International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-2, July 2019

# A Conceptual Model for Effectiveness of Knowledge Management Systems

**Abdul Rahman .A, Justus Selwyn**

***Abstract:*** ***Knowledge Management System (KMS) is a collective process of organizational knowledge from capturing to dissemination. The three fourth of world's corporate market value resides today in assets such as intellectual property, customer data, financial records, strategies and trade secrets. These assets are all knowledge based. KMS becomes inexorable to achieve competitive advantages in this present information and communication technology epoch. However Lack of effectiveness in knowledge Management System is turmoil to any organization due to its integrated domain. But an effective KMS can helps to organization to achieve tremendous benefits such as competitive advantages, innovation, leadership, social values, increased customer satisfactions, quality in product, financial credibility and people values, So knowledge management system needs to consider significant views such as technical, functional, people and organization image for effectiveness. Almost all the research works related to quality model for KMS are limited in views. This paper proposes an effectiveness framework which includes significant quality dimensions and variables to measure each. This paper also includes empirical validation using data collected from three sectors: nuclear power production, Electrical equipment manufacturing and software industry for suitability analysis through statistical method. We considered primary variable from each identified dimension to analyze the suitability of KMS with 25 knowledge workers in each sector through five parameters: Completeness of product, Customization of process, Ontology standard, Applicability of KMS content, and Decision making ability.***

***Index Terms:*** ***Knowledge Management System, Suitability of KMS, Cronbac's Alpha value, Completeness, Customization, Applicability, Ontology standard, decision making.***

## I. INTODUCTION

An importance of KMS increasing day by day in every sectors not only for tremendous benefits but also to avoid various issues such as loss of key personnel ,lack of communication among stakeholders due to geographically distances, lack sharing quality practices among employees. So quality based KMS is in need rather than successful. We have proposed an effectiveness framework for KMS, which includes a quality, based success model and factors to measure all its quality dimensions and constructs. This is a first work towards design of quality based success model prior to its previous works whereas the success models in literature are developed based on dimensions without measures. The proposed effectiveness framework consists of five dimensions and measures: Management /Leadership support, Product Quality, Process Quality, User Satisfactions and Net / Perceived benefits. The suitability of framework is validated statistically using data collected from three different sectors (nuclear power production, Electrical equipment manufacturing and software industry) with 25 knowledge workers in each sector through five parameters: Completeness of product, Customization of process, Ontology standard, Applicability of KMS content, and Decision making ability. An instrument tool is developed with respect to these parameters and each consists of 4, 8, 5, 5, 6 questionnaires respectively, annexure I. Shows list of questionnaires. The Medcalc application is used to calculate Cronbach's Alpha of KMS to compare suitability before and after using our framework. Rest of the paper is presented as follows. Section 2 presents an effectiveness framework for KMS, the parameters for suitability are discussed in section 3. Section 4 and section 5 describes research methodology and conclusion of work respectively.

**Revised Manuscript Received on 30 July 2019.**
***** Correspondence Author
**Abdul Rahman .A**, School of Computer Science and Engineering,, VIT University, Chennai, India.
**Justus Selwyn** , School of Computer Science and Engineering,, VIT University, Chennai, India.



## II. KMS EFFECTIVENESS FRAMEWORK

Almost all industries using some form of knowledge to achieve competitive advantages in their field, such as intellectual properties, customer data, financial records, strategies and trade secrets, Moreover Knowledge Management systems(KMS) becomes inevitable to every industry due to rapid chance in technologies, customer expectation, loss of key personals and non volatiles in market strategies. But knowledge management system needs to consider significant aspects such as technical, functional, people and organization image for effectiveness. Almost all the research works related to quality model for KMS are limited in views. The KMS development and usages is reaches to new edge due to its important, tremendous benefits and support of recent technologies such as big data, cloud computing. As stated in [1*]* Knowledge management (KM) is gaining importance in the business world as one of the critical enablers for innovation. But KMS has great deal of challenges in making it as effective instead of success, since effectiveness of KMS is an ability to meet stakeholders (end users, Management, Knowledge workers, developers, experts *etc)* expected quality of system in efficient way. However successful KMS need not to be effective but vice versa is not true. So it is necessary to develop a effectiveness framework which helps the knowledge workers to develop and customize KMS. So we are motivated to propose the effective quality model, which can include significant quality dimensions by incorporating above mentioned aspects with product,

process, people and values views. An integration diagram of KMS's effectiveness as shown in figure 1.

The proposed framework is developed with consideration of significant quality dimensions and measures to ensure effectiveness in technical, functional, organizational and people perceptions are summarized in table 1.

**Table 1. Proposed Effectiveness Framework for KMS**

| Product quality | Process Quality | User Satisfaction | Net Values | Organizational Quality |
|---|---|---|---|---|
| Completeness<br>Maintainability<br>Flexibility<br>Effectiveness<br>Adaptability<br>Security<br>Interoperability<br>(knowledge/concept Map Quality)<br>Scalability<br>Accessibility | Accuracy<br>Uniformity (Ontology)<br>Availability<br>Concurrency<br>KM Strategies<br>Enrichment | Customization<br>Timeliness<br>Reliability<br>Fault-Tolerance<br>Relevance<br>Heuristic/New knowledge<br>Solvability(Decision Making)<br>Portability<br>Applicability<br><br>Understandability<br>Provability<br>Simplicity | Efficiency<br>Value ability<br>Openness<br>Audit | Reward System<br>Communication<br><br>Experience & Involvement of Knowledge workers<br><br>Suitability of Experts<br>Training Culture to Learn and Share<br><br>Willingness of Management<br><br>Manageability |

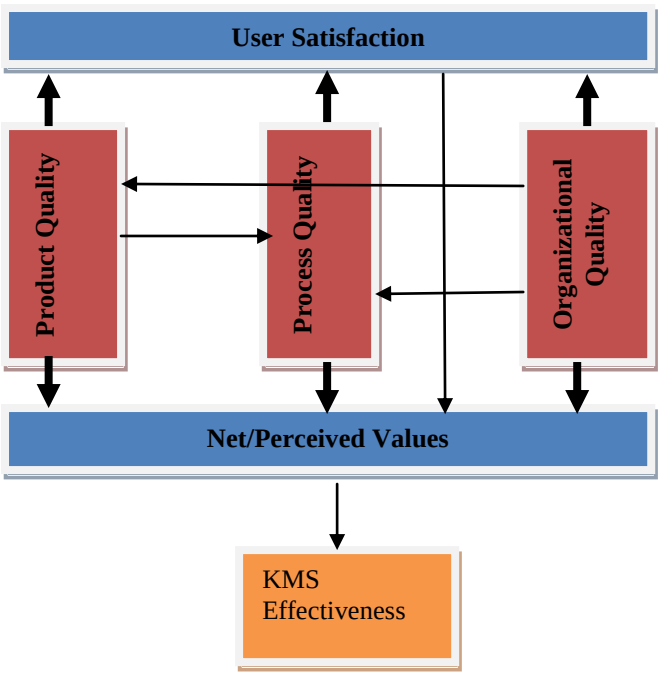


**Fig 1. Integration of Dimensions for KMS Effectiveness**

## III. FITNESS OF KMS

KMS Quality Model provides the basis through which it is possible to control and improve processes, there are Different reasons have been raised for the necessity of measurement [2][3][4]: determine the results of knowledge practices on business results and objectives; provide a scoreboard to monitor performance levels; To determine what to pay attention to and improve; To give an indication of bottlenecks and the cost of poor implementation; To give a standard for making comparisons, To provide enthusiasm and support for KM by measurable success. As stated in [5] if a model is used as a predictor, "it is used like a calculator to provide clear and concise predictions about the system". our proposed quality model suitability is validated using four variables : Completeness- An evaluation of system in terms of goal and implementation, Customization – the requirement of resource for implementation, Applicability – the value attained using system and Ontology – the standard to support different knowledge management systems. The case studies were conducted with knowledge workers in different carder for the period of 6 months of interval. The test is conducted in the month on August '2018 and January 2019. Product view related factors are assessed using completeness as variable with 4 questionaries, since some KMS can helps to only particular organization's process instead of all. User satisfactions considered into account for KMS effectiveness using 8 questionnaires and measured based on customization. Applicability of KMS contents are measured using 5 different questionnaires. The structures of knowledge to support different repositories are assessed using ontology with 5 questionnaires. Finally, the capability of KMS in an organization to support different task for decision making are assessed with decision making variables using 6 questionnaires. Reliability (fitness) of proposed quality model for KMS is validated using Cronbac's alpha values through MedCalc Software. This test to determine whether indicators in the latent variables are fit to represent the variables. Cronbach's Alp[illegible] be defined as : Given variable $x_1$, ..., $x_k$ and $x_0 = \sum_{j=1}^{k} x_k$, Cronbac's alpha is:

$$\frac{k}{k-1}\left(\frac{\sum_{i\neq j}^{k} cov(x_i, x_j)}{var(x_0)}\right) = \frac{k}{k-1}\left(1 - \frac{\sum_{j=1}^{k} var(x_j)}{var(x_0)}\right)$$

Here, K is the number of items, $cov(x_i, x_j)$ the factor loading of item i and $Var(x_0)$ the variance of the error of item i as shown in figure 2. This test is to determine whether indicators in the latent variables are suit to represent the variables or not.

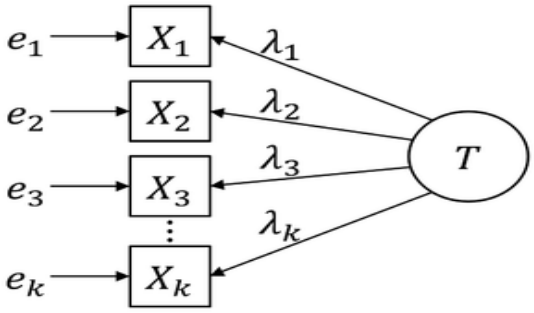


**Fig 2. Factors loading correlation between latent variables.**

## IV. RESEARCH METHODOLOGY

### Survey Instrument and sample Setting

The studies were conducted in three different sectors (nuclear power, Manufacturing and software development) with knowledge workers in different carder for the period of 6 months of interval. Reliability of proposed quality model for KMS is validated using Cronbac's alpha values through MedCalc Software,

results are shown in below tables. Empirical test were conducted in the month on August '2018 and January 2019. Product view related factors are assessed using completeness as variable with 4 questionaries, since some KMS can helps to only particular organization's process instead of all. User satisfactions considered into account for KMS effectiveness using 8 questionnaires; it is measured based on customization. Applicability of KMS contents are measured using 5 different questionnaires. The structures of knowledge to support different repositories are assessed using ontology with 5 questionnaires. Finally, the capability of KMS in an organization to support different task for decision making are assessed with decision making variables using 6 questionnaires. The measuring instrument of KMS fitness is presented in annexure I.

**Selection of Variables for Data collection**

More and more organizations undertaking KM initiatives and incorporating KM strategies into their overall business strategy to ensure the success of organizations in terms of financial indicators, this contribution is being progressively examined. But knowledge management system needs to consider significant aspects such as technical, functional, people and organization image for effectiveness. Almost all the research works related to quality model for KMS are limited in views. So we are motivated to propose the effective quality model, which can include significant quality dimensions by incorporating above mentioned aspects with product, process, people and values views.The suitability of KMS is majorly dependent on five variables:

*Completeness*- degree to which KMS meets expectation of users in order to solve or simplify its organizational problems.
*Customization:* It deals with required amount of resource and understandability of Generic KMS to adapt into working environment.
*Applicability:* Concern with quality of KMS content, but unfortunately there is no direct measure to ensure the quality of KMS content so we need to consider indirect measures such as perceived benefits, individual benefits and organization growth etc.
*Ontology Representation*: this variables helps to measure the quality of ontology standard to support various knowledge repositories such as explicit (unstructured Knowledge) and implicit knowledge (insight of human).
*Decision Making:* it an ability of KMS to helps users in decision making.
We considered above variables to analyze the suitability of KMS using data collected from three different sectors (nuclear power production, Electrical equipment manufacturing and software industry) with 25 knowledge workers in each sector through five parameters: Completeness of product, Customization of process, Ontology standard, Applicability of KMS content, and Decision making ability.

**Electrical Equipment Manufacturing Company(EEMC)**
one of the largest engineering and manufacturing companies of its kind in India engaged in design, engineering, construction, testing, commissioning and Servicing of a wide range of products and services with over 180 product Offerings to meet the ever- growing needs of the core sectors of economy.This test to determine whether indicators in the latent variables are fit to represent the variables. Test can be conducted using Cronbac's alpha value. The Cronbac's alpha values of proposed model before and after implementation using MedCalc Software are as table 2. The results show that there is a positive sign in improvement of KMS effectiveness.

**Table 2. Cronbac's alpha of Proposed Framework in EEMC**

| Applicability of KMS(Knowledge) | Cronbach's Alpha (Before Quality Model) | Cronbach's Alpha (After Quality Model) |
|---|---|---|
| Completeness(product) | 0.338 | 0.49 |
| Customization(user) | 0.625 | 0.784 |
| Applicability of KMS(Knowledge) | 0.732 | 0.874 |
| Ontology (process)Representation | 0.644 | 0.709 |
| Decision Making(organizational) | 0.601 | 0.689 |

**Department of Atomic Energy (DoAE)**
The organization is a second largest establishment of the Department of Atomic Energy next to Bhabha Atomic Research Centre, was set up at Kalpakkam, 80 KMs south of Chennai [MADRAS], in 1971. It is a part of the second stage of Indian Atomic Energy Programme, which is aimed at preparing the country for utilization of the extensive Thorium reserves and providing means to meet the large demands of electrical energy in 21st century. We conducted survey with 25 knowledge worker who are directed involved in their KMS in two interval .the results of system before implementation and after implementation of proposed quality framework as in table 3.An applicability, customization, decision making ability of KMS are not significantly improved, but ontology standard is supported in result.

**Table 3. Cronbac's alpha of Proposed Framework in DoAE**

| Quality Factors | Cronbach's Alpha (Before Quality Model) | Cronbach's Alpha (After Quality Model) |
|---|---|---|
| Completeness(product) | 0.27 | 0.371 |
| Customization(user) | 0.406 | 0.412 |
| Applicability of KMS(Knowledge) | 0.822 | 0.836 |
| Ontology (process)Representation | 0.291 | 0.371 |
| Decision Making(organizational) | 0.472 | 0.477 |

**Software Development Company (SDC)**
The company helps business and technology leaders drive transformations through simple and effective techniques using Cloud-Infrastructure, Analytics, and Digitalization & Security. Company bring a holistic understanding of issues and opportunities, the team has experience of over 2,500 successful global client engagements powered by innovative,

futuristic methodologies. The test shows that Applicability, completeness, customization, ontology quality are increased in stipulated time interval as 0.485, 0.318, 0.583, 0.277 respectively as shown in table 4.

**Table 4. Cronbac's alpha of Proposed Framework in SDC**

| Quality Factors | Cronbach's Alpha (Before Quality Model) | Cronbach's Alpha (After Quality Model) |
|---|---|---|
| Completeness(product) | 0.124 | 0.318 |
| Customization(user) | 0.379 | 0.583 |
| Applicability of KMS(Knowledge) | 0.183 | 0.485 |
| Ontology (process)Representation | 0.191 | 0.277 |
| Decision Making(organizational) | 0.5 | 0.51 |

## Conclusion

This work has considered five dimensions for the proposed framework: product quality, process quality, Organizational Quality, user satisfactions and Net values. An empirical validation of framework is conducted with five parameters such as completeness, customization, applicability of knowledge, ontology standard and Decision making. The data are collected from three different sectors (nuclear power, Manufacturing and software development) with knowledge workers in different carder for the period of 6 months of interval that is in the month of August '2018 and January 2019. Moreover the investigation shows that our proposed quality framework positively associated with effectiveness of KMS in Manufacturing and software development sectors. The limitation of this study is, considered limited number of knowledge workers in each sector and secondly KMS in social sectors such as medical, educational and service are not considered to analysis our model suitability. An investigation on Knowledge representation tools using ontology and Petri nets to develop conceptual model for knowledge representation quality is considered as the future of our research work.

## REFERENCES


1. Muhammad Jahanzaib Yousaf et. Al, Impact of Knowledge Management on Innovation: Evidence from a South Asian Country, *Journal of Information &Knowledge Management Vol. 17, No. 3 (2018).*
2. Ahmed, P.K., Lim, K.K., & Mohamed Zairi, M. (1999). Measurement practice for knowledge management, Journal of Workplace Learning: Employee Counselling Today, 11(8), 304–311.
3. Ahn, J., & Chang, S. (2004). Assessing the contribution of knowledge to business performance: The KP3 methodology. Decision Support Systems, 36, 403–416.
4. Liebowitz, J., & Suen, C.Y. (2000). Developing knowledge management metrics for measuring intellectual capital. Journal of Intellectual Capital, 1(1), 54–67.
5. Seddon, P.B., and Kiew, M.-Y. A partial test and development ot the DeLone and McLean model of IS success. In J.I. DeGross, S. Huff, and M. Munro (eds.), Proceedings of the Twelfth International Conference on Information Systems. New York: ACM Press, 1994, pp. 99-1 10.
6. *M*edCalc Software, https://www.medcalc.org/download.php
7. Murray E. Jennex, Re-Examining the Jennex Olfman Knowledge Management Success Model, Proceedings of the 50th Hawaii International Conference on System Sciences, 2017.
8. Uday R. Kulkarni, Sury Ravindran, And Ronald Freeze, A knowledge management success model: theoretical development and empirical validation Journal Of Management Information Systems/ Winter 2006-7, Vol. 23, No. 3, Pp. 309-34
9. Nor'ashikin Ali et al., Knowledge management systems success in healthcare: Leadership matters, International Journal of Medical Informatics, Elsevier,2017.
10. Lin, H.F. "A Stage Model of Knowledge Management: An Empirical Investigation of Process and Effectiveness", Journal of Information Science, 33(6), 2007, pp. 643-659.
11. Budiardjo, E. K., Pamenan, G., Hidayanto, A. N., Meyliana, & Cofriyanti, E., The impact of knowledge management system quality on the usage continuity and recommendation intention. Knowledge Management & E-Learning, 9(2), 200–224, 2017.
12. Murray E. J., S. Smolnik, and D. Croasdell, "Towards Measuring Knowledge Management Success", Proceedings of the 41st Hawaii International Conference on System Sciences.2008.
13. Mei-Hsiang Wang*, Tarng-Yao Yang, Investigating the success of knowledge Management: An empirical study of small and medium-sized enterprises, Asia Pacific Management Review 21 (2016) 79-91.
14. Sewchurran, N., M. O. Kosheek, M. Ndlovu, and A. Pillay, "Assessing the Application of the Knowledge Management Success Paradigm in South Africa", Communications of the IBIMA, Vol. 3, 2008.
15. Andersen, A., and C.S. O'Dell, "Knowledge Management: Consortium Benchmarking Study: Final Report", American Productivity and Quality Center, 1996. [18]. Nor'ashikin Ali et al., Knowledge management systems success in healthcare: Leadership matters, International Journal of Medical Informatics, Elsevier,2017
16. Nor'ashikin Aliet al., Knowledge Management Systems Success Model for Higher Education Institutions: A Partial Least Square Approach, Knowledge Management International Conference (KMICe) 2016.
17. Zheng W., B. Yang, G. N. McLean, "Linking Organizational Culture, Structure, Strategy, and Organizational Effectiveness: Mediating Role of Knowledge Management", Journal of Business Research, Vol. 63, 2010, pp. 763-771.
18. Chen, L.,"Individual-level Antecedents Influence Knowledge Management Effectiveness", Journal of Knowledge Management Practice, Vol. 10, No. 2, 2009.


## Annexure I. Measurement Instrument

**Product –Completeness**
1: KMS is easy to change
2: KMS is meeting intended needs
3: KMS is supportive in most environments
4: KMS is not easy to misuse

**Process -Customization of KMS**
1: KMS's functions and its purpose are easy to understand
2: I am satisfied with query handling and its inference
3: The response time of KMS is acceptable
4: I am satisfied with customization tools in KMS
5: I am satisfied with maintainability of KMS in order fulfilling its specific Function.
6: Service abort by KMS is reasonable
7: KMS is user friendly during user error
8: I am satisfied with effort requirements to migration of KMS to new work group.

**Knowledge- Applicability**
1: I am satisfied with proposed solution of KMS to my organizational problem.
2: Relation between knowledge in KMS and problems are satisfactory
3: KMS provides adequate support to solve problems
4: Number of problems solved is greater than attended.
5:KMS_SP1: Knowledge in KMS is up-to-date(enrichment)

**KMS-Ontology Standard**
1: Reasoning to fetched knowledge is acceptable (Reasoning)
2: KMS understandability of its content is satisfactory (Heuristics)
3: Representation of knowledge in KMS support different system (Semantic)

4: KMS's functions and its purpose are easy to understand
5: I am satisfied with query handling and its inference

**Decision Making**

1: KMS helps me to better decision making
2: KMS helps me in new or better way of working
3: I use KMS to communicate with colleagues
4: KMS helps me to empower my working skills
5: I use KMS to enhance to enhance collaboration
6: KMS helps be to share best practices in domain related people

## AUTHORS PROFILE

**AbdulRahman.A** obtained his Master of Engineering in Computer Science and Engineering from Sathyabama University, India in 2007. His previous appointment includes lecturer in King Khaled University (Ministry of Higher Education) Kingdom of Saudi Arabia, and worked as a Software Engineer at GrapeWyne Dot Company, Bhopal, India. Currently, He is working as Associate Professor at the Faculty of Computer Science and Engineering in Godavari Institute of Engineering & Technology, Rajahmundry (Affiliated to Jawaharlal Nehru Technological, India).. His current research interests are Knowledge Engineering, Open source Software Quality Assurance and Information Retrieval Systems.

.

**Dr. Justus Selwyn** is a PhD in computer science, specialized in software engineering and knowledge engineering. His specializations include Software Engineering, Metrics, Object-Relational modeling, and knowledge engineering. His is heading the software& knowledge engineering research group and is working as Associate Professor at the School of Computing Sciences and Engineering, VIT University, Chennai. He is the co-founder of a software consulting company, Inclefs, which is into product engineering and development. He has research publications in reputed journals and has regular consultancy works with tie-ups with software companies in Chennai.