Middle-East Journal of Scientific Research 11 (9): 1278-1285, 2012
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2012.11.09.3780

An Investigation of Innovation in Higher Educational Environments-A Consideration of Five Substructures (Technical, Administrative, Information Systems, Information Technology and Knowledge Management)

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Abstract: Innovation is communicated through certain channels over time among the members of a social system. Establishment of innovation and consequently creating new knowledge in various area have been regarded as important achievements for academic centers, have mainly focused their attempts on promoting knowledge through the implementation of their existing resources. The purpose of this study is to investigate within universities in the development of IT and KM. This study followed the change, development and completion of the Swanson model (three elements as substructure) to its five-element system (technical, administrative, ISs, IT and KM core). Research results indicate that there is a direct relationship between all of these substructures and innovation; the IT and KM core play a prominent role in the development to innovation. KM as a creator, transferor, distributer and regulator of information to innovation supports the system; IT can be conceived of as the infrastructure to KM. Furthermore, in this study, results show that applying IT and KM in the university has an effect on respondents' attitudes, so that could represent a dynamic environment with changing perspectives in developing of innovation. Subsequently, IT and KM were recognized as crucial factors to complete the Swanson model so that was developed to a quintuplet substructure.

Key words: Innovation % Information system % Information technology % Knowledge management % Technology and Administrative core

INTRODUCTION

Today, more than ever, the fate of humans and nations depends on their ability to communicate and influence each other. Information and communication technologies accelerate these effects and add to the complexity of their development [1]. Currently, even though organizational change and transformation depends largely on systems change, its essence and significance is still ambiguous [2].

In this study our goal is to investigate within universities in the development of Information technology (IT) and knowledge management (KM). Swanson [3] investigated issues related to the development of information system (IS). Swanson concluded that the dual-core model only applied to the role of administrative and technical change in an organization and to understand organizational change the model should be transformed to triple core to explain what the organization will become. In this way, the design of triple core was created and it has become the theoretical foundation of this study. This study not only investigated triple core in universities but also followed the triple core of the Swanson model to the quintuplet core model (IS core, technical core, administrative core, IT core and KM core).

The purpose of this research is to provide experiential evidence of the relationship between "IT and KM" and innovation as well as their impact on developing the Swanson model of organizational performance. A conceptual model of this study is shown in Figure 1. To achieve this aim we will:

- Identify the level of use of the five cores (technical, administrative, ISs, IT and KM) in various sectors of the university.
- Recognize the need to make systems innovation with five indicators.

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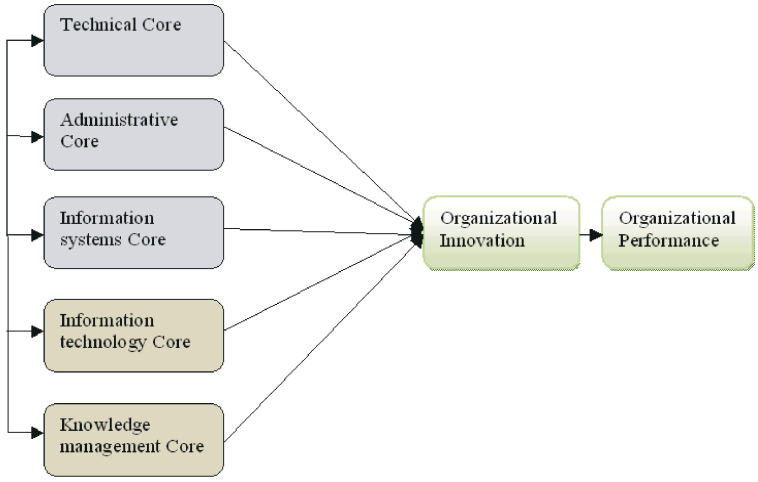

Fig. 1: A Conceptual Model of this study

C Suggest a suitable approach to neutralize obstacles to comprehensive innovation management in different sectors.

IT and KM

A General Review of IT and KM: Despite the considerable interest in the concept of IT management in the past two decades, researchers have not yet reached a consensus view on what this term entails. An equally irritating problem is the terminological fog nearby this concept: terms such as 'ISs management', 'information management', 'technology management', 'strategic information management' and 'IT management' are all used casually [4].

IT is different from IS [5]. IT is a general term for the junction of computers, hardware, software, telecommunications, Internet, electronics and the resulting technologies. It can be measured through the inventory of applications that organizations have. IS is a wider concept that refers to how information flows are designed within organizations so as to meet organizations' information needs [6].

Considering the distinction between IT and IS, IT can be conceived of as the infrastructure to KM [7] or a knowledge platform [8]. Some authors, such as Choi and Lee [9] and Gold *et al*. [10], view IT as an enabler of KM. The role of IT is to extend humans' capacity of knowledge creation through the speed, memory extension and communication facilities of technology [11]. IT infrastructure integration and KM share communal objectives: to transform organizations so that they become more effective and efficient, agile and innovative and more responsive to market changes [12].

In IS management, IT plays an important role in companies' performance. Although IT can be a conduit for information transfer, it also can introduce risks to confidentiality [13]. IT is a tool that can aid information management (IM) and speed up the information flow in firms. KM supports the information flow (creation, transfer and distribution) in the whole system.

IT and KM in Innovation Process: There is getting more and more open in the innovation process, so that allowing stakeholders to be involved in various phases of the process. Efficiently choosing the 'right' idea remains a challenge, particularly when the number of ideas becomes irresistible [14]. Taking a 'winning' idea up to the implementation phase requires strong collaboration among the various teams involved as well as proper information and KM. It could be thought of an idea as a piece of data that evolves/grows/matures all along the innovation process by gaining some more context, feedback, experimentation (information) until it becomes a prototype (knowledge artifact) and finally a product or service or new process or business model [15, 16].

The key question is: how can the information and knowledge gained through such practical and cognitive activities, as well as through the other phases of the innovation processes, be captured, structured and organized to fully represent the value, potential and risks associated with an idea? Currently, when possible, a portfolio of ideas is used to mitigate such risks but if a better management of internal and external knowledge was performed all along the innovation process we believe that it could strengthen and speed up the innovation process. Moreover technology can play an significant

role to provision and enable the management of knowledge all along the innovation process, mainly when the number of ideas get irresistible (idea overload) [14, 17].

The presence of IT neither guarantees knowledge creation, knowledge distribution nor knowledge use [5]. Knowledge creation has become a key element in business administration. It helps management to adapt and anticipate environmental changes through the development of new products and/or services. IT lets businesses to acquire, process and exchange information. Furthermore, in a KM context, IT can support transformation within and between tacit and explicit knowledge [15, 16].

Consequently, organizations must innovate if they are to survive and compete [1, 20-22]. The ability to innovate and do so smartly (i.e. effectively and efficiently), is a crucial competency that firms have yet to master [23, 24].

IT and KM Challenges: The research results of Nasiri yar and Fahimi [25] show that the most important challenges of applying IT in Iran are linked to factors such as productivity achievement instead of stability differentiation, lack of coordination among investments in IT organizations, the impact on corporate strategy of IT strategy and establishment of IT in traditional structures. Saedi [26] stated that the problems the country is facing with its IT development are: lack of awareness of the senior managers of its capabilities; lack of security of investment in IT; lack of rights provided to software developers; lack of speed and bandwidth; and lack of appropriate culture and attitudes in people, managers, companies, organizations, universities and research centers Moreover, Yeniman Yildirim *et al.* [27] studied enterprise information security. The results have shown that some companies do not attach as much importance to IT security as their counterpart companies in different countries.

In addition, Anvari *et al.* [28] from 30 resources, indentified 12 items as Critical Success Factors of KM, that included: Management and leadership, Organizational culture, Information technology, Training and education, Organizational infrastructure, strategy, Performance measurement, Rewarding and motivation, Processes and activities, Benchmarking, Removal or resource constraints, Human resources management. The most focuses are on leadership, management, Organizational culture and Information technology. Also the least repetitive is related to Human resources management. Furthermore to implementing KM, they categorized the most challenges which are faced organizations are: Organizational strategy, Cohesion between portal and organization structure, portal technology infrastructure, senior manager's commitment and support, High technical complexities of portals, Motivation among users and stakeholders, Knowledge sharing culture, Measuring knowledge. In fact, they are the obstacles, problems,… in organizations.

Methodology: This study uses the survey method. To this end, the viewpoints of professors, administrators, computer and IT experts in nine universities on the research topic were surveyed. The method of doing this kind of research in terms of dependence and solidarity and purpose can motivate the kind of applied method. Gathering data through a questionnaire is developed. Also, the library is used to structure theoretical studies.

In realization of the ultimate goal of research, the research hypotheses are as follows:

- There is a positive relationship between technical core and innovation.
- There is a meaningful relationship between IS and innovation.
- There is a meaningful relationship between administrative management and innovation.
- Between KM and innovation a significant relationship exists.
- There are significant relationships between IT systems and communications networks.

Sample and Data Collection: The views of all lecturers, managers, computer and IT experts in nine universities were investigated. Sample of lecturers was 297 (random sampling) according to the Cochrane formula and there were 91 non-faculty members in the sample; a total of 388 cases have been chosen.

The aim was to collect data from a questionnaire that covers five main substructures. In addition, questions related to the profile of the individuals include: gender, field of study, education and academic units.

Measures of Variables: Variables-Variables in the original research include: system hardware and software, office management and KM as well as sub-variables: gender, academic degree, professional groups, academic units as independent variables and to develop the model is a dependent variable.

Table 1: A demographic of study population from the perspective of statistics

Gender		Field study			Job groups Lecturer			Staff	
Male	Female	Human science	Basic science	Engineering science	PhD	PhD student	MS	Experts	Managers
267	121	150	101	137	134	64	99	28	63
388		388			388				

Table 2: No of sample in universities

		Lecturer		Manager & experts	
Universities	Province	Population	Sample	Sample=population	Total
Shiraz	Fars	190	41	13	54
O-T Fars	Fars	120	28	9	37
Firouzabad	Fars	120	37	11	48
Lar	Fars	110	33	10	43
Marvdasht	Fars	160	39	12	51
Gachsaran	Kohgiluye	130	39	13	52
Yasuj	Kohgiluye	130	38	11	49
Bushehr	Bushehr	170	42	12	54
Total	1130	297	91	388	

Table 3: Kruskal-Wallis test

	Technical core	Administrative core	ISs core	KM core	IT core
Chi-Square	75.68	86.76	70.73	81.57	88.76
df	4	4	4	4	4
Asymp. Sig.	.000	.000	.000	.000	.000

Table 4: Descriptive statistics - five indicators

Five indicators	No	Mean	SD	Minimum	Maximum
Technical systems	388	.4156	.07518	.20	.57
Administrative	388	.3334	.05944	.17	.80
ISs	388	.1974	.04002	.07	.31
KM	388	.5707	.08342	.30	080
Systems of IT	388	.5648	.09032	.28	.93
Total	388	2.08	.642	1	4

Table 5: Results of secondary hypothesis testing

Hypothesis	Used testing	Results
There is a relationship between gender and “IT and KM” development.	"Mann-Whitney U"	sig = 0.648 >0.05 between the attitudes of men and women is no significant difference.
“IT and KM” development in the study groups (faculty and staff) are the same.	"Mann-Whitney U"	sig = 0.006 <0.01, two groups and significant differences between the two groups shows.
“IT and KM” development in the jobs category: managers, experts and lecturer (MS, PhD student and PhD) are the same.	“Kruskal - Wallis”	Sig= 0.048<0.05, between the attitudes of Job groups is difference.
Development of “IT and KM” in education (humanities, sciences and engineering) is similar.	“Kruskal - Wallis”	sig = 0.155> 0.05, between groups in field studies and “IT and KM” development in other fields is similar.
“IT and KM” development is the same among branches of university.	“Kruskal - Wallis”	Sig = 0.071 > 0.05, development in other academic units is the same.

Table 6: Average scores of measuring factors

Factors	Score
Technical	3.45
Administrative	3.12
IS	2.85
IT systems	2.91
KM	3.22
Total average	3.11

Table 7: Viewpoint of participants on various areas

Area	Maximum	Medium	Minimum
Influencing IT in various areas	Financial, educational and research area of university	Managerial fields & graduate student	Administrative & civil
Innovation in IT	Design of tools needed - 43%	Information center - 36%	Information management - 20%
Change to IT development	Technology - 42.5%	Informing - 39%	Tasks / functions - 17.5%
Barriers to IT development	Management issues, cultural - social and human resources		Financial issues
Future orientation	Optimistic - 37%	Moderate - 36%	Pessimistic - 27%

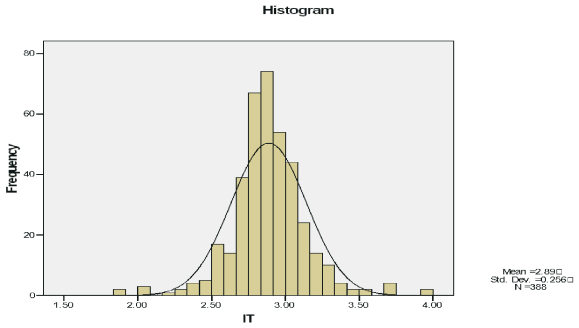

Fig. 2: Distribution of population

Validity: A draft questionnaire was then tested on a sample of 30 people and then minor defects were corrected (80%) and thus the desired questionnaire was prepared to gather information.

Reliability: According to Cronbach's alpha value (79%) we conclude that the validity and reliability of the questionnaire is acceptable.

Tables 1 and 2 show the community sample: the various factions including gender, academic degree and professional groups.

Statistical Analysis: Statistical inference for the conclusion and study population characteristics according to the nonparametric statistical tests of statistical methods Kruskal-Wallis and Mann-Whitney U for analysis of data were used. Descriptive analysis of frequency tables and bar graphs or circles to show results to each of the questions are also used.

Research Results: The histogram chart (Figure 2) considers how the distribution of population improves and because the chart is compatible with the normal curve we consider the population distribution to be normal. To confirm this, the normality test Kolmogorov-Smirnov was done and according to the amount of sig = 0.003 <0.01 significance level 0.01 the normality test was rejected. The Kolmogorov test (Table 3) to test the normal distribution of target samples in this study shows that with sig = 0.007 <0.05 we can assume normal distribution of samples will be rejected.

Analysis of Results

Test Hypotheses: The non-parametric test of Kruskal-Wallis results for the five groups and each of the five Average Development Index organizational structures (technical, administrative, ISs, IT, KM) and all assumptions used are shown in Table 3.

Considering the average ratings in each five groups each five organizational structure development index can be achieved; this result means that everything in each index has a greater realization of feasibility of IT and KM development.

Table 4 shows the development of innovation based on descriptive statistics of each index. So it is clear, with a maximum number of 388 participants in columns 4, 5 and 6, relating to the hypothesis 'IT systems' and the least of them is the third hypothesis (ISs).

Table 5 shows results from nonparametric Kruskal-Wallis tests for each level of grouping in each of the indicators. As can be seen, the highest average ratings are located in Group 4.

According to the Kruskal-Wallis values ??sig <0.01 is that all five indicators are ineffective in developing IT and KM, the significance level 0.01 and 0.99 level of confidence was rejected and all the indicators developed IT and KM. Results of secondary hypothesis testing are shown in Table 5.

Descriptive Statistics: Most scores relate technical scoring average (3.45) and lowest scoring average information (2.85). In this connection, the technical core (3.45), knowledge-based core (3.22) and administrative core (3.12) are above the average whereas the information core (2.85) is lower than average. The average score of 'applying the IT systems' is mean 2.91 with a total average of 3.11 (Table 6).

Also, a few questions on influencing IT, innovation in IT, change in IT development, barriers to IT development and future orientation are presented in Table 7.

According to Table 7, the most influential areas of IT are seen in the financial, educational and research areas of the university. Innovation in the three items was evaluated at 43% in design of tools and techniques needed 36% innovation in the information center and 20% covers information management.

Furthermore, change in IT development based on three factors including tasks, informing and organizational technology were studied: rate of 42.5% in enterprise technology, 39% in informing and 17.5% the tasks / functions of the importance of IT development. The most important barriers to IT development are management issues, cultural, social and human resources, for the time being financial issues is the minimum obstacle.

Additionally, for investigating future orientation, results showed that not only are 27% pessimistic but also less than half had optimistic attitudes. These findings indicate that most respondents are not hopeful about the development of IT in the university.

DISCUSSION

The advocate took on this study in order to develop the Swanson model in KM based on a survey in universities and to distribute it to the academic community.

According to the findings (Table 3), all of the main hypotheses were accepted. The findings support: Technical core, Administrative core, ISs core, IT core and KM core to innovation system. Moreover, the average scores of measuring factors show that the highest scores belong to the technical core (3.45) and then the KM core (3.22) (Table 6). Likewise, the results showed that there is no meaningful significant relationship between “gender, the study groups, field study and branches of university” and “IT and KM” development. Meanwhile there is a significant meaningful relationship between job groups and IT/IS development.

Knowledge creation has become a key element in organizations. It helps management to adapt and anticipate environmental changes through the development of new products and services. IT allows organizations to obtain, process, store and exchange information. So in this new situation, IS plays an important role in organizations’ performance. Although IS can be a conduit for information transfer, it can also introduce risks to confidentiality. Therefore, IT is a tool that can aid IM and speed up the information flow in firms. KM supports the information flow in the whole system.

CONCLUSION

In this research the technical core factors account for the highest average that represent the main cause of changes in technology and rapidly changing era of globalization. However, the concept of KM in the second rank as a factor in the transformation taking place among the factors in the transformation is recognized.

It seems that one of the most important barriers in IT development in universities is their concentrated structure although the structures have now been decentralized. However, a review to identify solutions to reduce this barrier is required in order to reach the main index factor of globalization.

Also, the reviewed sub-variables indicate a lack of correlation between gender, education level and IT development. The findings indicate that with a centralized management structure, roles and even managerial groups and individual units in the development of IT are weak. So management needs to move toward acceptance of globalization and its dynamic components for development.

Recommendation: According to the findings, a suggestions and solutions to increase the effectiveness of IT and KM are:

- Further research on the role of IT and KM issues in innovation development.
- Giving importance to the theoretical debates surrounding the causes of development of IT and KM in universities, to raise competitiveness and quality of training process.

ACKNOWLEDGMENT

We would like to thank I.A.U. especially Gachsran Branch for the support provided.

REFERENCES

1. Chesbrough, H., 2003. Open Innovation: the new imperative for creating and profiting from technology. Harvard Business School Press.

2. Anvari, A.R., G.A. Alipourian, R. Moghimi, L. Baktash and M. Mojahed, 2011. An assessment of Knowledge Management (KM): A consideration of information, culture, skills and technology. African Journal of Business Management, 5(28): 11283-11294. DOI: 10.5897/AJBM10.1069.
3. Swanson, E.B., 1994. "Information Systems Innovation Among Organizations," Management Science, 40(9): 1069-1092.
4. Booth, M.E. and G. Philip, 2005. Information systems management in practice: An empirical study of UK companies. International Journal of Information Management, 25: 287-302.
5. Ruiz-Mercader, J., A. Luis Merono, O.C. Ramo and S.S. Nchez, 2006. Information technology and learning: Their relationship and impact on organisational performance in small businesses. International Journal of Information Management, 26: 16-29.
6. Gunasekaran, A., P. Love, F. Rahimi and R. Miele, 2001. A model for investment justification in information technology projects. International Journal of Information Management, 21: 349-364.
7. Chou, S., 2003. Computer systems to facilitating organizational learning: IT and organizational context. Expert Systems with Applications, 24: 273-280.
8. Tiwana, A., 2002. The knowledge management toolkit: Orchestrating IT, strategy and knowledge platforms. Englewood Cliffs, NJ: Prentice-Hall.
9. Choi, B. and H. Lee, 2003. An empirical investigation of KM styles and their effect on corporate performance. Information and Management, 40(5): 403-417.
10. Gold, A., A. Malhotra and A. Segars, 2001. Knowledge management: An organizational capabilities perspective. Journal of Management Information Systems, 18(1): 185-214.
11. Baroni, R. and M. Araujo, 2001. Using information technology to support knowledge conversion processes. Information Research, 7: 1. http://informationr.net/ir/7-1/paper118.html.
12. Mustafa Kamal, M., 2011. The case of EAI facilitating knowledge management integration in local government domain. International Journal of Information Management, 31: 294-300.
13. Pereira, J.V., 2009. The new supply chain's frontier: Information management. International Journal of Information Management, 29: 372-379.
14. Lindic, J., P. Balohb, V.M. Ribièrec and K.C. Desouza, 2011. Deploying information technologies for organizational innovation: Lessons from case studies. International Journal of Information Management, 31: 183-188.
15. Lyytinen, K. and G. Rose, 2003. The disruptive nature of information technology innovations: the case of Internet computing in systems development organisations, MIS Quarterly, 4: 557-595.
16. Scupola, A., 2003. "The Adoption of Internet Commerce by SMEs in the South of Italy: An Environmental, Technological and Organizational Perspective," Journal of Global Information Technology Management, 6(1): 51-71.
17. Xu, S., K. Zhu and J. Gibbs, 2004. "Global Technology, Local Adoption: A Cross-Country Investigation of Internet Adoption by Companies in the United State and China," Electronic Markets, 14(1): 13-24.
18. Lopez, D., 2010. A case analysis of semantic technologies for R&D intermediation information Management. International Journal of Information Management, 30: 465-469.
19. Stair, R. and G. Reynolds, 2010. Principles of Information Systems: a managerial approach, 9th edn, Course Technology Cengage Learning, Boston, Massachusetts.
20. Drucker, P.F., 1986. Innovation and entrepreneurship: practice and principles. New York: Simon and Schuster.
21. Porter, M.E., 1990. The Competitive Advantage of Nations. New York: Free Press.
22. Desouza, K.C., C. Dombrowski, Y. Awazu, P. Baloh, S.R.P. Sangareddy, S. Jha and J.Y. Kim, 2009. Crafting Organizational Innovation Processes. Innovation: Management, Policy & Practice, 11(1): 6-33.
23. Pohle, G. and M. Chapman, 2006. IBM's global CEO report 2006: business model innovation matters. Strategy & Leadership, 34(5): 34-40.
24. Jaruzelski, B. and K. Dehoff, 2010. The global innovation 1000: how the top innovators keep winning. Strategy+Business, 61: 1-14.
25. Nasiri yar, M. and M. Fahimi, 2006. Identifying challenges of applying information technology in Iran. Tadbir Journal, Industrial Management Organization, pp: 167.

26. Saedi, M., 2001. Manufacturing and production under web and its requirements in Iran. International conference of electronic deployment in Fars province. Shiraz. Iran. pp: 29-31.
27. Yeniman Yildirim, E., G. Akalp, S. Aytac and N. Bayram, 2010. Factors influencing information security management in small-and medium-sized enterprises: A case study from Turkey. International Journal of Information Management, Elsevier Ltd. All rights reserved. doi:10.1016/j.ijinfomgt, 2010.10.006 (Kabul edildi).
28. Anvari, A.L., G.A. Alipourian R. Moghimi and L. Baktash, 2011. Towards Evaluating Knowledge Management Through the Five Pointers. APCEMaL 2011-29th November - 1st December, The Legend Hotel Kuala Lumpur, Malaysia.