

Digital Social Networks: Examining the Knowledge Characteristics

Nurul Aini M. Nordan, Ahmad I. Z. Abidin, Ahmad K. Mahmood, and Noreen I. Arshad

Abstract—In today's information age, numbers of organizations are still arguing on capitalizing the values of Information Technology (IT) and Knowledge Management (KM) to which individuals can benefit from and effective communication among the individuals can be established. IT exists in enabling positive improvement for communication among knowledge workers (k-workers) with a number of social network technology domains at workplace. The acceptance of digital discourse in sharing of knowledge and facilitating the knowledge and information flows at most of the organizations indeed impose the culture of knowledge sharing in Digital Social Networks (DSN). Therefore, this study examines whether the k-workers with IT background would confer an effect on the three knowledge characteristics -- conceptual, contextual, and operational. Derived from these three knowledge characteristics, five potential factors will be examined on the effects of knowledge exchange via e-mail domain as the chosen query. It is expected, that the results could provide such a parameter in exploring how DSN contributes in supporting the k-workers' virtues, performance and qualities as well as revealing the mutual point between IT and KM.

Keywords—Digital social networks, e-mail, knowledge management, knowledge worker.

I. INTRODUCTION

OVER the past two decades, as a result of managerial initiatives such as de-layering, re-engineering and team-based designs, most organizations have become flatter and more flexible and this has significantly changed the way work gets done [1]. Furthermore, from the phenomenal developments in Information Technology (IT) and the Internet, there is a significant impact on social networks culture at workplace to occur virtually from actual contact to digital discourse. IT environment has certainly made an improvement on the implementation of social networks technology at most organizations. This scenario indeed has led to the new culture of information and knowledge sharing in Digital Social Networks (DSN). Moreover, DSN is positively supporting informal collaboration and communication among employees. Cross et al. [2] discussed that informal

relationships among employees are often far more reflective of the way work happens in an organization than the relationships established by position within the formal structure.

From Knowledge Management (KM) perspective, the DSN makes the communication, information sharing and knowledge transfers possible to be constructed virtually and to provide a platform for knowledge workers (k-workers) to proactively communicate with their peers. DSN on the other hand, is competent in cultivating knowledge sharing and trust. This could avoid lack or missing of communication as Crawford [3] explained that even well documented and organized information carries less impact if communication is lacking or missing.

Most of the previous researches have seen the IT resources or assets as the enabler for better communication and performance in an organizational context rather revealing the mutual point between IT and KM. These two fields can be leveraged towards achieving efficient and ongoing practices of KM in a competitive business environment. These two values are important to venture because, recently in an era where knowledge is considered valuable resource, information and knowledge within organizations must be adopted with social networks technology. However, communication that occurs through social networks technology domains should also be taken into account of the main principles of k-worker practices which are knowledge creation, knowledge sharing, knowledge access, knowledge capture, and knowledge application in dealing with daily businesses in complex knowledge environment.

Various studies have shown that effective organizations only managed to integrate personal knowledge for organizational needs when they allowed employees to use the information networks autonomously and on an ongoing basis, and to decide what solutions were required [4]. These previous studies indeed acknowledged the importance of shared values between IT and KM in organizations towards dealing with competitive knowledge environment. However, there is still lack of focus on the significance of shared values between IT and KM on the digital discourse among k-workers who have IT background and how to encounter this aspect towards improving KM practices in their organizations.

Therefore, the fundamental idea of this study is to focus upon the ties of actors in DSN in examining a k-worker's performance and contribution. The authors would highlight numbers of hypotheses in meeting the objectives. The formal

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and informal social networks that occur through e-mail domain would be mapped and this includes DSN structures of both individual relationships (i.e. k-worker) and the collection of relationships in DSN as a whole (i.e. team).

II. RESEARCH DESIGN AND HYPOTHESES

For the pilot study of this research, the authors chose the Department of Computer and Information Sciences (CIS), Universiti Teknologi PETRONAS (UTP), Malaysia as the platform of study. UTP is one of the PETRONAS educational institutions placed under the PETRONAS-KM six-year Strategy Planning in building the capability via KM.

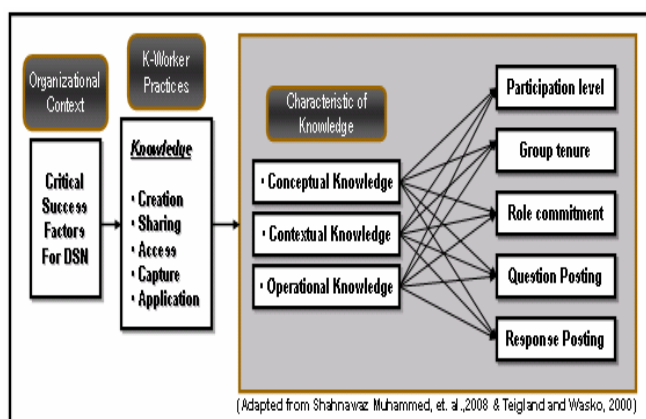


Fig. 1 K-workers' knowledge exchange in DSN

The respondents assigned as the k-workers were the final year undergraduates from the CIS. K-worker as mentioned by Pederson [5] and Broberg et al. [6] is a person who principally has data, information, and knowledge as working objects, and mostly works with these objects in a physical-virtual working environment. In addition, Broberg explained that the knowledge workers form their understanding by working with information [7]. The authors believe that the factors of the respondents' background, their exposures to and knowledge in IT could assist in achieving the objectives of this research.

As this study deals with such knowledge assessments and audits, qualitative case study on knowledge and information sharing among the k-workers based on e-mail domain will be employed. Therefore, questionnaire has been chosen for knowledge audit and assessment process.

This study will posit proposed structures of DSN based on e-mail domain towards supporting the findings of relationships between knowledge characteristics and the five factors which are highlighted in the proposed framework of k-workers' knowledge exchange in DSN (see Fig. 1). In achieving the aims, researchers have laid down numbers of hypotheses that would be used as a parameter to examine whether the ties of k-workers in DSN affect the three knowledge characteristics which are conceptual knowledge, contextual knowledge and operational knowledge. Derived from these three characteristics of knowledge, five potential factors which are participation level, group tenure, role commitment, question posting, and response posting, expected to affect the knowledge exchange via e-mails, would be

examined (see Table I). It is expected that the results could provide statistical findings in examining how DSN contributes in supporting the k-workers' virtues, performance and qualities towards improving the efficiency of KM practices as well as revealing the mutual point between IT and KM.

TABLE I
 KNOWLEDGE CHARACTERISTICS FOR KNOWLEDGE EXCHANGE IN DSN

Knowledge Characteristics	Definition	Literature Base
Conceptual Knowledge	A state of individual's (k-worker) understanding on why specific actions need to be taken towards completing the given task (know-why)	[8], [9], [10], [11], [12], [13], [14]
Contextual Knowledge	A state of individual's (k-worker) understanding on the essential aspects necessary to take into account due to completing the given task to discover the aspects of people (know-who), locations (know-where), and timing (know-when)	[8], [12], [15], [16], [17]
Operational Knowledge	A state of individual's (k-worker) understanding towards working with task requirements (know-what) and dealing with the processes (know-how) to complete the given task	[8], [10], [12], [15], [16], [17], [18]

A. The Knowledge Characteristics

i. Conceptual Knowledge

Fig. 1 shows the proposed framework of k-workers' knowledge exchange in DSN that would be examined and the expected relationships that would affect the knowledge exchange via e-mail domain between the knowledge characteristics and the five potential factors -- participation level, group tenure, role commitment, question posting and response posting. It is expected that the five factors which are derived from the conceptual knowledge, contextual knowledge and operational knowledge would affect the knowledge exchange among k-workers via the chosen query. The conceptual knowledge helps an individual to look at his/her actions from higher levels of abstraction [19]. It is the individual level of understanding on why specific actions need to be taken towards completing the given task. Being able to conceptualize the task from a higher level of abstraction translates to the ability to make richer connections with other knowledge that may or may not be immediately necessary for the execution of the task at hand; hence enabling the creation of a richer context for the execution of that task [8, 20]. This leads researchers to the first hypothesis:

Hypothesis 1a: The higher the k-worker's conceptual knowledge, the higher the participation level in DSN would become.

E-mail communication is as much a tool that helps the k-worker performs his/her work more efficiently [21]. As one of preferred domains of communication, e-mail indeed improves

digital discourse among team members towards completing their given tasks. Especially in today's knowledge intensive environment, there is an increasing need to combine and negotiate such knowledge from multiple domains [20]. In addition, it is becoming apparent that most k-workers turn to IT in creating dynamic online discussion forums rather than utilizing and contributing to the statistic knowledge repositories [1]. Generally, when k-workers seriously focus on completing their tasks, their participation level in DSN in facilitating their communication and knowledge transfer would be affected.

Hypothesis 1b: The higher the k-worker's conceptual knowledge, the more the group tenure commitment would be given.

The conceptual knowledge helps a k-worker look at his/her actions from a higher level of abstraction [19]. It leads the k-worker to have a clearer picture towards the given tasks. This would encourage the sense of group tenure commitment among all team members. As discussed in [22], we are in an era where the future will be essentially determined by our ability to use knowledge wisely, a precious global resource that is the embodiment of human intellectual capital and technology. As we begin to expand our understanding of knowledge as an essential asset, we realize that in many ways our future is limited only by our imagination and ability to leverage the human mind.

Hypothesis 1c: The higher the k-worker's conceptual knowledge, the better the role commitment would be given.

Eoin Whelan explained that, recently in the field of KM, there has been an increased recognition of the importance of less structured forms of knowledge and the role played by social networks in stimulating innovation and creation of new knowledge [1]. For an individual who has a clear conceptual knowledge, he/she would be determined on the importance of playing an active involvement in the project with the assigned portfolio to ensure all related processes will successfully come to an end within the given period of time rather than working under a complex structure. As a result, knowledge is continuously created and shared through open discussion and collaboration, regardless of distance [23].

Hypothesis 1d: The higher the k-worker's conceptual knowledge, the higher the quantity of questions posted via e-mail would become.

The DSN based on e-mail domain provides a platform for k-workers to proactively communicate with their peers. In addition, DSN is positively able to cultivate knowledge sharing and could make the question-posting activity via e-mail through open discussion a norm.

Hypothesis 1e: The higher the k-worker's conceptual knowledge, the higher the quantity of responses posted in sharing the knowledge among the group members would become.

The conceptual knowledge leads the k-workers to be able to

conceptualize their tasks from a higher level of abstraction, translating to the ability to make richer connections with other knowledge in completing the given tasks. Many companies discover that the real value of KM is not about sharing of documents, but of insights and ideas. Further, within these electronic communities, individuals are able to share knowledge through a mechanism (i.e. e-mail) that supports posting of and responding to questions, sharing stories of personal experience, and discussing and debating issues relevant to the community [24].

ii. Contextual Knowledge

Hypothesis 2a: The higher the k-worker's contextual knowledge, the higher the participation level in DSN would become.

In today's IT era, employees have a wealth of synchronous and asynchronous information and communication channels at their fingertips and can easily search their companies' intranets and databases, as well as externally available information (i.e. the Internet) for advice [25]. The contextual knowledge certainly gives the momentum to the k-workers to participate continuously in DSN when there is a need for them to act at appropriate time and with appropriate action. Thus, digital discourse via e-mail domain benefits individuals to establish effective communication.

Hypothesis 2b: The higher the k-worker's contextual knowledge, the more the group tenure commitment would be given.

The value of contextual knowledge leads the k-workers to be very particular in dealing with the right person or group besides being conscious in completing the given tasks within allocated time period. This value brings positive impact by changing the way organizations function and individuals go about their daily tasks and avoid individuals from acting without full knowledge of the situation [26]. The contextual knowledge supports the group tenure commitment and cultivates the positive cooperation from all team members once assigned tasks are given.

Hypothesis 2c: The higher the k-worker's contextual knowledge, the better the role commitment would be given.

The contextual knowledge in relation to a task is the knowledge that may not be central to the satisfactory execution of that task, but may be peripherally related to it [19]. It may be considered as the backstage knowledge with respect to a particular task [16]. Contextual knowledge is essential in putting the values of professional contribution and active commitment to all members in a group regardless of the role given to them. Such knowledge helps embellish and enrich the operational of an act in addition to providing a broader knowledge base for innovative ideas [15].

Hypothesis 2d: The higher the k-worker's contextual knowledge, the higher the quantity of questions posted via e-mail would become.

The contextual knowledge is able to create active participation from all team members to involve in actual

contact or virtual interaction among them in completing assigned tasks. For the platform of communication based on e-mail domain, the contextual knowledge encourages the k-workers in posting questions via e-mail as part of the digital discourse activity. This knowledge characteristic helps in developing ties among the k-workers through the quality and frequency of interaction via email between them. In this situation, as explained by Fernie et al. [27], individual may play a significant role in connecting both sides by introducing and referring people to the purpose of the intended knowledge exchange.

Hypothesis 2e: The higher the k-worker's contextual knowledge, the higher the quantity of responses posted in sharing the knowledge among the group members would become.

In many cases, people seek the most easily accessed information rather than searching for the best information [28]. The value of contextual knowledge already exists in most social networks among individuals at workplace by transferring information and sharing the knowledge. In addition, technologies are being used to facilitate communication and collaboration, reducing the impact of time and geographic constraints [29]. Therefore, the DSN is positively able to support the culture of knowledge sharing and make the response-posting activities in sharing the knowledge among k-workers via e-mail domain a norm.

iii. Operational Knowledge

Hypothesis 3a: The higher the k-worker's operational knowledge, the higher the participation level in DSN would become.

No organization can successfully implement KM without changing the culture of the organization. The values of operational knowledge are able to encourage the k-workers to participate actively in DSN towards achieving the demands of the assigned tasks besides developing the ties among group members. This is important because as Don Cohen and Laurence Prusak [4] said, in binding the members of human networks and communities, it could make cooperative action possible.

Hypothesis 3b: The higher the k-worker's operational knowledge, the more the group tenure commitment would be given.

Operational knowledge leads to a positive environment in which members in an organization are able to use what they have learned and to find ways to solve the problems they encounter. Conversely, it could bring to the powerful organization that enables employees be more focused on the organization's business [30].

Hypothesis 3c: The higher the k-worker's operational knowledge, the better the role commitment would be given.

Operational knowledge is the core knowledge needed to accomplish a task satisfactorily [19]. This is sometimes referred to as problem-solving knowledge or domain knowledge [18]. Without at least a cursory idea of this

operational knowledge of the task, it is unlikely that the individual be able to complete his/her tasks satisfactorily [31], [32], [33]. This could contribute to the role commitment for the k-worker who has a clear view and implement the value of operational knowledge in dealing with his/her given tasks.

Hypothesis 3d: The higher the k-worker's operational knowledge, the higher the quantity of questions posted via e-mail would become.

Chatzkel [34] mentioned that, companies that successfully adopt KM understand that KM is not intended to ever stand there on its own. It is there to help people to improve. It is there to connect information to people and people to people.

Hypothesis 3e: The higher the k-worker's operational knowledge, the higher the quantity of responses posted in sharing the knowledge among the group members would become.

The organizational environment in today's digital world is characterized by accelerated global development of communications, technology and portability [35]. Thus, the ability to make the most of the knowledge at the right time and place becomes a strategic asset. Using KM process in cultivating knowledge sharing culture among the k-workers allows the organization to cope with a dynamic environment [36].

III. METHODOLOGY

The authors have developed questionnaire as a tool in collecting data of k-workers' perception on the importance of e-mail as a medium of communication

A. The Questionnaire

In conducting the study, questionnaire and discussion approaches were used in collecting data. According to Sekaran [37], quantitative data refers to the information gathered in a narrative form through observations, surveys, interviews and questionnaires.

For the sampling technique, simple random technique is chosen for this study in which every member of the population has known each other for all of them are involved in a team project. This technique assures that every member in the team project has an equal chance of being selected as a subject [37]. The process of sampling was only done at one stage of the sample selection. The questionnaire was divided into two sections, A and B. In section A, the questions comprised of demographic data. Section B comprised of Likert-scale structured questions.

IV. RESULTS & DISCUSSIONS

In total, 47 final year undergraduates from the Department of CIS, UTP participated in the survey. The students previously had eight-month industrial attachment to various companies in Malaysia and abroad. The students had been equipped with various skills relevant to IT. The students were given KM projects and familiar with e-mail. They could then

be considered to have necessary skills of IT k-workers. The data collected from the respondents were tabulated for hypotheses testing purpose using linear regression technique.

A. Hypotheses Testing: H1a, H1b, H1c, H1d, and H1e

Tables II and III summarize the linear regression tests on hypotheses H1a, H1b, H1c, H1d, and H1e.

TABLE II
 ANOVA OF CONCEPTUAL KNOWLEDGE DEPENDENT VARIABLES AGAINST
 CONCEPTUAL KNOWLEDGE

Dependent Variable	Sum of Squares	Df	Mean Square	F	Sig.
Participation Level					
Regression	15.541	1	15.541	23.89	.000
Residual	29.263	45	.650		
Total	44.804	46			
Group Tenure					
Regression	63.775	1	63.775	131.99	.000
Residual	21.743	45	.483		
Total	85.518	46			
Role Commitment					
Regression	28.939	1	28.939	47.640	.000
Residual	27.335	45	.607		
Total	56.274	46			
Question Posting					
Regression	34.913	1	34.913	44.29	.000
Residual	35.474	45	.788		
Total	70.387	46			
Response Posting					
Regression	49.752	1	49.752	66.82	.000
Residual	33.506	45	.745		
Total	83.258	46			

Based on Table II for the linear regression, there were relationships between all dependent variables and the independent variable. Since the probability of F statistics ($p < 0.001$) for each in Table II was less than or equal to the level of significance (0.05), the research hypotheses that there were relationships between Conceptual Knowledge and the five dependent variables were supported. Therefore, H1a, H1b, H1c, H1d, and H1e were substantiated.

Given the significant F-test results in Table II, the correlation coefficient in Table III could be interpreted. Based on the R value in Table III, the relationship between Conceptual Knowledge and Participation Level was categorized as moderate ($0.4 < R < 0.6$), the relationship between Conceptual Knowledge and Group Tenure was very strong ($R \geq 0.8$), and the relationships between Conceptual Knowledge and all Role Commitment, Question Posting, and Response Posting were strong with each R value between 0.6 and 0.8.

TABLE III
 MODEL SUMMARY OF CONCEPTUAL KNOWLEDGE AGAINST ITS DEPENDENT
 VARIABLES

Dependent Variable	R	R Square	Adjusted R Square	Std. Error of the Estimate
Participation Level	.589	.347	.332	.806
Group Tenure	.864	.746	.740	.695
Role Commitment	.717	.514	.503	.779
Question Posting	.704	.496	.485	.888
Response Posting	.773	.598	.589	.863

B. Hypotheses Testing: H2a, H2b, H2c, H2d, and H2e

TABLE IV
 ANOVA OF CONTEXTUAL KNOWLEDGE DEPENDENT VARIABLES AGAINST
 CONTEXTUAL KNOWLEDGE

	Sum of Squares	Df	Mean Square	F	Sig.
Participation Level					
Regression	11.384	1	11.384	15.33	.000
Residual	33.420	45	.743		
Total	44.804	46			
Group Tenure					
Regression	65.307	1	65.307	145.408	.000
Residual	20.211	45	.449		
Total	85.518	46			
Role Commitment					
Regression	29.362	1	29.362	49.10	.000
Residual	26.912	45	.598		
Total	56.274	46			
Question Posting					
Regression	41.792	1	41.792	65.765	.000
Residual	28.596	45	.635		
Total	70.388	46			
Response Posting					
Regression	58.791	1	58.791	108.13	.000
Residual	24.466	45	.544		
Total	83.257	46			

TABLE V
 MODEL SUMMARY OF CONTEXTUAL KNOWLEDGE AGAINST ITS DEPENDENT
 VARIABLES

Dependent Variable	R	R Square	Adjusted R Square	Std. Error of the Estimate
Participation Level	.504	.254	.237	.862
Group Tenure	.874	.764	.758	.670
Role Commitment	.722	.522	.511	.773
Question Posting	.771	.594	.585	.797
Response Posting	.840	.706	.700	.737

Tables IV and V summarize the linear regression tests on hypotheses H2a, H2b, H2c, H2d, and H2e. Based on Table IV for the linear regression, there were relationships between all dependent variables and the independent variable. Since the probability of F statistics ($p < 0.001$) for each in Table IV was less than or equal to the level of significance (0.05), the research hypotheses that there were relationships between Contextual Knowledge and the five dependent variables were supported. Therefore, H2a, H2b, H2c, H2d, and H2e were substantiated.

Given the significant F-test results in Table IV, the correlation coefficient in Table V could be interpreted. Based on the R value in Table V, the relationship between Contextual Knowledge and Participation Level was moderate ($0.4 < R < 0.6$), the relationship between Contextual Knowledge and both Group Tenure and Response Posting were very strong ($R \geq 0.8$), and the relationships between Contextual Knowledge and both Role Commitment and Question Posting were strong with each R value between 0.6 and 0.8.

C. Hypotheses Testing: H3a, H3b, H3c, H3d, and H3e

TABLE VI
 ANOVA OF OPERATIONAL KNOWLEDGE DEPENDENT VARIABLES AGAINST OPERATIONAL KNOWLEDGE

Dependent Variable	Sum of Squares	Df	Mean Square	F	Sig.
Participation Level					
Regression	7.450	1	7.450	8.975	.004
Residual	37.354	45	.830		
Total	44.804	46			
Group Tenure					
Regression	51.223	1	51.223	67.211	.000
Residual	34.295	45	.762		
Total	85.518	46			
Role Commitment					
Regression	30.004	1	30.004	51.397	.000
Residual	26.270	45	.584		
Total	56.274	46			
Question Posting					
Regression	39.689	1	39.689	57.18	.000
Residual	30.699	45	.682		
Total	70.388	46			
Response Posting					
Regression	57.871	1	57.871	102.58	.000
Residual	25.387	45	.564		
Total	83.258	46			

TABLE VII
 MODEL SUMMARY OF OPERATIONAL KNOWLEDGE AGAINST ITS DEPENDENT VARIABLES

Dependent Variable	R	R Square	Adjusted R Square	Std. Error of the Estimate
Participation Level	.408	.166	.148	.911
Group Tenure	.774	.599	.590	.873
Role Commitment	.730	.533	.523	.764
Question Posting	.751	.564	.554	.826
Response Posting	.834	.695	.688	.751

Tables VI and VII summarize the linear regression tests on hypotheses H3a, H3b, H3c, H3d, and H3e. Based on Table VI for the linear regression, there were relationships between all dependent variables and the independent variable. Since the probability of F statistics ($p < 0.001$) for each in Table VI was less than or equal to the level of significance (0.05), the research hypotheses that there were relationships between Operational Knowledge and the five dependent variables were supported. Therefore, H3a, H3b, H3c, H3d, and H3e were substantiated.

Given the significant F-test results in Table VI, the correlation coefficient in Table VII could be interpreted. Based on the R value in Table VII, the relationship between Operational Knowledge and Participation Level was categorized as moderate ($0.4 < R < 0.6$), the relationship between Operational Knowledge and all Group Tenure, Role Commitment and Question Posting were strong ($0.6 < R < 0.8$), and the relationships between Operational Knowledge and Response Posting was very strong with $R > 0.8$.

V. CONCLUSION & FUTURE WORK

In conclusion, the framework for k-workers' knowledge exchange in DSN has been developed. The proposed structures of DSN based on e-mail domain towards supporting the findings of relationships between knowledge characteristics and the five factors highlighted in the proposed framework of k-workers' knowledge exchange in DSN have been statistically examined.

Based on the results of the distributed questionnaires, all hypotheses were supported. Surprisingly the relationship between Conceptual Knowledge and Participation Level was moderate and so was the relationship between Operational Knowledge and Participation Level. The results reveal that the k-workers' participation level need to foster effective communication via email.

In the future, Affiliation Network analyzing the structures of DSN will be created using AGNA software. The purpose of the Affiliation Network is to determine the knowledge shared among k-workers in email communications during the course of completing an IT project which requires collaborative efforts. While the substantiated hypotheses discussed in the paper are based on the k-workers' perceptions on the importance of e-mail as a medium of communication, the AGNA software and Affiliation Network later will reveal

whether the k-workers' actually use e-mail extensively as the paths of their e-mail communications are captured.

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