



ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com



View of knowledge flow description

¹Mustafa S.Khalefa, ²Marzanah A.Jabar, ³Rusli Hj. Abdullah, ⁴Salfarina Abdullah, ⁵Ali Yahya Ghenni

^{1,2,3,4,5}University Putra Malaysia (UPM), Department of Software engineering & Information System ,Faculty of Computer Science & Information technology, 43400 Selangor, Serdang, Malaysia

ARTICLE INFO

Article history:

Received 3 October 2015

Accepted 31 October 2015

Keywords:

Knowledge flow,
Knowledge flow process,
Knowledge flow type,
Knowledge flow mechanical

ABSTRACT

Knowledge flow exists in very nearly in each teamwork , community cooperation environment and now it attracts much consideration , attention in the knowledge management field. In a knowledge-based organization, knowledge workers need to acquire a variety of knowledge (information) about their tasks .Therefore; many organizations have built knowledge support plat forms to assist workers in meeting their knowledge-needs. These platforms help workers to identify and share knowledge in order to speed up organization innovation and improve employee Productivity. The paper gives an over view of knowledge flow, type of knowledge flow, mechanical of knowledge flow, knowledge flow process. This review shows the description of Knowledge flow element and knowledge characteristic. This paper as systematic review of the knowledge flow. Choose the best way according to that.

© 2015 AENSI Publisher All rights reserved.

To Cite This Article: Mustafa S.Khalefa, Marzanah A.Jabar, Rusli Hj. Abdullah, Salfarina Abdullah., Ali Yahya Ghenni View of knowledge Flow Description. *Aust. J. Basic & Appl. Sci.*, 9(33): 278-285, 2015

INTRODUCTION

Knowledge has turned into the foundation of business or instruction, hypothesis. Knowledge management has the real effect in increasing the intensity or soul of a group. Knowledge management apprehends enhancing spreading, imparting, and utilizing of knowledge (Drucker, 1998). Knowledge position has not been suspected until the end of time. Notwithstanding, the Knowledge has been a basic variable and an inward drive to create economy in monetary times. Knowledge management (KM) is a region of extensive importance now (H.Zhuge, 2002) (Xiaoggang Zhang, 2005). The majority of KM look into consistently uses knowledge as an inactive or stationary object, then again a moment interest is carried on to the dynamic characteristic of knowledge processing and knowledge management which will be predominantly called as knowledge flow. Recent years, knowledge flow has been distinguished in diverse examples in the knowledge management research and works. (Newman, B, 1999) Characterizing it as methods, activities and occasions through which information, data, knowledge and meta-knowledge are changed over starting with one state then onto the next.

Knowledge Flow:

A lot of academics have different definitions on knowledge flow. One of them is (H.Zhuge, 2002) who characterized knowledge flow as a system of bypassing knowledge among individuals or knowledge processing instruments, and alluded to the positive different peculiarities of knowledge flow including direction, content and carrier. (H.Zhuge, 2002) Another researcher is (Xiaogang Zhang, 2005) who characterized knowledge flow as a strategy for making, passing on and stratifying knowledge among distinctive members (Xiaogang Zhang, 2005). Development needs knowledge's flow. In (H. Zhuge,2006), (H. Zhuge,2007) KF examination focuses on how Kfs transmit, impart and gather knowledge in a group. On account of a workflow, work knowledge may pass among laborers, in the meantime handle knowledge may pass through distinctive capacities or assignments. Thusly, the KF considers the level of knowledge cooperation between laborers or process, and impact the proficiency of collaboration or workflow. The KF in a software development group can join together knowledge from one team member and transmit it to another. Knowledge partnership will be easier (H. Zhuge,2006) To improvement the efficiency of teamwork cooperation, (Zhuge, 2007) recommended an example based strategy which joins codification and personalization methodologies to outline a successful knowledge flow system. With a specific

Corresponding Author: Mustafa S.Khalefa, Marzanah A.Jabar, University Putra Malaysia (UPM), Department of Software engineering & Information System ,Faculty of Computer Science & Information technology, 43400 Selangor, Serdang, Malaysia.
Phone: 0060176484073; E-mail: mustafakhalefa@gmail.com , marzanah@upm.edu.my

end goal to backing the computerization of Kfs, a system of knowledge workflow created by (Sarnikar,2007) (S. Sarnikar, 2008) to mechanize Kfs by conjugating workflow and knowledge to discover the methods and techniques. (Rodriguez, 2004) recommended that Kfs in societies of practice help the team members to share and to take an interest in their data and encounter around a specific fields, so as to finish their works. Kfs can simplicity knowledge offering and reuse in research area. Especially, a reference system could be recognized as a KF that spreads knowledge between the analysts and the researchers. In the most recent years (X. Luo,2008), some KF models have been proposed. Planned a Textual Knowledge Flow (TKF) model for a semantic connection system. TKF can prompt suitable channels to clients in the wake of assessing their profits and inputs. Moreover, Kfs can additionally symbolize the grouping of knowledge-needs and/or knowledge reference patterns when specialists perform errands (Lai and Liu, 2009) sorted out a period requested KF model to characterize the request of laborers' knowledge with regarding activities. Workers are able to gain knowledge to gratify to satisfy their needs through the Kfs found from record access logs. Likewise, the referencing request in weblogs might be considered as a KF, and depicted as a sender-message-beneficiary or receiver, since a blogger's weblog post may incorporate a hyperlink to a weblog post from of an alternate blogger (A. Anjewierden, 2005), (Kim *et al*,2003) recommended a KF show that uses a procedure turned methodology to catch, store and exchange knowledge. (Z.hang , 2008) utilized Petri-net to model a KF. Specifically, a knowledge hub can deliver, learn, work, comprehend, combine and convey knowledge based on four sorts of flow relations: creation, uniting, replication and broadcasting. (Zhao,2008) exhibited a technique that incorporates business procedure and Kfs by separating Kfs into consecution, distribution, blend and reflection toward oneself. Knowledge flow is imperceptible, nonetheless it meets expectations with any helpful group Regardless of whether individuals purposefully make use of it or not. We can visualize the accompanying situation of the knowledge flow as they work collaboration group. Affiliation group are interfaced with a few sorts of knowledge transmission cinches' similar to the produce line. All team members can propose knowledge on to a suitable cinch, which then naturally conveys the knowledge to the colleague who obliges it. Each one colleague get the obliged knowledge from the 'transmission belt' connected with him after the team members make a knowledge flow system (KFN). Individuals can increase the viability of collaboration work by accurately planning the network and controlling its execution process (H.Zhuge, 2002). One focal point of knowledge flow is that it can sidestep or cancel unnecessary knowledge passing

between team members (H.Zhuge, 2002) since diverse team members may achieve various sorts of assignments and oblige different sorts of knowledge. on more benefit profit is that people don't need to invest more time and make more effort In H. Zhuge ,2002 Knowledge flow is focus as the system of knowledge "development" from exporter to a receptor and its after admission and utilization, to enhance the organization ability to perform the activities. This could be seen as a strategy of knowledge passing between individuals or knowledge processing mechanisms [19]. (Zhuge,2002) mentioned that the focuses of issuing/the receiver of knowledge will be perceived as a "knowledge node". The flow containing three significant key attributes: direction,content and a bearer or carrier, which separately appoint who will send and who will receive, the knowledge substance and how is the substance transmitted. The knowledge node appropriately could be "a team member "a" part or a knowledge gateway or procedure (C. Lin,2012). (Yoo, Suh and Kim 2007), figured that knowledge flow in associations can focus the issues in the parallel business forms. A clear recognizable proof and optimization of the knowledge flow could be affirming the genuine utilization of knowledge inside the organization, to upgrading the dynamic between organization knowledge and business processes.

Distinguishing and mapping the knowledge flow are deliberately paramount to organization in three real areas (Yoo, Suh and Kim 2007):

1. The flow of knowledge transfers the skill made in a sub unit to different areas inside the organization.
2. Knowledge flows help the concordance of workflows joining numerous sub units which are geographically scattered.
3. Knowledge flows help organization to be useful business opportunities that need collaboration of different subunits.

A clear understanding of organization about how the knowledge flows through their structure is important and critical even for a better understanding of the characteristics of these flows and scenic forms.

In (H. Zhuge,2002), Knowledge flow is an intersection method of the knowledge invention, division and reuse from a bunch individual (called knowledge sender) to the next person (called knowledge recipient) permitting to a describe process rationale. It has knowledge source and knowledge recipient. It has additionally passing direction and knowledge substance. Knowledge substance is shared among parts in cooperation system.

Knowledge flow can be specifying by four groups: $KF = \langle S, R, T, D \rangle$.

- $S = \{s_i: i=1, 2, \dots, |S|\}$, a depiction of knowledge sources such as people, repository.

- $R = \{r_j: j=1, 2, \dots, |R|\}$, represents required knowledge of the implementation task.
- $T = \{t_m: m=1, 2, \dots, |T|\}$, a description of un-coded tacit knowledge such as beliefs, attitudes.
- $D = \{d_n: n=1, 2, \dots, |D|\}$ consists of knowledge destinations (or receivers).

Clarify a knowledge node for the period of task process. The knowledge flow from A to B is represented by KN_{AB} . KN_{AB} consists of K_{AT} and K_{RD} . K_{AT} Represents the tacit knowledge of A such as its beliefs, interests. K_{RD} Represents the required knowledge that B works for tasks. KF_{BC} and KF_{AC} are the same as KF_{AB}

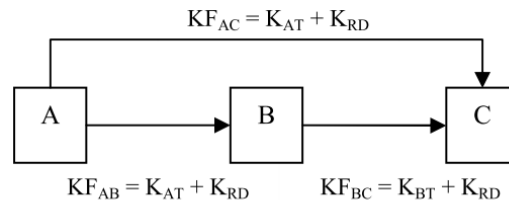


Fig. 1: knowledge flow example

In (H. Zhuge, 2002), a knowledge flow is a system of knowledge passing between individuals or knowledge processing mechanism. The transfer of knowledge from an individual, group or storage medium to someone else, gathering or storage medium persevere through the capacity of people to creative, pass and apply knowledge on distinguishing proof and implementation of new errands, giving logistic backing continuously and production of new logistic thoughts and capacities. Three real criteria which are Direction, substance and carrier characterise a knowledge flow and identify the sender and the receiver, the shareable knowledge content and the media that can pass the content.

- Building of knowledge by knowledge transfer from external sources and invention of new one by research and development;
- Storage of knowledge by keeping current knowledge in artefacts;
- Supply of knowledge by distribution and transfer;
- Application of knowledge by integration in organizational procedures, products and facilities

In (A. Anjewierden, 2005), (S. Kim, 2003), (H. Zhuge, 2006) Knowledge flow among people and individuals and procedures to suit knowledge offering and reuse. The perception of knowledge flow has been applied in a several fields, e.g., scientific research, groups of practice, cooperation, industry, and associations. Academic articles connote the main average for spreading knowledge amongst researchers to propel new ideas (F. Casati, 1999). A reference incorporate that there is a knowledge flow in the midst of the referring to article and the referred to article like references methodology a knowledge flow arrange that permits knowledge to motivate interdisciplinary research and scientific development. In (H. Zhuge, 2002), (H. Zhuge, 2006) A knowledge flow model enhanced the effectiveness of teamwork

cooperation by gathering and offering knowledge between team members to empower distributed knowledge spreading. To improve the efficiency of teamwork, proposed an example based approach that joins both codification and personalization systems the effective knowledge flow network. (S. Kim, 2003) proposed a knowledge flow model joined with a procedure turned methodology to capture, store, exchange knowledge and transfer knowledge. Knowledge flows in groups of practice support parts impart their knowledge and encounter around a target field to complete certain task (O.M. Rodriguez, 2003), (X. Luo, 2008) to recommend the find the text based on knowledge flow focused around the semantic connection network. A connection based knowledge flow is recommended to reflect the main features of a knowledge flow (J. Guo, 2008). In an organization, knowledge employees typically have diverse data and information needs over time when execution assignments. Thusly, a knowledge flow is defined from the perspective of a workers data fundamentally to explain the development of referencing activities and the knowledge cumulative for a specific assignment (C.-H. Lai, 2009). In (Liu, D.R, 2009) Knowledge Flow Description. A knowledge flow (KF) is characterized as the improvement of a specialist's knowledge demands and worker knowledge on performing an undertaking task, inclusive data, information fundamentally, priority and referencing demeanor for to categorize knowledge; KF is recognized from the laborer's work logs on verifiable assignment implementation. Two levels of KF had been distinguished: the codified level and the point level. The knowledge in the classified level alludes to the knowledge flows between documents and reports focused around the arrival time. In the greater part of cases, the knowledge gained from an archive document prompts knowledge specialists workers to get to the following related document (codified knowledge). The document progression contains

various task -related reports. Also, documents with the same subjects of interests might be accumulated into the same subject to structure a point level deliberation of knowledge. The codified level KF it can be separate to structure a theme level KF, who represents the transmission between numerous subjects of codified knowledge.

1) Collection of information: enables the collection of information and or knowledge through task performance.it also can save the information to use it later;

2) Ranking: capability to rank the knowledge according to the variety plans and varying work teams;

3) Abstraction: the capability to express the knowledge in various stages of abstraction and smooth content

4) Analogy: should create familiar organization between related meanings;

5) Management of the version: should to sustain the management of the growth procedure of knowledge flow during addition union and/ or removal of the flows.

(H. Zhuge,2002) indicates four basic types of knowledge flow (Figure 1):

1) Sequence Connection: knowledge derives from two rivers and forms one unique flow;

2) Junction connection: double or more streams come together in one flow only;

3) Division of flows: the stream can be separated into double or more flows of knowledge;

4) Dissemination of the flows: allotment the flow can be distributed to multiple flow of knowledge.

(K. Yoo, 2007) recommended ten tenets to diagnose and upgrade the flow of knowledge courses of action. The goal of these tenets is organising the flow of knowledge maps; stratify it with the methods of a current workflow. As indicated by these rules, a contention has raised that the knowledge flow must be straight, clear and destination, objective, avoiding parallel flows of knowledge (unnecessary flows) inside the comparable check point and/or business process. Also, it is important to put as a top priority the goals of these organizations, businesses and for its sub-processes and tasks. The model recommended by (K. Yoo, 2007) means to restructure operation business by drawing knowledge flow. In accordance with the writers, we can conclude that the update of methods focused around knowledge flow abatements decreases expenses and time requirement for errands, keeping the quality standard and making business forms resilient. (H. Zhuge, 2002), (k. Yoo,2007) Suh prepared a few deals on knowledge flows from business procedure inside organization. Nevertheless, the results nowadays are not sufficient about how knowledge flows ought to be recognized and mapped in between firms' relationship substance.

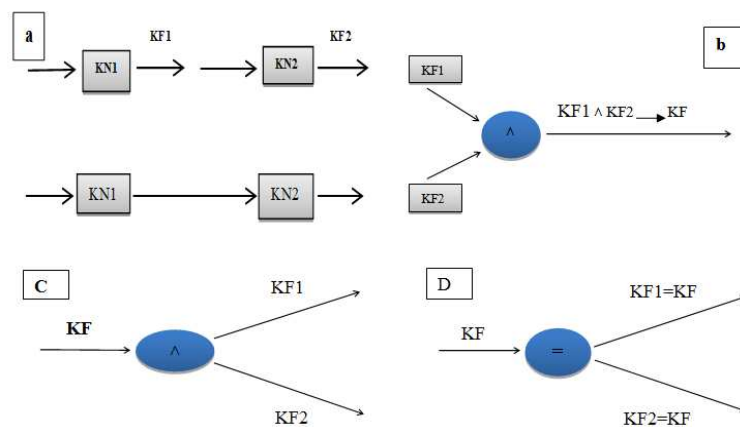


Fig. 2: representation of knowledge flow: source adapted from (H. Zhuge, 2002).

Knowledge node is the station of the source and receiver of knowledge flow It matches a gathering part (or part) and to throw back knowledge generation and requisite through the group member task execution process. The productivity of knowledge node is knowledge flow that to depend on the capability of indistinguishable team members' epistemic ability and the information, input

knowledge flow. A knowledge node could be executed as tool that to combine a person knowledge store and deputy for support team members to the procedure knowledge. A knowledge node might be active and energetic when the comparable team members working on it, generally, the knowledge node will be idle.

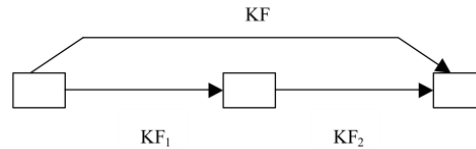


Fig. 3: an example of knowledge flow paths

When the knowledge node inactive the corresponding team member can make it active again and work on it.

Definition 3. A knowledge flow move and passing during the teamwork processing time for the team member to create the knowledge flow network. A knowledge flow network contain a set of knowledge node it can be produce the contributor of group member and the knowledge flow between them. The answering of the question that we follow it can explain for us what the best knowledge flow network is.

Definition 4: a knowledge flow network called connected if any two knowledge nodes have exists flow path.

Definition 5: A knowledge flow is called complete on task it should be linked, like the knowledge node to put the drawing plan image of the all members and their parts for carry out the task. The knowledge flow network should be complete to remove the seclusion among the team work.

Definition 6: for all the complete knowledge flow network of team member for carry out goal, a knowledge flow network is called the smallest complete when the knowledge flow have fewer number connection among knowledge flow network.

Characteristic 2: The little full knowledge flow arrange not simply just dispense with knowledge evacuation however excessively perform dynamic gathering knowledge offering, because of it is standard to mapping knowledge flow system.

The knowledge flow ought to be clarified by five classifications. (1) Information amassing, it ought has the ability to accumulate the precursors' knowledge through the current venture advancement time and continue generating knowledge within developing the existed projects. (2) Classification, the knowledge flow ought have the ability to categories or classify knowledge depending on diverse tasks and different team members. (3) Abstraction, it ought to be able to consider or explain knowledge for various abstraction levels and the content should be refined. (4) Analogy, to create analogy association between linked contents of the flow. (5) Version management, the development process should be achieved by knowledge flow. (H. Zhuge, 2002).

The knowledge flow ought to be clarified by five classifications. (1) Information amassing, it ought to gather the forerunners' knowledge through the current venture advancement time and continue producing knowledge inside creating the existed activities. (2) Classification, the knowledge flow ought to can arrange or order knowledge relying upon diverse tasks and distinctive colleagues. (3) Abstraction, it ought to have the capacity to consider or clarify knowledge for different reflection levels and the substance ought to be refined. (4) Analogy, to make similarity relationship between interfaced substance of the flow. (5) Version management, the advancement methodology ought to be accomplished by knowledge flow. (H. Zhuge, 2002).

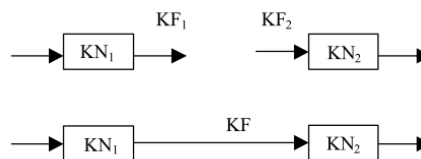


Fig. 4: Sequential connection between Knowledge flows

3. Knowledge flow process model:

A knowledge flow process interest in four sorts of association between knowledge flows: The successive connection, the common connection, the separate connection and the broadcast connection.

Definition 7. Successive connection of two knowledge flows (KF_1 and KF_2) shape one knowledge flow (meant as $KF_1.KF_2$) such that the nest two item hold:

1. $\text{Field}(KF_1.KF_2) = \text{field}(KF_1) = \text{field}(KF_2)$ if field $(KF_1) = \text{field}(KF_2)$.
 2. $\text{Field}(KF_1.KF_2) = \text{field}(KF_2)$ if $\text{field}(KF_1) \in \text{field}(KF_2)$
- The successive connection of two knowledge flow reasons.

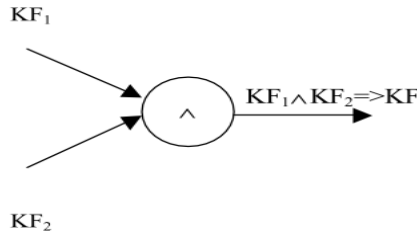


Fig. 5: join connection two knowledge flows

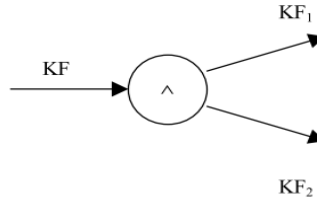


Fig. 6: the split of a Knowledge flow

The output flow of one knowledge node unites with the information flow of an alternate knowledge node as demonstrated in figure 4

Definition 8: common connection of two or more knowledge flows forms one knowledge flow, denoted as $KF_1 \wedge KF_2 \wedge \dots \wedge KF_n \Rightarrow KF$, such that field $(KF_1 \wedge KF_2 \wedge \dots \wedge KF_n \Rightarrow KF) = \text{field}(KF_1) \cup \text{field}(KF_2) \cup \dots \cup \text{field}(KF_n) = [LR_1 \cup LR_2 \cup \dots \cup LR_n, TR_1 \cup TR_2 \cup \dots \cup TR_n]$ holds.

Figure 5 shows the common connection between two knowledge flows.

Definition 9. A knowledge flow (KF) might be separate into two or more knowledge flows, indicated as

$KF \Rightarrow KF_1 \vee KF_2 \vee \dots \vee KF_n$, such that field $(KF \Rightarrow KF_1 \vee KF_2 \vee \dots \vee KF_n) = \text{field}(KF_1) \cup \text{field}(KF_2) \cup \dots \cup \text{field}(KF_n) = [LR_1 \cup LR_2 \cup \dots \cup LR_n, TR_1 \cup TR_2 \cup \dots \cup TR_n]$ holds.

Figure. 5 explained that a knowledge flow is separate into two knowledge flows.

Definition 10. An knowledge flow KF might be broadcast to various knowledge flows, meant as $KF = (KF_1, KF_2, \dots, KF_n)$ such that field $(KF = (KF_1, KF_2, \dots, KF_n)) = \text{field}(KF_1) = \text{field}(KF_2) = \dots = \text{field}(KF_n)$ holds.

Figure 8 broadcasted that a knowledge flow is shown to two

Mechanical of Knowledge flows:

A knowledge flow can aggregate the information created by the previous KN throughout its passing process. Figure 7 depicts the constitution of the input and output knowledge flows of a KN (KN_i).the entry of knowledge flow is the join association of the yield knowledge flows of its forerunners: $KF_{out}(KN_{p1}) \wedge \dots \wedge KF_{out}(KN_{pn}) \Rightarrow KF_{in}(KN_i)$. The last output of the knowledge node KN_i , $KF_{out}(KN_i)$ is constituted by the join association of the input $KF_{in}(KN_i)$ and the output $KF_{out}(KN_i)$, to stand for as $KF_{out}(KN_i) \wedge KF_{in}(KN_i)$.

$\Rightarrow KF_{out}(KN_i)$. For a recently made knowledge flow network, the knowledge input of the first KN, $KF_{in}(KN_0)$ will be initialised by the collaboration principles of the group. After the first run of the KFN, the output of the end KN of the last run will be the input of the first KN of the

Current run. In the wake of completing to perform a task, the created knowledge might be stored in a knowledge space for later utilize (H. Zhuge, 2002).

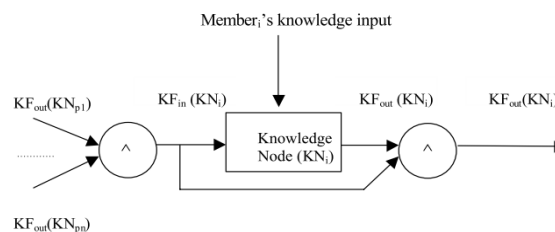


Fig. 7: Input and output of knowledge node

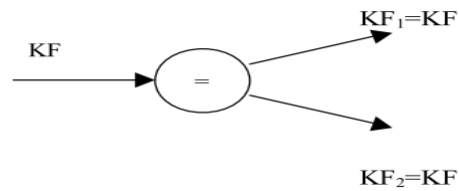


Fig. 8: broad cast of a knowledge flow

5. Knowledge flow management:

it implies that throughout a task improvement process, the knowledge flow ought to be executed, controlled, stored and preserved (Hai Zhuge, 2002).

5.1. Implementation control and version management:

Execution control system is in control with observation and classification the knowledge flow passing process. This system should engage a knowledge flow method to happen with the workflow process. A colleague should finish to fill in his/her knowledge into the knowledge flow edge all through his/her change period then pass it to the succeeding group member(s). For better understanding of the execution control, it should unification the knowledge flow into the matching workflow method as another flow sort and to make full use of the (WFMS, 2012) to accomplish the knowledge flows and cognitive flows. The sort of the management contains of the space management and the form control. One of the need of the knowledge is the configuration of a knowledge flow casing obliges a space that could hold a specific number of venture forms. At the point when making another wander, a wander space should be sorted out an assignment form that including the knowledge delivered all through the undertaking advancement and each of gathering part should be appointed a space for a part structure after the task space is made. The structure control needs to manage three sorts of adaptations: the task form; the part form; and, the correction rendition. To decline losing data in the occasion of flow passing exceptional case, each knowledge hub should keep a copy of the current knowledge (with the sparing date) in a part data flow store before he/she passes the flow to the succeeding member.

5.2. Knowledge flow generalization:

The era and generalization of learning streams is the obligation of colleagues. Fig.4 graphically portrays to the relationship between the information flow period and generalization and what's more the workflow execution. The dark bolts mean to the workflow process. The dabbed shafts mean the generalization process. the learning stream generalization in each one gathering relies on upon three sort enter: (1) the information flow delivered all through making the current component (the strong upward bolts in Fig. 4); (2) the learning flow yield of

the prompt predecessor(s), the data of the first information hub could be the cognitive yield of the end learning hub of the last execution of the flow or the predesigned beginning info when it first actualize; (3) the general information stream of the first the procedure. the general information inside the first gathering or colleague will be made the learning yield of the information hub of the last execution of the stream of prestructure first include when it beginning executes The summed up information flow can broaden its critical thinking area. It can additionally refine knowledge flow in order to prevent boundless extension of the learning flow content.

Conclusion:

Knowledge flow is the dynamic process occurring among knowledge-processing participants and in certain context wherein relevant knowledge is created, transformed, propagated and applied. Another description of knowledge flow according to the process of knowledge passing between people or knowledge processing mechanism. This paper shows the overview of knowledge flow element, process, and description of knowledge flow mechanical. In addition the team work in any organization they need right information at the right time from the right person this is the knowledge flow objective. This paper reviews some of previously written papers related to enhancement the knowledge flow description in specific and general published between 1997 and 2012 in IEEE explorer, science publication, Elsevier, the high quality journal in this field.

REFERENCES

- Anjewierden, A., R. de Hoog, R. Brussee, L. Efimova, 2005. " Detecting knowledge flows in weblogs, 13th International Conference on Conceptual Structures (ICCS), pp: 1-12.
- Geppert, A., D. Tombros, K.R. Dittrich, 1998. Defining the semantics of reactive components in event-driven workflow execution with event histories, *Inform. Syst.*, 23(3/4): 235-252.
- Lai, C.-H., D.-R. Liu, 2009. Integrating knowledge flow mining and collaborative filtering to support document recommendation, *Journal of Systems and Software*, 82(12): 2023-2037.
- Lin, C., J.-C. Wu and D.C. Yen, 2012. "Exploring Barriers to Knowledge Flow at Different Knowledge Management Maturity

Stages,” *Information & Management*, 49: 10-23. doi:10.1016/j.im.2011.11.001.

Drucker, p.f. (Ed) 1998. *Harvard business review on knowledge management*, Boston, MA: Harvard business school press

Leymann, F., D. Roller, 1997. *Workflow-based applications*, *IBM Syst. J.* 36(1): 102-122.

Casati, F., M. Fugini, I. Mirbel, 1999. *An environment for designing exceptions in workflows*, *Inform. Syst.*, 24(3): 255-273.

Zhuge, H., 2002. “A Knowledge Flow Model for Peer-to-Peer Team Knowledge Sharing and Management”, *Expert Systems with Applications*, 23(1): 23-30.

Zhuge, H., T.Y. Cheung, H.K. Pung, 2001. *A timed workflow process model*, *J. Syst. Software*, 57(3): 231-243.

Hollingsworth, D., *The workflow reference model*. TC00-1003: UK, Workflow Management Coalition, 2931.

Zhuge, H., 1995. “Resource Space Model, Its Design Method and Applications”, *Systems and Software*, 26(8): 71-78.

Hai Zhuge, 2002. *Knowledge flow management for distributed team software development* *Knowledge-Based Systems*, 15: 465–471.

Zhuge, H., 2006. *Knowledge flow network planning and simulation*, *Decision Support Systems*, 42: 571-592.

Zhuge, H., 2006. *Discovery of knowledge flow in science*, *Communications of the ACM*, ACM Press, New York, NY, USA, pp: 101-107.

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

Zhuge, H., W. Guo, 2007. *Virtual knowledge service market — for effective knowledge flow within knowledge grid*, *Journal of Systems and Software*, 80(11): 1833-1842.

Yoo, K., E. Suh and K.-Y. Kim, 2007. “Knowledge Flow-Based Business Process Redesign: Applying a Knowledge Map to Redesign a Business Process,” *Journal of Knowledge Management*, 11(3): 104-125. doi:10.1108/13673270710752144.

Puustjarvi, J., H. Tirri, J. Vejjalainen, 1997. *Reusability and modularity in transactional workflows*, *Inform. Syst.*, 22(2/3)101-120.

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

Newman, B., and K. Conrad, 1999. *A Framework for characterizing knowledge management methods, practices, and technologies. The Introduction to Knowledge Management. In support of The Introduction to Knowledge*

Management, George Washington University Course EMGT 298. T1, Spring.

Nissen, M.E., R.E. Levitt, 2004. “Agent-based Modeling of Knowledge Flows: illustration from the Domain of Information Systems Design”, *Proceedings of the 37th Hawaii International Conference on System Sciences-*, pp: 1265-1230.

Marjanovic, O., M.E. Orłowska, 1999.”*On modeling and verification of temporal constraints in production workflows*, *Knowledge Inform. Syst.*, 1(2): 157-192.

Rodriguez, O.M., A.I. Martinez, J. Favela, A. Vizcaino, M. Piattini, 2004.”*Understanding and supporting knowledge flows in a community of software developers*, *International Workshop on Groupware (CRIWG 2004)*, Springer, pp: 52–66.

Lawrence, P., 1997.” *Workflow Handbook 1997*, Wiley, New York.

Sarnikar, S., J.L. Zhao, 2007.” *Automating knowledge flows by integrating workflow and knowledge discovery techniques*, *Proceedings of the Winter Conference on Business Intelligence*, Salt Lake City, UT.

Sarnikar, S., J. Zhao, 2008.” *Pattern-based knowledge workflow automation: concepts and issues*, *Information Systems and E-Business Management.*, 6(4): 385-402.

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

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

WFMC, 2012. *The Workflow Reference Model*, <http://www.wfmc.org>.

Wu, I.C., D.R. Liu, W.H. Chen, 2005. *Task-stage knowledge support: coupling user information needs with stage identification*. In: *IEEE International Conference on Information Reuse and Integration*, IRI, pp: 19-24.

Xiaogang Zhang, Mingshu Li., 2005. “*Workflow-based Knowledge Flow Modeling and Control*”, *Journal of Software*, 16(2): 184-193.

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

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

Zhao Rongying, Qiu Junping, 2007.” *Study on the Classification of Knowledge Network [J]*. *Library and Information Service*, 51(9): 11-15+2.