; Szulanski, 1996; Shah, 1998) and learning how to do your work (Lave & Wenger, 1991; Brown & Duguid, 1991 & 2000; Orr**,** 1996; Wenger, 1998). To facilitate the transfer of knowledge further, this tool has been added to the portal, which encourages communication between academia that can post on forums, have chats, participate in discussions, and videoconference on chosen topics. These knowledge-sharing sessions can be stored for future reference.

Discussion and Conclusion

The growth in the number of Internet users has given an added impetus to globalisation. Information patterns have transformed the electronic information systems by the use of cyber technologies. As a result of this, knowledge transmission patterns within academic organizations must develop and change the education systems in order for information to be effectively transmitted. Consequently, the Knowledge Management method is becoming a perfect educational development tool for all academic levels (Thitithananon & Klaewthanong, 2007). The results of the present study, based on a survey of academia of IHTE, are also in agreement with the viewpoint of other researchers. There is an increasing consciousness amongst the academia of IHTE for setting up of KM portals for research.

The results of the present study highlight that the academia of Institutions of Higher Technical Education in India wants an improvement in the existing research process and support the implementation of Knowledge Management through portals. The survey results highlight that the academia of IHTE has shown a higher preference for Web-based technologies. Three components of portal design as identified by academia of IHTE are: *Research Initiation* with the variables i) pre-populated proposals, budgets and protocols, ii) research funding opportunities, and iii) research proposal routing policies and procedures; *Research Facilitation* with the items i) contract and grant management policies and procedures, ii) technical and financial report templates and policies and procedures, and iii) award notification, account setup, and negotiation policies and procedures; and *Research Commercialisation* with the two items, viz. i) dissemination of research results (where possible) and funding organizations (federal agencies, foundations, and corporations) with easy search capabilities and ii) Commercial opportunities for research results. The mean score of Research Commercialisation and research facilitation is higher than that of Research Initiation. Hence, Research Facilitation and Research Commercialisation are important factors influencing research in IHTE. The results of regression analysis also support these two factors, as the perceived benefits of research are positively related with Research Facilitation and Research Commercialisation. Thus it becomes equally pertinent to pursue good research,

which has practical and commercial use. Based on inputs from academia, a portal has been designed to stimulate research in IHTE.

This study presents comprehensive research covering all aspects of Knowledge Management to enhance research. Researchers like Hansen, Nohria, and Tierney (1999) advocate Information Technology (IT) to connect people with reusable codified knowledge. Others think that technology has little to do with KM. Success of KM is related to appropriate culture rather than technology (Dixon, 2000; Stankosky, 2005). However, it is human nature to create and use tools. Thus it is not wise to deny or ignore technology, which shows an aspect of human complexity (Snowden, 2003).

Today, the world economy is experiencing an unprecedented change. New developments in science and technology, media revolution, and internationalisation of the ever-expanding competitive environment are revolutionizing the education scene. A paradigm shift has been noticed in education from 'national education' to 'global education,' from 'one time education for a few' to 'life-long education for all,' and from 'teacher-centric education' to 'learner centric education.' These changes make new demands and pose fresh challenges to the established education systems and practices in India. Because of interdependence and integration of world economies in recent years, the Indian higher education system has a new role and a challenge to provide to the nation and the world at large. The education system must result in skilled human power at all levels, having requisite knowledge and confidence to effectively confront the social and economic realities. As the Knowledge Management method is becoming a perfect educational development tool for all academic levels (Thitithananon & Klaewthanong, 2007), Institutions of Higher Technical Education can enhance their competitiveness and face the challenges of education through the suggested KM framework for research.

Implications of the Study

Research is the pillar of any educational institution. This study is one of a kind in that is suggests the framework for enhancing research of IHTE in India. It provides a valuable insight, regarding important features and factors of research that require more attention for KM. The study analyses the important technologies used for KM by existing IHTE. The proposed KM framework can be used as a blueprint for the implementation of KM in research of IHTE, thus, helping the institutions to improve the research. The study also sheds light on perceived benefits that can be reaped after the implementation of KM in research.

Future Research

Further studies can consider respondents from more IHTE, to ensure more generality of the findings. Future research could focus on validating this framework in IHTE where KM is being implemented. In addition to the learning/sharing culture, further studies can expand this study to address the factors that may impact the collaboration between IHTE and industry. Also, the impact of government policies on commercialisation of research results is another area where further research could be viable.

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