Modeling For Valuing Knowledge as Perceived by Business Managers Using Statistical Tools

Muhammad Syed-ul Haque[1,*], Irfan Anjum Manarvi[2], Memoona R. Khan[3], Afaq Ahmed Siddiqui[4] and Shameel Ahmed Zubairi[5]

[1]*Department of Engineering Management, Center of Advanced Studies in Engineering, Islamabad, Pakistan*

[2]*College of Engineering, Prince Sultan University, Riyadh, KSA, Saudi Arabia*

3*Department of Engineering Management, Center of Advanced Studies in Engineering, Islamabad, Pakistan*

[4]*Department of Pharm. Chem., Faculty of Pharmacy, University of Karachi, Karachi, Pakistan*

[5]*KUBS, Faculty of Management Sciences, University of Karachi, Karachi, Pakistan*

Abstract: Knowledge is a valuable asset as it brings success and sustainability to the organizations. Till recently, the value of an organization is determined from its financial statements. These statements are historical in nature and contain the book value of physical assets, hence do not depict the true worth of an organization. The future revenue/profit from the organization depends upon its capability to make best use of its assets. This depends on the quality of knowledge an organization possess and its capability to use that knowledge asset. Therefore, knowledge is the most important asset in an organization. However there is no financial statement or business document that shows the volume and value of knowledge present in the organization. Hence, it is critical to determine the value of knowledge to ascertain true worth of an organization.

This research study attempts to present factors that influence the value of knowledge during its life cycle. Data were collected through interviews and questionnaire instrument was used to get subsequent data from 521 business managers working in various industries. The collected data was subjected to various statistical tools to evaluate the factors and their hypothesis. The twenty two factors identified initially were first analyzed for their verification and authenticity. Later each item was regrouped through the Rotated Component Matrix analysis – first order for meaningful set of factors. Based on the result of second order Rotated Component Matrix analysis, all the newly identified factors were finally grouped into two groups of factors that influences the value of knowledge. These groups were: 'Efforts' and 'Business'. The integration of 'Efforts' and 'Business' factors forms the Knowledge Value Wheel (KVW) that helps in defining the "Knowledge Value Line" (KVL). The KVL depicts the value of knowledge at any given time. The KVL and KVW combines to form the "Knowledge Value Life Cycle" (KVLC).

The findings will help further research in the area of knowledge management. Managers would be able to differentiate most valuable and useful knowledge asset for effective management. Need for further R&D on critical knowledge can be identified. It would also be beneficial to the investors in determining the true worth of an organization in terms of its knowledge asset.

Keywords: Knowledge Management, Value of Knowledge, Knowledge Lifecycle, Knowledge Value Line, Knowledge Value Wheel, Knowledge Value Lifecycle.

INTRODUCTION

The competitive market environment has moved from physical factors to the internet enabled information based intangible factors [1]. As a result, knowledge has become strategic resource [2], making its effective and efficient management a challenge to organizations [3].

The future profitability is dependent upon the knowledge possessed by the organization and its capability to make best use of its knowledge assets. It is difficult to ascertain the monetary value of knowledge present in the organization, therefore, there is a clear need for an empirical research to determine potential of a knowledge to generate future revenue.

Benya *et al*., presented summary of knowledge life cycles [4]. However, monetary value of knowledge was never discussed [5], therefore literature on this subject is very limited. The researcher believes, that the absence of understanding about the factors that impacts the value of knowledge is the reason for knowledge being not valued. To begin with, the researcher first identifies the literature available on the factors that are used in ascertaining value of tangible assets like products and services. The factors found were: 1. Competitive advantage, 2. Attracting investment, 3. Intellectual capital, 4. Human capital, 5. Intellectual property right, 6. Knowledge Protection, 7. Business Process Improvement (BPI), 8. Work instruction, 9. Problem solving, 10. Transfer of

*Address correspondence to this author at the Department of Engineering Management, Center of Advanced Studies in Engineering, Islamabad, Pakistan; Tel: 92-333-2275042; E-mail: syedpim@yahoo.com

knowledge, 11. Market awareness, 12. Communicating cost, 13. Cost of generating new knowledge, 14. New product development, 15. New services development, 16. Product Improvement, 17. Services Improvement, 18. Number of users, 19. Monetary benefit, 20. Personal benefit, 21. Individual time spent in creating new knowledge, and 22. Total time spent in creating new knowledge. Analysis of these 22 factors reveal that not all of these factors are applicable to value the knowledge. Therefore, this research study attempts to identify factors that influences the value of knowledge from the perceptions and believes of business managers having masters' degree, mainly MBA, and are also responsible for knowledge management activities in their organization.

CONCEPTUAL AND THEORETICAL BACKGROUND

Renner defined 'value' as estimated market worth of commodities and services. An intangible asset like software has a license, and license has a fee. This fee is considered as a value of that software [6]. However, employee expertise and tacit knowledge are difficult to value. So far there is no specific unit available to measure the value of knowledge, as there are units available to measure distance, height, volume, revenue and expenses.

The value chain model helped in developing 'Knowledge Value Chain' [7] which to some extent assisted in understanding and handling the knowledge resources. However, quantifying any increase or decrease in workers knowledge has remained an issue because knowledge resides in the human minds [8].

Knowledge may not be useful initially in its lifecycle [9], but further development makes it beneficial. When beneficial, it is given some value. Therefore, knowledge has to continuously evolve and grow itself to supplement its ability to arrive and remain useful and hence become valuable.

Now, it is clear that knowledge has certain value, previous studies show lack of direct focus on the subject. The researcher believes that the identification of factors which can impact on the value of knowledge should be identified as a first step in determining the value of knowledge. The findings would be universally applicable to all sorts of businesses across the globe.

Hypothesis

The twenty two variables were cross checked through unstructured interviews with business managers. These managers were selected from the organizations listed in Karachi Stock Exchange (KSE). Requests for interview with manager having responsibility of knowledge management or similar were sent to 72 firms. Only 36 interviews were conducted. All the interviewees agreed on the need of valuing knowledge. They also believe that the identified 22 variables have impact on the value of knowledge. They were of the opinion that the list need to be refined on the basis of some empirical study. The researcher grouped the 22 variables into 7 constructs based on their logic, concepts and similarity in nature. Separate hypothesis were built to test the validity of each construct.

1) Strategic Advantage {Competitive advantage, Attracting investment}*:* Being multiplicative in nature, knowledge offers competitive and strategic advantage to the organization [10]. Therefore, business organizations are always attracted to new and innovative knowledge. Managers in business organizations are willingly attracted to help academia for research through funding. As a result they expect new knowledge for their innovative products. So a regular flow of funding and knowledge gets established between the two. Thus we can hypothesize:

Hypothesis 1: The knowledge will be valued high if it gives strategic advantage.

2) Benefit to the Creator/Acquirer of the Knowledge {Intellectual capital, Human capital, Intellectual property right, Protection of new knowledge}: Ability to develop new products is dependent on intellectual capital of the firm [11]. Organizations always value their human capital. The law of Intellectual Property Right gives protection against misuse of vital concepts [12]. Therefore we can hypothesize:

Hypothesis 2: The knowledge will be valued high if it benefits its creator/acquirer.

3) Business Process Improvement (BPI) {Business process, Work instruction, Problem solving}: BPI brings improvement in work instructions, which are guides for workers to organize and perform task systematically, effectively, and professionally [13]. Problem solving is an activity of resolving issues through data processing which often results in development of new knowledge. Therefore we can hypothesize:

Hypothesis 3: The knowledge will be valued high if it helps in business process improvement.

4) Cost of Creating and Communicating Knowledge {Transfer of knowledge, Market awareness, communicating cost, Cost of generating new knowledge}: Knowledge transfer requires communication process. It incurs various costs like, interruption in the communication process, social, and technical cost, etc., [14]. Sometimes organization advertises about their research results or acquisition of new technology/knowledge to develop potential customers for their incoming new products and services. Acquisition or development of new knowledge is critical for survival and growth and incurs cost [15]. Thus we can hypothesize:

Hypothesis 4: The knowledge will be valued high if its creation and communication incurs cost.

5) Outputs in the form of Products and Services {New product development, New service offered, Improvement in products, Improvement in services}: Innovation is a dynamic, complex and multidimensional process that impacts on productivity [16]. Therefore, development of new products/services is an exercise of information processing. This leads to industrial sector growths which are linked with financial reforms [17]. Both, industrial growth and financial reforms, are dependent on knowledge. Therefore we can hypothesize:

Hypothesis 5: The knowledge will be valued high if it brings new or improved products/services.

6) Benefit to the Knowledge User {Monetary benefit, Personal benefit}: Presence of huge beneficiaries of a knowledge makes it valuable. Boeing Company has served huge number of travelers and airlines through its aircrafts, and that suggests that the knowledge Boeing has is of high value for stakeholders of aviation industry. Involvement, commitment, and engagement at the job has impact on employee motivation and benefits [18]. Therefore we can hypothesize:

Hypothesis 6: The knowledge will be valued high if it is beneficial to the user.

7) Time Period Involved {Individual time, Total time}: Time spent, research funds available, research facilities, networks ties, professional training and education, level of personal motivation, environment for research, and the research outputs are few of the criterions for the quality of research work [19]. Often, when the duration of research activity increases, its cost also increases. Thus, we can hypothesize:

Hypothesis 7: The value of knowledge increases as the duration of its research increases.

RESEARCH DESIGN

To test the 7 hypothesis, a field survey method was adopted using a convenient sample. A questionnaire was developed with 52 items to empirically test the 7 constructs. Multiple evaluation technique was used to improve the reliability and validity of the measure. In the light of the feedbacks from academicians, and experts during seven pretests, a 3 point questionnaire having "Agree", "Neither Agree Nor Disagree", and "Disagree" in scale was finalized. With Cronbach's alpha value of 0.8983 the test-retest was 0.968, the instrument was found reliable and measuring the same construct. Taking responses from 521 respondents minimized the chances of Type I and Type II errors.

The sample size for this study was business managers with MBA degree. They were 93 out of total 521 respondents. They all were trainees of various management training programs at Pakistan Institute of Management (PIM).

ANALYSIS AND RESULTS

Overall, majority of the respondents (60% approx.) has validated the relationship between each item and variables. Only 17% didn't validate the relationship between the items and the variables, rests were neutral.

Frequency Analysis

Results of frequency analysis shows most of the items were validated by the respondents for having impact on the value of knowledge, thus establishing the fact that developed constructs have impact on the value of knowledge (Table **1**). However, we have a mixed result at item levels. This means our initial grouping of items into variables and constructs needs to be revised. This requires us to use dimension reduction factor analysis using *varimax* rotation at item level.

Reliability and Validity of Measurement Instrument

Results of Standard deviation analysis remained between 0.90 and 0.241 indicating the concepts are well covered by the respective items. The mean value of all the items was greater than 2.0, an indication of respondents' agreement regarding the relationship mentioned in each items. With alpha value of 0.05 and

Table 1: Frequency Analysis of Responses on the Basis of Each Item, Variable and Construct

Construct	Variable from the Past Literature	Items No.	Response Agree %
1. Strategic Advantage Agree:70.75% NAND:20.26% DA:6.55%	1. Competitive Advantage (Agree:88.15%)	1	94.6
		2	81.7
	2. Attract Investment (Agree:52%)	3	68.8
		4	48.3
		5	38.7
2. Benefit to the Creator/ Acquirer Agree:52.55% NAND:29.90% DA:14.71%	3. Intellectual Capital (Agree:67%)	8	86.0
		9	63.4
		10	51.6
	4. Human Capital (Agree:51.3%)	23	86.0
		24	8.6
		25	83.0
		26	27.9
	5. IPR (Agree:42%)	40	45.1
		41	38.7
	6. Knowledge Protection (Agree:64%)	47	66.7
		48	61.3
3. Business Process Improvement Agree:70.46% NAND:20.46% DA:6.7%	7. BPI (Agree:75.6%)	16	46.2
		17	90.3
		18	90.3
	8. Work Instructions (Agree:55.3%)	19	64.5
		20	46.2
	9. Problem Solving (Agree:83.3%)	21	84.9
		22	81.7
4. Cost of Creating and Communicating Knowledge Agree:36.61% NAND:28.76% DA:32.54%	10. Transfer of Knowledge (Agree:24.3%)	11	26.8
		12	26.8
		13	19.3
	11. Market Awareness (Agree:67.1%)	14	54.8
		15	79.5
	12. Cost of Communicating Knowledge (Agree:25.4%)	27	24.7
		28	20.4
		29	31.2
	13. Cost of Generating New Knowledge (Agree:37.6%)	30	45.1
		31	30.1
5. Outputs in the form of Products and Services Agree:78.37% NAND:16.56% DA:13.35%	14. New Products Development (Agree:78.9%)	32	79.5
		33	78.4
	15. New Services Development (Agree:79.5%)	34	80.6
		35	78.4
	16. Product Improvement (Agree:80%)	36	81.7
		37	78.4
	17. Services Improvement (Agree:79.5%)	38	81.7
		39	77.4

(Table 1). Continues

Construct	Variable from the Past Literature	Items No.	Response Agree %
6. Benefits to the Knowledge User Agree:66% NAND:20.24% DA:11.48%	18. Number of Users (Agree:68.7%)	6	76.3
		7	61.2
	19. Monetary Benefit (Agree:78.4%)	42	76.3
		43	80.6
	20. Personal Benefits (Agree:61.6%)	44	40.8
		45	64.5
		46	79.5
7. Time Period Involved Agree:36.3% NAND:36% DA:25.03%	21. Individual Time (Agree:37%)	49	40.8
		50	33.3
	22. Total Time (Agree:28%)	51	25.8
		52	30.1

NAND = Neither agree nor disagree.
DA = Disagree.

df=2, the chi square analysis values are all greater than 5.991. The KMO value is 0.772 (higher than 0.50) and Bartletts test of Sphericity had the significance value less than 0.05 indicates the suitability of data for structure detection and factor analysis. Content validity of the survey instrument was established by adopting instruments that had already been used and validated in previous literatures with good reliability measure. The items were discussed with industry experts and academicians. It was unanimously decided that all items confirm to the face validity and criterion validity. Since each factor was measured via multi-item constructs, an item analysis and factor analysis was conducted to validate the scales.

Convergent validity, the degree to which multiple attempts to measure the same concept is in agreement, was evaluated by the item-to-total correlation; meaning, the correlation of each item to the sum of the remaining items. Majority of the items has convergent validity greater than 0.5, however few has less than 0.5 but they are with other items having greater than 0.5 values in the same factor therefore they can be neglected. The multicollinearity was applied to check if the data is appropriate for the study. All the 52 items have Variance Inflation Factor (VIF) less than 3.1 and tolerance value greater than 0.30. Finally, the discriminant validity was assessed via factor analysis by items for each variable was loaded onto single factor. Again higher than 0.5 values confirms the unidimensionality among the items.

Analysis Approach

The correlation remained between 0.70 and -0.291 with majority lying between 0.2 and -0.01 indicating no significant correlation among the concepts present in the items. Only three items had correlation values between 0.70 and 0.81.

The –2log likelihood value demonstrate that the overall model was significant at a level of 0.001. Cox and Snell, pseudo R-square values for McFadden, and Nagelkerke were 0.966, 0.730, and 0.976 respectively. Larger values of the pseudo R-square explain that the model proposed in this study fits the collected data. Items having Communality value 0.50 or greater were considered for analysis. Using principle component analysis for extraction, only 17 items have Eigen values greater than 1.00. However first 8 items makes the cumulative percentage 50. 34. Higher values of chi-square shows strong relationship of each item with the basic concept i.e., value of knowledge. From principle component method using varimax rotation 17 components were finalized and loading was performed. Out of 17 components, only 7 have three or more than three loadings. These factors are related to the value of knowledge at significance levels of 0.05, 0.01, and 0.001. The result of rotated component matrix regrouped the items into 7 variables (Table **2**).

Based on the concepts and meanings behind each items, the newly formed 7 variables were named as:

1.   *Duration:* This variable describes the duration spent in acquiring or generating knowledge.

2.   *Cost:* This variable includes all sorts of cost involved in knowledge transfer and acquisition.

3.   *Product Improvement:* This variable defines aspects of improvement in products, and profitability enhancement.

4.   *Process Improvement:* This variable constitutes elements of process improvement through work instructions, problem solving, and better decision making through new knowledge.

5.   *Training:* This variable outlines the difficulties in acquiring new knowledge through training.

6.   *Improvement in Services:* This variable describes the improvement in services, and new services offered.

7.   *Beneficiaries:* This variable sketches the beneficiaries of knowledge. The benefits could be recognition, reward, profit, or satisfaction.

The correlation analysis shows that there is no relationship between the 7 variables. The KMO measure for sample adequacy was 0.500 which is acceptable for second order Factor Analysis. With Eigen value set for 1.0, four components makes the total Cumulative Variance 57.143. The Rotated Component Matrix procedure produced two Components/Factors in Second Order Factor Analysis. The two Factors were named as: 1. Efforts, and 2. Business, based on the concept and the meanings behind each variables inside the two factors (Table **3**).

Table 3:   Rotated Component Matrix[a]

	Component			
	1	**2** **Efforts**	**3** **Business**	**4**
Process Improvement	-.663			
Duration		.788		
Products Improvement		.518		
Cost			.793	
Beneficiaries	.513		.546	
Improvement in Services				.767
Training				

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
[a]Rotation converged in 9 iterations.

Results from Data Analysis

All the items of the survey instrument were found relevant to the value of knowledge. The initial analysis proved that the factors taken from the valuation of tangible assets are not one hundred percent applicable to value the knowledge. For example, "Strategic Advantage" is considered as important factor for valuing tangible assets however it was eliminated for

valuing knowledge. On the other hand, "Training" is never considered a factor in valuing tangible asset however it was found critical for valuing knowledge.

DISCUSSION

The Second Order Factor Analysis produced two factors, "Efforts" and "Business" that has impact on the value of knowledge. The "Efforts" constitutes all the elements that are related to the acquisition of knowledge. This mainly involves time, which is a limited and precious resource. The time consumed in research to develop new knowledge, time consumed in transferring knowledge, and time involved in using that knowledge in bringing improvement in products, all are important for an organization. Since transferring knowledge is difficult and challenging, there is a risk of information loss. Higher the risk, higher would be the challenge, thus more efforts would be put in to develop, acquire, transfer, and use the knowledge, and therefore more worthy would be the knowledge. The second factor identified is "Business". This includes the investment made or expense incurred today in order to achieve profit/benefit in the future. These investments/expenses are made with the help of certain knowledge that predicts profit/benefit in the future. In business, cost is incurred to gain benefit/profit in the future. This concludes that knowledge is an asset having certain value, and are used to generate revenue for organization and benefits to individuals. Since money is critical resource [14] when used to acquire knowledge, that amount becomes the cost of knowledge.

Analysis of data or knowledge regarding customers demand are driving force behind the technical progress and innovation in product design innovation [20] and creation of new value added services [21]. New value added products and services would satisfy customers, and will produce revenue to the organizations. All these Efforts are part of Business activities, and are factors that can impact on the value of knowledge. Hence, 'Effort' and 'Business' can be used to value the knowledge.

Knowledge Value Life Cycle (KVLC)

The proposed model of KVLC is composed of two parts: Knowledge Value Wheel (KVW) and Knowledge Value Line (KVL). The 'Efforts' and 'Business' forms the KVW. The wheel travels in time from left to right thus drawing the Knowledge Value Line (KVL) (Figure **1**).
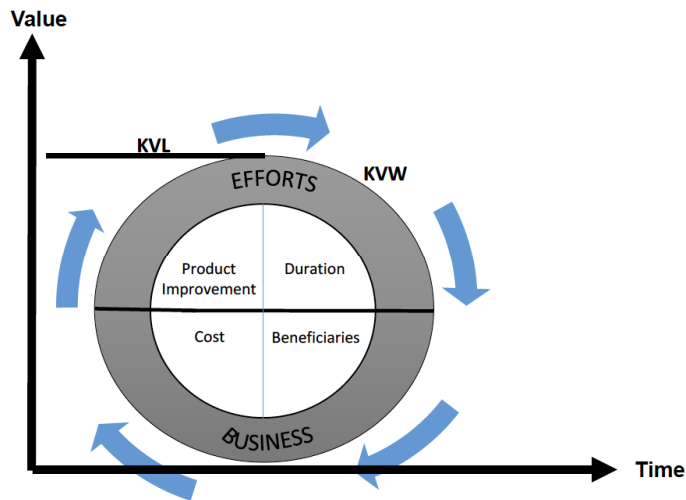
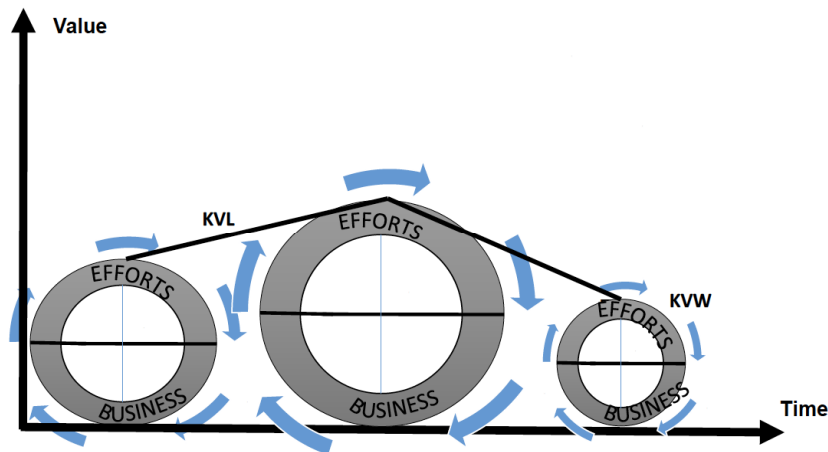**Figure 1:** Knowledge value life cycle (KVLC) and knowledge value line (KVL).

Figure 2: Effect of factors on the value of knowledge.

When factors are strong, they will inflate the wheel, which will draw the KVL high. The wheel tends to shrink when the factors are weak, thus the KVL will be drawn low. "Improvement in Product" due to some "Efforts", will exert pressure towards outside, thus enlarging the wheel, hence drawing the KVL higher. When number of beneficiaries' decreases, the factor will lose its pressure, thus the wheel will shrunk and the KVL will be lowered (Figure **2**). As the wheel moves in time from left to right with its inflation or deflation, the value of knowledge line gets drawn.

CONCLUSION, CONTRIBUTION AND LIMITATION OF THIS STUDY

First, this study would probably serve as a gateway for valuing the most important asset in the organization i.e., knowledge. The two factors: 'Efforts' and 'Business' were identified which impacts on the value of knowledge and thus can be used to ascertain true

worth of a knowledge. Certainly, this will lead to better management of knowledge. Second, organizations would be able to identify reasons for increase/decrease in their worth. This leads to measures needed for maintaining their competitive position. Third, these factors would help in ascertaining future prospects of new knowledge. Fourth, organization can classify its knowledge assets among the two factors for better management and productivity. For instance, new knowledge developed after considerable efforts need to be safeguarded as they can be used with minimal or no changes by other organizations. However, knowledge gained or acquired after incurring high cost can be advertised for possible future business advantage and good will development. Similarly, knowledge related to product improvement is specific to the industry and should not be open to competitors. Knowledge related to 'Business' could be strategic in nature because it may contain information about customers and their behaviors. And knowledge regarding cost of product or

services produced need to be safeguard as it may hurt the competitiveness of the organization.

There are some limitations as well as opportunities for future research. First, this study comprise of cross sectional research. Longitudinal research overtime is suggested to track changes in the value of knowledge by the impacts of these factors. Second, findings are equally applicable to organizations worldwide therefore it is suggested that similar sort of study may be repeated in other parts of the world to verify the findings. Further, this study represents the opinion of business managers having MBA degree. There are possibilities of different result with respondents having diverse educational background. One potential research area would be the formulization of inter-relationships between the factors. This may lead to development of a mathematical equation for calculating the dollar value of knowledge.

REFERENCES

[1]   Varadarajan R, Yadav MS, Shankar V. First-Mover Advantage in an Internet-Enabled Market Environment: Conceptual Framework and Propositions. Journal of the Academy of Marketing Sciences 2008; 36(3): 293-308.
http://dx.doi.org/10.1007/s11747-007-0080-y

[2]   Feher P. Combining Knowledge and Change Management at Consultancies. The Electronic Journal of Knowledge Management 2004; 2(1): 19-32.

[3]   Blumentritt R, Johnston R. Towards A Strategy For Knowledge Management. Technology Analysis & Strategic Management 1999; 11(3): 287-300.
http://dx.doi.org/10.1080/095373299107366

[4]   Benya H, Passiante G, Belbaly NA. Corporate Portal: A Tool for Knowledge Management Synchronization. International Journal of Information Management 2004; 24: 201-220.
http://dx.doi.org/10.1016/j.ijinfomgt.2003.12.012

[5]   Haque MS, Manarvi IA. Knowledge Value Life Cycle (KVLC): Determining Parameters of Valuing Knowledge. International Journal of Knowledge, Culture and Change Management 2010; 10(1): 205-220.
http://dx.doi.org/10.18848/1447-9524/CGP/v10i01/49900

[6]   Renner W. Human Values: A Lexical Perspective. Personality and Individual Differences 2003; 34(1): 127-141.
http://dx.doi.org/10.1016/S0191-8869(02)00037-5

[7]   Holsapple CW, Singh M. The Knowledge Chain Model: Activities for Competitiveness. Expert Systems with Applications 2001; 20(1): 77-98.
http://dx.doi.org/10.1016/S0957-4174(00)00050-6

[8]   Krogstie L, Sindre G, Jorgensen H. Process Models Representing Knowledge for Action: A Revised Quality Framework. European Journal of Information System 2006; 15: 91-102.
http://dx.doi.org/10.1057/palgrave.ejis.3000598

[9]   Birkinshaw J, Sheehan T. Managing the Knowledge Life Cycle. IEEE Engineering Management Review 2003; 31(3): 75-83.
http://dx.doi.org/10.1109/EMR.2003.24901

[10]   Mesaric J. Knowledge Management – Necessity and Challenge in Small and Medium Enterprise. 26th International Conference on Information Technology Interfaces, Iti 2004; Cavtat, Croatia, June 7-10.

[11]   Chen Y, James LM, Chang C. The Influence of Intellectual Capital on New Product Development Performance - The Manufacturing Companies Of Taiwan As An Example. Total Quality Management & Business Excellence 2006; 17(10): 1323-1339.
http://dx.doi.org/10.1080/14783360601058979

[12]   Woker T. Principles of Copyright in Intellectual Property Law: An Overview. Critical Arts 2006; 20(1): 35-46.
http://dx.doi.org/10.1080/02560040608557775

[13]   Malet L, Reynaud M, Llorca PM, Falissard B. Impact of Practitioner's Training in the Management of Alcohol Dependence: A Quasi-Experimental 18-Month Follow-Up Study. Substance Abuse Treatment, Prevention, and Policy 2006; 1(18).

[14]   Ye Y, Nakakoji K, Yamamoto Y. Reducing. The Cost Of Communication And Coordination In Distributed Software Development, In Bertrand Meyer & Mathai Joseph. (Ed.) Seafood, Lncs 4716. Springer 2007; 152-169.

[15]   Xu Y, Elgh F, Erkoyuncu JA, Bankole O, Goh Y, Cheung WM, Baguley P, Wang Q, Arundachawat P, Shehab E, Newnes L, Roy R. Cost Engineering For Manufacturing: Current And Future Research. International Journal of Computer Integrated Manufacturing 2011.

[16]   Tang J, Le CD. Multidimensional Innovation and Productivity. Economics of Innovation and New Technology 2007; 16(7): 501-516.
http://dx.doi.org/10.1080/10438590600914585

[17]   Wizarat S, Hye Q. Financial Reforms And Industrial Sector Growth: Bound Testing Analysis For Pakistan. South East European Journal of Economics and Business 2010; 5(2): 75-81.
http://dx.doi.org/10.2478/v10033-010-0017-0

[18]   Shaheen A, Farooqi YA. Relationship Among Employee Motivation, Employee Commitment, Job Involvement, Employee Engagement: A Case Study Of University of Gujrat, Pakistan. International Journal of Multidisciplinary Sciences and Engineering 2014; 5(9): 12-18.

[19]   Tien FF. To What Degree Does The Desire For Promotion Motivate Faculty To Perform Research? Testing the Expectancy Theory. Research in Higher Education 2000; 41(6): 723-752.
http://dx.doi.org/10.1023/A:1007020721531

[20]   Guo C. Liu Y, Hou S, Wang W. Innovative Product Design Based On Customer Requirement Weight Calculation Model. International Journal of Automation and Computing 2010; 7(4): 578-583.
http://dx.doi.org/10.1007/s11633-010-0543-3

[21]   Lee J, Ali MA. Innovative Product Advanced Service Systems (I-Pass): Methodology, Tools, and Applications for Dominant Service Design. International Journal of Advanced Manufacturing Technology 2010.