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ARCHITECTURE KNOWLEDGE FLOW FRAMEWORK DESGIN

[1*] MUSTAFA S.KHALEFA, [2*] MARZANAH A.JABAR, [3] RUSLI HJ ABDULLAH, [4] SALFARINA ABDULLAH

[1] University Putra Malaysia (UPM), Department of Software engineering & Information System ,Faculty of Computer Science &Information technology, 43400 Selangor, Serdang, Malaysia, Computer Science, Education College for Pure Science, Basra University, Iraq
[2,3,4] University Putra Malaysia (UPM), Department of Software engineering & Information System ,Faculty of Computer Science &Information technology, 43400 Selangor, Serdang, Malaysia

[1]mustafakhalefa@gmail.com, [2]marzanah@upm.edu.my , [3] rusli@upm.edu.my , [4]salfarina@upm.edu.my

ABSTRACT

Flow of Knowledge pertains in most teamwork and it attracts the researchers in the field of knowledge management. Since flow of knowledge usually happens in a particular context, context has to be taken into consideration in knowledge flow modeling. Past models of flow of knowledge lacked in terms of software development and lacked in-depth exploration of context modeling, which made those models less applicable. This research proposes a conceptual framework of context oriented flow of knowledge in software development aspects. In this framework, the context is seen as an inseparable element of flow of knowledge, which is regarding the creation, transformation as well as application of knowledge items. Framework KFFD is proposed based on three aspects- flow of knowledge, software development project and ontology. For the proper use of knowledge, dynamic flow to destinations form sources is necessary. In this context, a new framework in KM is analyzing, designing and implementing knowledge flow management systems. One crucial challenge in such systems is the exploration of flow of knowledge from its origin to the receiver. Another challenge is controlling the flow for quality enhancements regarding the requirements of the users. As such, the aim of this research is to provide a framework so as to solve this challenge.

Keywords: *knowledge flow, knowledge flow framework design, type of knowledge flow, knowledge flow management.*

1. INTRODUCTION

In the case of knowledge oriented organizations, knowledge employees have to gain a set of information (knowledge) regarding their activities [1]. As such, many firms have developed knowledge support mechanisms for assisting their employees in fulfilling their knowledge related requirements. Such mechanisms enable the employees to find out as well as share knowledge for fastening organizational innovation and enhancing employee productivity [2,3]. Studies associated with the formulation of knowledge needs together with knowledge provision streamlining have got prevalent more since the value of knowledge supports is getting enhanced [4,5,6,7,8,9]. Rapid technological changes and reduced time cycle for problem solving in present intense knowledge surroundings has paved the way to emphasize teamwork [10,11]. For instance, research & development practices usually have many knowledge intensive activities which have to be finished within a specific period of time. Such activities are normally done via inter-function collaboration. Via expertise integration as well as aspects of different people, teams can have immediate responses to interdisciplinary issues and improve quality of decisions,

Thereby giving a holistic remedy. Due to their separate activities at work, most members of the team have varying knowledge-needs; which makes them expend significant effort in knowledge search and synthesis for gaining the needed task related knowledge [12, 13]. One main issue of collaborative knowledge support is the lowering of this expense of effort. With the help of knowledge flow mapping, firms can give task related knowledge to employees which aid the workers to satisfy their knowledge needs fast and in effective way [14]. A Knowledge Flow (KF) indicates a

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person's or a group member's flow related to their knowledge requirements and the referencing order of codified knowledge in performing activities of the organization. KFs are an upcoming hot subject of discussion in the field of KM and many studies have built KF models for illustrating Knowledge Sharing (KS) within knowledge workers [3, 14, 15, 16, 17, 18, and 19]. For instance, scholars in the field of science suggested new ideas via content publishing form a KF in science [20]. Existing ideas in a research paves the way for further new ideas for other researchers as a means of inspiration, and the association established among them leads to citation chain. Certain researchers have studied KS by process definition where knowledge is being transformed between members of the team [18,21,and 19]. Other scholars have emphasized on discovering KFs by assessing employee's knowledge requirements; the outcome proved support to KS where the codified knowledge gets available for employee recommendations [14]. One disadvantage of these researches is that same knowledge support is given to entire team and its members in the case of conventional models; i.e., they take into consideration of the knowledge needs of individuals which results in an environment of collaborative nature. This research expands the past studies via understanding how to increase traditional KF models for satisfying workers' varying knowledge requirements. The issues in team environment of collaborative nature are significant and they pose different obstacles to KFs [22, 23]. Among them, one is the low effectiveness as well as bad communication. Members of the team with varying task functions need various conceptual extents of knowledge so as to perform their tasks as well as communicate among them. For instance, workers require certain knowledge for performing their job activities as well as general knowledge for communicating with other employees whose activities at work vary from their work. Via considering the various conceptual extents of knowledge during identifying individual knowledge requirements, this research suggests a KF View (KFV) model which targets for generalizing knowledge concepts as well as derives KFVs; as such, the model has the ability to serve various knowledge requirements. KFV is derived from a base KF and it is a virtual KF that is engaged in order to extract the knowledge concepts. The novel KFV model of this research utilizes a sequence-preserving method and a generalization mechanism of knowledge concept for extracting certain Knowledge Nodes (KNs) in a base KF, whereby developing virtual knowledge nodes corresponds to the separate knowledge requirements of various employees. The suggested KFV model enhances knowledge support in work setups of collaborative team work nature and provides contents to the literature on KF. Knowledge is a crucial asset in today's organizations. Effective KM can to a great extent enhance the creativity and competitiveness of organizations [24, 25]. hoards of knowledge have less value; only the knowledge which gets active processing in the mind of an individual via a process of reflection, enlightenment, or learning is seen as useful. Knowledge creation, transfer and its application can result in sustainable competitive advantages [26]. As such, the research on KF received more attention these days. KF focuses on KM processes and the parties who are part of the processes, that is reflected in different phases of knowledge lifecycle management. KFM is for enhancing the efficiency as well as efficacy of knowledge processing in an environment of collaborative knowledge management. Even though knowledge of organization is a crucial asset of organization, maintenance of major knowledge resources is not always advantageous to the organizations, as knowledge is a rare asset of which the value increases when it is being used [27]. Hence, dynamic KF from the origins to receivers is necessary for effective knowledge utilization [28]. As a result, the ultimate goal of KM systems is effective KF and application of the transferred knowledge in the activities. Past studies on KM mostly concentrated on organizational learning as well as on giving course of actions and systems for encouraging members of communication, whereby it gave less significance for their efficiency as well as efficacy of KS, particularly knowledge routing in a geographically distributed team [29].

2. RELATED WORK

Knowledge is a major asset for ensuring sustainable competitive advantage in the fast paced technological and globalized modern world [30, 31, 32, and 33]. To achieve success in such an environment, employees got to apply knowledge in an effective manner for properly conducting knowledge based operations as well as management tasks [34, 35, and 21]. KM forms the foundation principles of creating, organizing, transferring as well as applying knowledge within the firms [21] and is identified as an important practice which enables firms for surviving in a knowledge economy in the present world [37]. The aim of KM is supporting workers in attaining their knowledge

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requirements, via closing the gap among their knowledge and the requirements by different activities [38, 39, and 40]. Researchers have indicated that precise as well as timely knowledge support is a crucial system for enhancing productivity as well as work effectiveness [41, 35]. In task based organizational mechanisms, activities are performed in work processes. The active provision of task based knowledge and context information is important for enhancing employees' productivity. For meeting this provision, options that combine Information Retrieval (IR) and Work flow Management Systems (W f M S) are in existence. They proactively give task-related knowledge as per the context of tasks [42, 43]. For instance, using the process definitions, Know More systems derive task profiles which aid knowledge provision [42]. The Flow-Wiki system was proposed by a wiki oriented method for agile management of work flows as well as effectively giving crucial information to participators [44]. As such, participants of the process can collect knowledge which pertains to the application context of the present process and/or task profiles. For fulfilling knowledge requirements of the workers, KFs provide relationships between knowledge sources. Via KFs, employees can effectively collect knowledge from such sources in order to perform tasks [36]. KFs indicate the order of knowledge requirements and/or the sequence of referring documents when employees do tasks. KFs aid KS and can be reused in both business as well as R&D environments. For instance, Huge [21] showed in a distributed organization, a KF within its software development team. Here, , the KF carried and gained knowledge from one member of the team to another for sequential KS. Similar KS can happen in one citation chain where scientific researches, knowledge get exchanged in between. In this context, the main paper's citation is a KF which emits knowledge among researchers and gives inspiration for new ideas [46].Different KF models have been proposed in various researches. Luo et al. [46] proposed the Textual Knowledge Flow (TKF) from a semantic related network. The goal of TKF was to put forward appropriate browsing platforms for users upon evaluation of their interests as well as contributions. Lai and Liu [48] proposed a time sequencing KF model for showing the order of knowledge referencing behaviors of employees. The workers gained appropriate knowledge for fulfilling their knowledge requirements via the KFs identified in data access logs. Kim et al. [36] developed the KF model using a process based method for capturing, storing and transferring knowledge. Zhang et al. [49] used Petri-Net for modeling KF. A knowledge node was used for generating, learning, processing, understanding, synthesizing and delivering knowledge based on four different flow relations: creating, merging, replicating and broadcasting. Zhao and Dai [49] combined business processes and KFs and segregated them into order, distribution, and combination as well as own reflection sets according to RAD (Role-Activity-Diagram). Anjewierden et al. [50] proposed in online blogs, the order of referencing may be considered as KFs. He further mentioned that these mechanisms can be considered as a model of sender-message-receiver system. KF as well as knowledge-based planning prompt related ideas regarding knowledge embedding while developing models. Knowledge-based planning is defined as a method of planning engaged for identifying an order of tasks done by many agents under given existing conditions and resource constrains for attaining ultimate goals [51]. The method comprises of acquiring knowledge, validating it, planning domains' knowledge maintenance, adopting proper knowledge oriented planning tools for developing planning models [51]. For instance, R-Moreno et al. [52] used a planning and scheduling platform and a work flow modeling tool in order to plan a model of telephone installation workflow. For acquitting related knowledge, including prior existing conditions, resource constrains and ultimate goals the tool was used. Planning and scheduling platform was utilized for converting knowledge into planning standard expressions. A knowledge oriented planning mechanism can be engaged for managing the outcome of planned activities for fulfilling preconditions of other tasks. Chow et al. [53], for instance came up with a Strategic Knowledge-Based Planning System (SKPS) which integrated rules related to knowledge with models in mathematics for formulating combined loading shipment plans. Via SKPS, planners of the shipment could get, validate as well as retain knowledge regarding shipment domain, and as such develop a combined loading shipment planning model where buyers could use the model's knowledge for performing activities efficiently. As shown by these examples, building planning models are emphasized by knowledge-based planning in order to solve problems or performance of tasks. Knowledge flow studies leads to the building of KF models to the corresponding activities' plan of execution (or work flow

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processes) which paves foundation for knowledge provision, sharing as well as transferring [47,21].
KFs can be derived via access logs of mining employees [47] or they can be specified by KF modelers as per their experience in doing the corresponding workflow process [18, 19]. Apart from such approaches, knowledge related planning mechanisms can complement KF research via aiding researchers build the proper KFs and models which corresponds to plans of task execution. Ontology is common method used for capturing as well as representing knowledge within a firm [54, 52, 55]. It's a conceptualization mechanism which gives definition for knowledge concepts in a particular domain as well as constructs a hierarchical structure for describing their interlink [56]. Ontology supports a general understanding within the whole organization for facilitating storage of knowledge, its retrieval as well as synthesis [57]. For instance in ontology, the usual terminologies and knowledge concepts can enhance the problem-solving capability as well as efficiency within a SC [58]. The knowledge concepts that are derived from Wikipedia articles together with categories are yet another example of the same that can be used for predicting contents of documents [59]. Weng and Chang [60] came up with a research document recommendation system that explored ontology for constructing user profiles, and used the profiles for illustrating researchers' interests. Afacan and Demirkan [61].presented an ontology-oriented worldwide design support for supporting researchers in the stage of conceptualization; it undertakes ontology for processing and representing the needed knowledge. Ontology is a versatile paradigms illustrated by these examples that is applicable in varying domains. In the recent time, business process modeling is greatly applied for streamlining business administration and for facilitating cooperation within and between organizations. Business process modeling is the design, analysis and execution of business processes [62].]. It aims to describe a group of tasks that can be done in order, as well as for allocating resources and arranging jobs optimally via analysis of technological environments and organizational environments [63]. With the help of engaging proper modeling mechanisms, business process modeling can provide templates that are pre-defined which enable organizations for enacting their business processes with efficiency and effectiveness. In an organizational setup business operations' flow are described by organizational processes. Workflow Management Systems (WfMS) are tools of definition and execution which aids these operations [57]. In reality, members who involve in a workflow require flexibility in workflow model that is able of giving proper process information [38,64]. Due to the increasing complex nature of business processes and because of various participants, it is advantageous for the firms to give definitions for virtual processes and varying views of the workflow [65, 67, 64, and 21]. Liu and Shen [66] proposed a concept of process abstraction, a novel one: the process-view. It is an abstracted process which is derived from a base process for giving generalized process information. The process-view is derived by an order-preserving method, which makes sure that the original sequence of activities in the base process is preserved. This research has similar such ideas for generating knowledge-flow views from a base knowledge flow, whereby the knowledge referencing sequence is maintained.

3. THE ELEMENT OF KNOWLEDGE FLOW

KF indicates the dynamic sides of knowledge processing, and is seen in different phases of knowledge lifecycle management. For example, in creation of knowledge, its storage and retrieval transfer as well as application stages. Moreover, KF shows the cooperation between the parties involved in knowledge processing, e.g., team members usually share previous knowledge and develop new knowledge in distributed team software development. Apart from this, knowledge flow has to take place in certain context. In certain sense, KF detached from related context will have less of applicability, and cannot support making of informed decisions and execution of sensible actions. As such, the concept of the element of the KF is proposed below: KF is the dynamic process happening among knowledge-processing parties and in some context wherein related knowledge is created, transformed, propagated as well as applied. Another description of KF as per [21] is a procedure of distributing knowledge among people or knowledge processing mechanisms.

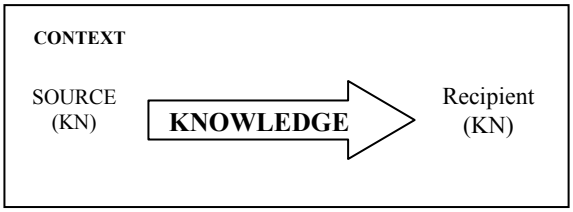

Figure 1 Element Of Knowledge Flow

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As per KF definition above it contains 4 elements as follows:

Source and Recipient (KN): Source of knowledge (sender) and the recipients. (customer) is the 1stelement, named as Knowledge Nodes (KNs). KNs probably correspond to team member or an executor who is capable of creating, processing, and delivering knowledge.

Knowledge: Illustrates certain sharable knowledge contents that are processed in KF.

The link of source and recipient (direction) of KF: In reality the source and recipient can be the same knowledge processing participant. I.e., KF can be due to the knowledge source's trigger which is termed as 'push strategy' It can also be prompted via a request for knowledge from the recipient which is termed as 'pull strategy'.

Context: It indicates the application environment where the KF takes place. KF without a common shared context between KNs is not possible to take place. In other words, it is essential that both the source as well as the recipient has a common apprehension of knowledge to have a successful KF [21, 69].

4. TYPE OF KNOWLEDGE

As per the multidimensional nature of knowledge, many scholars have categorized organizational knowledge from various points of views. Knowledge is categorized into three categories from one such perspective: tacit, explicit and implicit. A group of knowledge is achieved via experience, apprentice with a master as well as long talks with experts. Such knowledge is normally acquired unconsciously over a long time. Mainly individual skills such as pottery, programming, etc. belong to this group. Such knowledge that is hard to explicitly express, is termed as tacit knowledge [70, 71, and 72]. Explicit knowledge is a clearer class of knowledge when compared with tacit knowledge and can be documented easily. This class is transmitted via formal languages, mathematical equations, logic, rules, procedures and symbols. They can be described and shared as documents, manuals, programs as well as knowledge representation languages [70, 71, 72]. Apart from these two classes of knowledge, another class considered by some scholars is termed as, implicit knowledge [70, 73]. Implicit Knowledge can be externalized when needed but has not been externalized yet [73]. Framework and model of Nonaka [73, 75] gives a rationale for using knowledge-creation activities for generating group knowledge via engaging individual team members in process enhancement projects. The framework illustrates the process of knowledge creation as conversion cycles between explicit and tacit knowledge types.

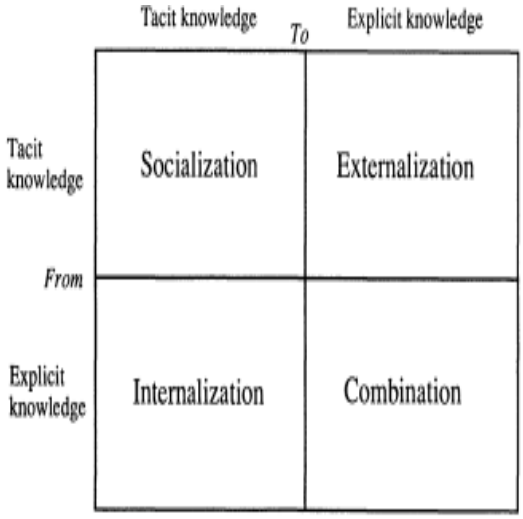

Figure 2 Nonaka's Framework And Model

Socialization (tacit to tacit): sharing of tacit knowledge via face-to-face communication or shared experience. Apprenticeship is an example.

Externalization (tacit to explicit): development of concepts, that embeds the combined tacit knowledge, and of its communication enabling.

Combination (explicit to explicit): various elements of explicit knowledge's combination. Prototype development is an example.

Internalization (explicit to tacit): learning by doing is closely associated with this. The explicit knowledge becomes a portion of the individual's knowledge base (example: mental model) and becomes an organizational asset.

5. PROBLEM DEFINITION

Basically, there is much time since the needed knowledge of a KN is found till the knowledge can be delivered in reality; particularly if the identification is based on the work context information given by the project management System. It is believed that the explicit knowledge's quality can be enhanced concerning the needs of users in the time constraint, utilizing tacit as well as implicit knowledge of the associated Experts. The goal of the knowledge quality is the

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Extent of relevance and effectiveness of knowledge to the task or the need of the recipient. As such this study introduces the framework design KFFD. For the firms with distributed knowledge base, proper knowledge would be given to right person at right time. Right time is the time when the recipient requires the knowledge for doing the activity, which normally is a time interval. If knowledge (even best quality knowledge) is not given on time, it is of less use and effectiveness for doing the desired activity. Consequent to this, the right time is preferable over the right knowledge in KFFD. .Hence, KFFD tries to enhance knowledge quality during the specified time constraint via getting a suitable flow path as possible. Certain assumptions are done for simplicity as well as complexity lowering of the issue listed below.

Network stability: organizational network is assumed as a stable network alongside fixed topology. That is, the desired network is not always scalable. The nodal communication will never be disconnected.

KNs Activity: it is assumed in this problem that the KNs are throughout active.

Mutual trust: As seen, the Trust is a crucial element that affects KF between the KNs. It is assumed in this problem that every KN trusts each other fully. As such, they offer their knowledge with no concerns. There is no sabotage and prejudice as well in the knowledge processing.

The major issues in this study (problem statement) which the new framework intends to solve are as follows:

1. The KF among various Software development stages of the Project is inefficient.
2. The lack of Evaluation on the efficiency of KF in Software development project.
3. Ontology is useful for mapping as well as identifying KF properly but there is a lack of study in using ontology based framework in Software development project.

6. KFFD (KNOWLEDGE FLOW FRAMEWORK DESIGN).

As per the conceptual analysis mentioned above, no KF happens without a sharable context. The KFFD functions as a stand for KF management in software development time. This will enhance the quality of the product by lowering time and cost, KM between team members via KF layers. For this, the framework successfully utilizes ontology so as to manage along with retrieve the explicit knowledge, KNs and context information for determining the right knowledge and right time and the KNs. Tacit knowledge and implicit knowledge for enhancing the quality of KF.

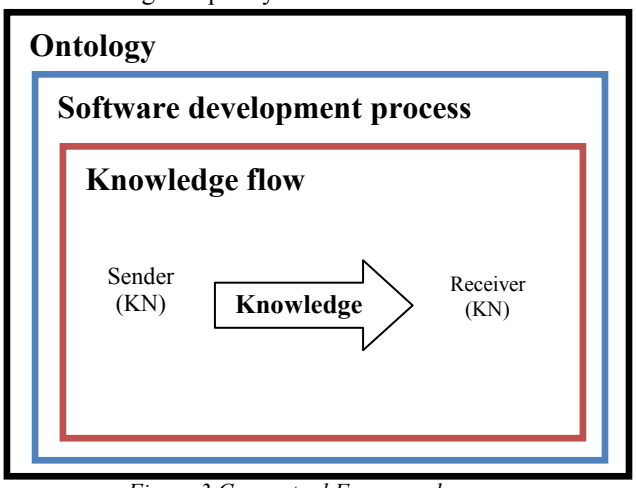

Figure 3 Conceptual Framework

KFFD structure comprises of many stages and definitions. SDP, software development process project indicates that the team work in the framework will be the software development team. The team is specified by selecting analysts, developers, testers, managers and any other option that is a part of the project team one can choose. Data domain is utilized for the environment of data and in which domain it will be. In the background, one can briefly explain the problem in project and the issues in project. Software engineering team consists of analysts, developers, testers and manager. Focused group of the study is approached with primary survey and interview for primary data collection from the project team using the knowledge map to get the KF in the project via studying the interviewer. Two types are derived by the interviewer- one regarding the documentation storage and the other regarding the communication among software project team members. Apart from this, there is an attempt to specify the knowledge, information and data in the due course of the software project. Upon data collection and KF specification, the work will be implemented in ontology as storage and retrieval explicit knowledge. The ontology in platform will be showcase using language from the semantic web such as RDF and OWL [76,77] and will be managed via protégé framework [77]which is open source java framework for the development of semantic web application. Stanford University Developed this tool.

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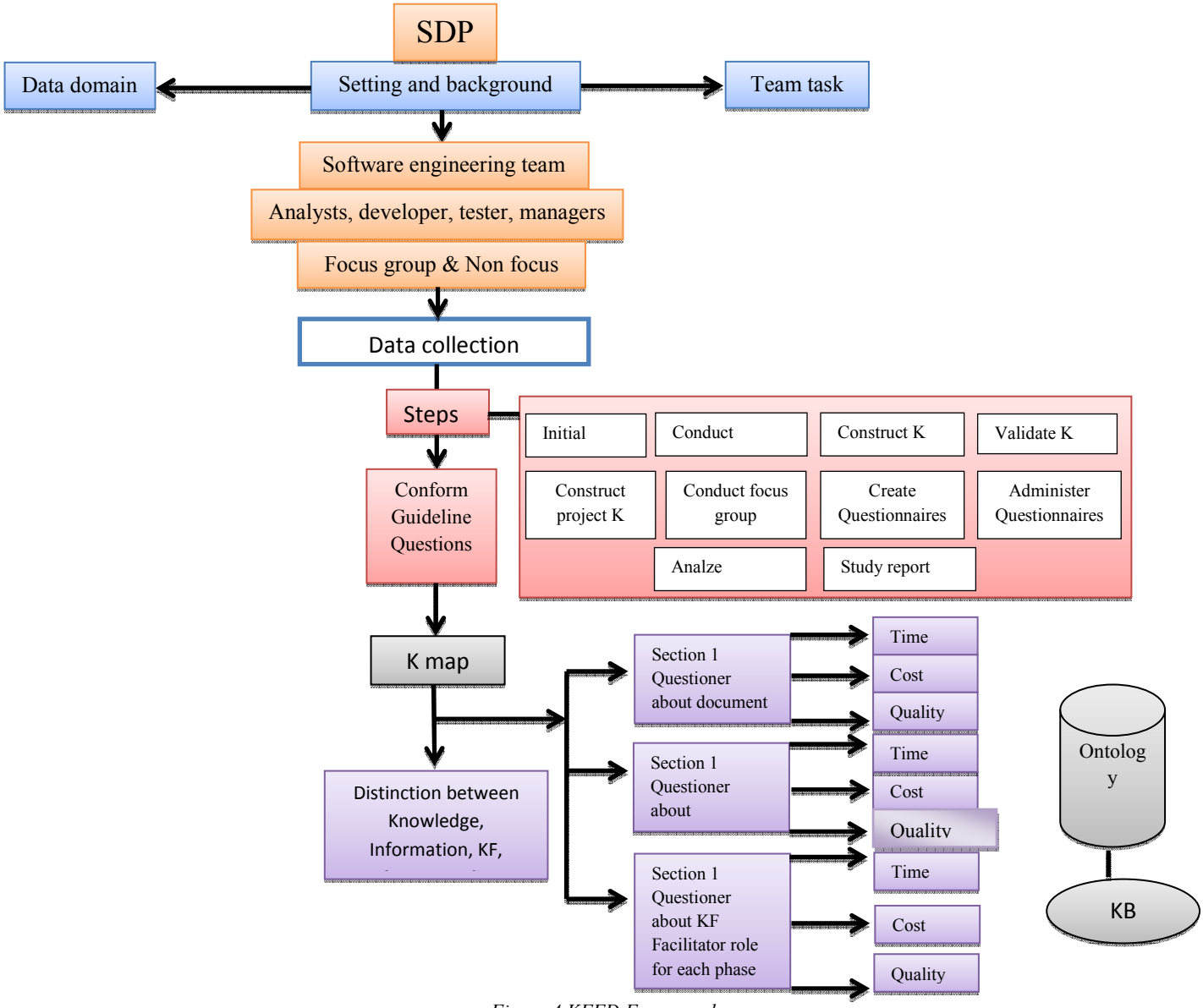

Figure 4 KFFD Framework

The KFFD will utilize Domain ontology for enhancing the efficiency as well as accuracy of semantic search in the system. The domain ontology is made of concepts together with associations between them. It is needed for understanding concepts in the firm.

7. GOALS OF THE KFFD

KFFD aids to align KFFD objective with the overall KF and software development project goals. This alignment aids future success as well as sustainability of KF. As per the analysis of context of KF and KF issues, the following KFFD goals are found:

1. For studying the efficiency (Time, Cost, Quality) of KF in software development process project.
2. For evaluating the efficiency of KF in SDP with regards to (Time, Cost and Quality).
3. For designing and developing ontology based KF framework in software development process project.

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8. DISCUSSION AND CONCLUSION

Various perspectives of KF resulted in different approaches to its modeling [78, 79, 80]. KF always takes place in specific contexts.In knowledge-based firms, workers are in need of having tasked related knowledge as well as documents for supporting their task performance. A KF represents an individual's or group members' flow of knowledge-needs together with the referencing order of documents in the performance of activities. Via KFs, firms can give task-relevant knowledge to workers for fulfilling their knowledge requirements. Elements of competitive advantage comprise of knowledge as well as KM [81]. That is organizations with wider, specialized and updated knowledge, that appropriately uses knowledge resources, have more success probabilities than its competitors. For effective knowledge use, dynamic KF from the sources to destinations is essential. As such, the ultimate goal of KF framework is the effective KF as well as application of transferred knowledge in the tasks. Consequent to this, a novel complex concept in KM is the analysis, design as well as implementation of KF in software development team. KFFD is proposed by this research in this context. Major innovations of the proposed architecture includes taking advantage of ontology for retrieving explicit knowledge, quality enhancement of KF by dynamic KF network generation, supporting both Push as well as Pull KF strategies and context of the KNs for giving proper knowledge at the right time in the process of KF in the KFFD framework. The advantage of this model can give high quality in short time with low cost, the disadvantage of this model need to identify the variable to draw a map for new domain to implement the model in addition the number of participant is affected on the model. In the future this model needs to implement empirically in industrial to achieve the model objective because it implement in academic domain need to implement in different domain.

REFERNCES

[1] P.F. Drucker, The coming of the new organization, Harvard Business *Review 66 (1) (1988) 45–53.*

[2] S.Y. Choi, Y.S. Kang, H. Lee, The effects of socio- technical enablers on knowledge sharing: an exploratory examination, *Journal of Information Science 34 (5) (2008) 742–754.*

[3] S. Kim, H. Hwang, E. Suh, A process-based approach to knowledge-flow analysis: a case study of a manufacturing firm, *Knowledge and Process Management 10 (4) (2003) 260–276.*

[4] A. Abecker, A. Bernardi, H. Maus, M. Sintek, C. Wenzel, Information supply for business processes: coupling workflow with document analysis and information retrieval, *Knowledge-Based Systems 13 (5) (2000) 271–284.*

[5] D.-R. Liu, I.-C. Wu, Collaborative relevance assessment for task-based knowledge support, Decision Support *Systems 44 (2) (2008) 524–543.*

[6] V.T. Nunes, F.M. Santoro, M.R.S. Borges, A context-based model for knowledge management embodied in work processes, *Information Sciences 179 (15) (2009) 2538–2554.*

[7] O.M. Rodríguez-Elias, A.I. Martínez-García, A. Vizcaíno, J. Favela, M. Piattini, A framework to analyze information systems as knowledge flow facilitators,Information and Software Technology *50 (6) (2008) 481–498.*

[8] I.-C. Wu, D.-R. Liu, P.-C. Chang, Learning dynamic information needs: a collaborative topic variation inspection approach, *Journal of the American Society for Information Science and Technology 60 (12) (2009) 2430–2451.*

[9] I.C. Wu, D.R. Liu, P.C. Chang, Toward incorporating a task-stage identification technique into the long-term document support process, *Information Processing & Management 44 (5) (2008) 1649–1672.*

[10] A.C. Edmondson, I.M. Nembhard, Product development and learning in project teams: the challenges are the benefits, *Journal of Product Innovation Management 26 (2) (2009) 123–138.*

[11] R.S. Huckman, B.R. Staats, D.M. Upton, Team familiarity, role experience, and performance. evidence from Indian software services, *Management Science 55 (1) (2009) 85–100.*

[12] Y. Ren, K.M. Carley, L. Argote, The contingent effects of transactive memory: when is it more beneficial to know what others know?, *Management Science 52 (5) (2006) 671–682.*

[13] C.C. Yang, J. Lin, C.-P. Wei, Retaining knowledge for document management: category-tree integration by exploiting category relationships and hierarchical structures, *Journal of the American Society for Information Science and Technology 61 (7) (2010) 1313–1331.*

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[14] C.-H. Lai, D.-R. Liu, Integrating knowledge flow mining and collaborative filtering to support document recommendation, *Journal of Systems and Software 82 (12) (2009) 2023–2037.*

[15] D.-R. Liu, C.-H. Lai, Mining group-based knowledge flows for sharing task knowledge, *Decision Support Systems 50 (2) (2011) 370–386.*

[16] X. Luo, Q. Hu, W. Xu, Z. Yu, Discovery of textual knowledge flow based on the management of knowledge maps, Concurrency and Computation: *Practice and Experience 20 (15) (2008) 1791–1806.*

[17] M.E. Nissen, An extended model of knowledge-flow dynamics, *Communications of the Association for Information Systems 8 (2002) 251–266.*

[18] H. Zhuge, Knowledge flow management for distributed team software development, Knowledge-*Based Systems 15 (8) (2002) 465–471.*

[19] H. Zhuge, Knowledge flow network planning and simulation, *Decision Support Systems 42 (2) (2006) 571–592.*

[20] H. Zhuge, Discovery of knowledge flow in science, Communications *of the ACM 49 (5) (2006) 101–107*

[21] H. Zhuge, A knowledge flow model for peer-to-peer team knowledge sharing and management, Expert Systems with Applications *23 (1) (2002) 23–30.*

[22] C. Lin, B. Tan, S. Chang, An exploratory model of knowledge flow barriers within healthcare organizations, *Information & Management 45 (5) (2008) 331–339.*

[23] A. Riege, Three-dozen knowledge-sharing barriers managers must consider, *Journal of Knowledge Management 9 (3) (2005) 18–35.*

[24] Drucker, P.F., Harvard Business Review on Knowledge Management, *Harvard Business School Press, Boston, MA, 1998.*

[25] Bots, P.W.G. and H. de Bruijn, "Effective knowledge management in professional organizations: going by the rules", Proceedings of the 35th Annual Hawaii International Conference on System Sciences, HICSS'2002, Hawaii, USA, 2002.

[26] Maryam, A. and E.L. Dorothy, "Review: knowledge management and knowledge management systems: conceptual foundations and research issues", Management Information Systems Quarterly, Vol. 25, No. 1, pp. 107-136, 2001.

[27] M. Schutte, and M.M.M. Snyman, "Knowledge flow elements within a context - a model", *South African Journal of Information Management, Vol.8, No. 2, 2006.*

[28] M. E. Nissen, "An extended model of knowledge flow dynamics", *Communications of the Association for Information Systems Vol. 8, 2002, pp. 251-266.*

[29] H. Zhuge, W. Guo, and X. Li, "The potential energy of knowledge flow", Concurrency And Computation: *Practice And Experience, Volume 19, Issue 15, 2007, pp.2067–2090.*

[30] J.J. Huang, The evolutionary perspective of knowledge creation - amathematical representation, Knowledge-Based *Systems 22 (6) (2009) 430–438.*

[31] H.-F. Lin, A stage model of knowledge management: an empirical investigation of process and effectiveness, *Journal of Information Science 33 (6) (2007) 643–659.*

[32] V. Sambamurthy, M. Subramani, Special issue on information technologies and knowledge management, *MIS Quarterly 29 (1) (2005) 1–7.*

[33] Y.-F. Wen, An effectiveness measurement model for knowledge management, Knowledge-Based *Systems 22 (5) (2009) 363–367.*

[34] H.H. Chen, C. Pang, Organizational forms for knowledge management in photovoltaic solar energy industry, *Knowledge-Based Systems 23 (8) (2010) 924–933.*

[35] D.-R. Liu, I.-C. Wu, Collaborative relevance assessment for task-based knowledge support, Decision Support *Systems 44 (2) (2008) 524–543.*

[36] S. Kim, H. Hwang, E. Suh, A process-based approach to knowledge-flow analysis: a case study of a manufacturing firm, *Knowledge and Process Management 10 (4) (2003) 260–276.*

[37] Y. Xu, A. Bernard, Quantifying the value of knowledge within the context of product development, Knowledge-Based *Systems 24 (1) (2011) 166–175.*

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[38] A. Abecker, A. Bernardi, H. Maus, M. Sintek, C. Wenzel, Information supply for business processes: coupling workflow with document analysis and information retrieval, *Knowledge-Based Systems 13 (5) (2000) 271–284.*

[39] W.-T. Wang, S. Belardo, The role of knowledge management in achieving effective crisis management: a case study, *Journal of Information Science 35 (6) (2009) 635–659.*

[40] I.-C. Wu, D.-R. Liu, P.-C. Chang, Learning dynamic information needs: a collaborative topic variation inspection approach, *Journal of the American Society for Information Science and Technology 60 (12) (2009) 2430–2451.*

[41] J. Kingston, A. Macintosh, Knowledge management through multi-perspective modelling: representing and distributing organizational memory, *Knowledge Based Systems 13 (2–3) (2000) 121–131.*

[42] A. Abecker, A. Bernardi, K. Hinkelmann, O. Kuhn, M. Sintek, Context-aware, proactive delivery of task-specific information: *the knowmore project, Information Systems Frontiers 2 (3) (2000) 253–276.*

[43] V.T. Nunes, F.M. Santoro, M.R.S. Borges, A context-based model for knowledge management embodied in work processes, *Information Sciences 179 (15) (2009) 2538–2554.*

[44] J.-Y. Jung, K. Kim, D. Shin, J. Park, FlowWiki: A wiki based platform for ad hoc collaborative workflows, *Knowledge-Based Systems 24 (1) (2011)* 154–165.

[45] H. Zhuge, Discovery of knowledge flow in science, Communications *of the ACM 49 (5) (2006) 101–107.*

[46] X. Luo, Q. Hu, W. Xu, Z. Yu, Discovery of textual knowledge flow based on the management of knowledge maps, *Concurrency and Computation: Practice and Experience 20 (15) (2008) 1791–1806.*

[47] C.-H. Lai, D.-R. Liu, Integrating knowledge flow mining and collaborative filtering to support document recommendation, *Journal of Systems and Software 82 (12) (2009) 2023–2037.*

[48] Z. Zhang, Z. Yang, Q. Liu, Modeling knowledge flow using Petri Net, in: *IEEE International Symposium on Knowledge Acquisition and Modeling Workshop, China, 2008, pp. 142–146.*

[49] W. Zhao, W. Dai, Integrated modeling of business processes and knowledge flow based on RAD, in: *IEEE International Symposium on Knowledge Acquisition and Modeling Workshop, China, 2008, pp. 49–53.*

[50] A. Anjewierden, R. de Hoog, R. Brussee, L. Efimova, ''Detecting knowledge flows in weblogs'', *in Proceedings of the Thirteenth International Conference on Conceptual Structures, Atlanta (2005) 1–12.*

[51] S. Biundo, R. Aylett, M. Beetz, D. Borrajo, A. Cesta, T. Grant, L. McCluskey, A. Milani, G. Verfaille, ''Technological roadmap on AI planning and scheduling''. *PLANET, 2003.*

[52] M.D. R-Moreno, D. Borrajo, A. Cesta, A. Oddi, Integrating planning and scheduling in workflow domains, *Expert Systems with Applications 33 (2) (2007) 389–406.*

[53] H.K.H. Chow, K.L. Choy, W.B. Lee, A strategic knowledge-based planning system for freight forwarding industry, *Expert Systems with Applications 33 (4) (2007) 936–954.*

[54] A. Öhgren, K. Sandkuhl, ''Towards a methodology for ontology development in small and medium-sized enterprises,'' *inIADIS Conference on Applied Computing, Algarve, Portugal (2005).*

[55] V. Sugumaran, V.C. Storey, Ontologies for conceptual modeling: their creation, use, and management, Data & Knowledge Engineering *42 (3) (2002) 251–271.*

[56] T.R. Gruber, A translation approach to portable ontology specifications, Knowledge Acquisition *5 (2) (1993) 199–220.*

[57] Á.E. Prieto, A. Lozano-Tello, Use of ontologies as representation support of workflows oriented to administrative management, *Journal of Network and Systems Management 17 (3) (2009) 309–325.*

[58] C. Chandra, A. Tumanyan, Organization and problem ontology for supply chain information support system, Data & Knowledge Engineering *61 (2) (2007) 263–280.*

[59] Z. S. Syed, T. Finin, A. J., ''Wikipedia as an ontology for describing documents'', *in Proceedings of the Second International Conference on Weblogs and Social Media, Seattle, Washington (2008).*

[60] S.-S. Weng, H.-L. Chang, Using ontology network analysis for research document recommendation, Expert Systems with Applications *34 (3) (2008) 1857–1869.*

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[61] Y. Afacan, H. Demirkan, An ontology-based universal design knowledge support system, *Knowledge-Based Systems 24 (4) (2011) 530–541.*

[62] M. Havey, Essential business process modeling, *O'Reilly Media, Inc., 2005.*

[63] M. Weske, Business process management: *concepts, languages, architectures, Springer, 2007.*

[64] D.-R. Liu, M. Shen, Workflow modeling for virtual processes: *an order-preserving process-view approach, Information Systems 28 (6) (2003) 505–532.*

[65] I. Chebbi, S. Dustdar, S. Tata, The view-based approach to dynamic inter-organizational workflow cooperation, Data *& Knowledge Engineering 56 (2) (2006) 139–173.*

[66] R. Eshuis, P. Grefen, Constructing customized process views, Data & Knowledge Engineering *64 (2) (2008) 419–438.*

[67] K.A. Schulz, M.E. Orlowska, Facilitating cross-organisational workflows with a workflow view approach, Data & Knowledge Engineering *51 (1) (2004) 109–147.*

[68] M. Schutte, and M.M.M. Snyman, "Knowledge flow elements within a context - a model", South *African Journal of Information Management, Vol.8, No. 2, 2006.*

[69] J. Guo, and Y. Wang, "Context modeling for knowledge flow," *IEEE International Conference on Information Reuse and Integration (IRI 2008), 2008, pp.330-335.*

[70] M. Schutte, and M.M.M. Snyman, "Knowledge flow elements within a context - a model", South *African Journal of Information Management, Vol.8, No. 2, 2006.*

[71] V. Supyuenyong, and N. Islam, "Knowledge Management Architecture: Building Blocks and Their Relationships" *in PICMET, Istanbul, 2006, pp. 1210-1219.*

[72] I. Nonaka, "A Dynamic Theory of Organizational Knowledge Creation", *Journal of Organization Science Vol. 5, No. 1, 1994, pp. 14-37.*

[73] Young-Gul Kim, Sung-Ho Yu, and Jang-Hwan Lee, "Knowledge strategy planning: methodology and case", Expert Systems with Applications, *Vol. 24, No. 3, 2003, pp. 295-307.*

[74] I. Nonaka, "A Dynamic Theory of Organizational Knowledge Creation", *Journal of Organization Science Vol. 5, No. 1, 1994, pp. 14-37.*

[75] I. Nonaka, "The Knowledge-Creating Company," Harvard Business Review, *Vol. 69, No. 6, 1991, pp. 96-104.*

[76] M. C. Daconta, L. J. Obrst, and K. T. Smith, The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management. Indianapolis, United States of America: *Wiley Publishing Inc, 2003.*

[77] J. Cardoso, Semantic Web Services: Theory, Tools, and Applications, Information *Science Reference (IGI Global), 2007.*

[78] Nissen, M. and R. Levitt. "Dynamic models of knowledge-flow *dynamics"[Online]. 2002.* Available:http://cife.stanford.edu/online.publications/WP076.pdf.

[79]. McAdam, R. and S. McCreedy, "A critical review of knowledge management models", *The learning organization, Vol. 6, No. 3, pp. 91-100, 1999.*

[80]. Zhuge, H. and W. Guo, "Virtual knowledge service market-for effective knowledge flow within knowledge grid ", Journal of Systems and Software, Vol. 80, pp. 1833-1842, 2007.

[81]. M. E. Nissen, Harnessing Knowledge Dynamics: Principled Organizational Knowing and Learning. *London, United Kingdom: IRM Press, 2006.*