The Emergence of ICTs for Knowledge Sharing Based on Research in Indonesia

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Abstract. This paper presents organizations in applying ICTs (Information, Communication, and Technologies) contribution for supporting knowledge activities, in order to gain organizational competitiveness. Through ICT, knowledge workers in different fields are empowered to contribute and share their knowledge effectively and efficiently. In Knowledge Sharing (KS), organization must focus on results of research in the development of Knowledge Management System features, adoption, and use of ICTs itself. Creating a knowledge repository and providing best practices via ICTs tools enable the starting of knowledge sharing application. The study found that the features to support mechanism, content, and process of KS are mostly applied based on identification of knowledge from structural and functional areas. Moreover, it needs to share in perspective as well as an important asset that must be managed efficiently for organizational success.

Keywords: Information technology and communications · Knowledge sharing

1 Introduction

Emerging of Knowledge Management (KM) has to a great extent result to industries since it has been launched in economy era. KM is an important escalating interest for organizations, to prove the concept and theory, getting the best practices, and to achieve organization in competition through ICT. KM also is widely becoming a core competence that companies must develop in order to succeed and exist in dynamic global economy [1]. The importance of intellectual capital beyond knowledge will be able to increase efficiency and effectiveness within the organization and now widely better acknowledged in several large companies and/or small business organizations. Valuable skills and competencies have become knowledge resources, and they will be wasted unless management supports the efforts to capture, collect, gather, store, transform, and share knowledge among others.

ICT allows the process of the movement of data and information at increasing speeds and efficiencies, and thus facilitate sharing as well as organization needed for the growth of knowledge. Specifically, [2] mentioned internet and web site through WWW (World Wide Web) that becomes unlimited sources of knowledge available for all of us. Also, [3] reported that ICTs provided a major impetus for implementing of

KM applications. Moreover, as learning has accrued in the area of social and structural mechanisms, through mentoring that enable effective KS, it is possible to develop KM applications that best leverage by deploying sophisticated technologies. Also, she contend that using ICTs (e.g., Web-based conferencing) to support KM mechanisms in ways not earlier possible (e.g., interactive conversations or exchange of voluminous documents among individuals which is located at long distances) enables dramatic improvement in KM.

The top and middle managers in organizations are consistently looking for better ways to improve performance, to sustain the existence, and to increase business results by gaining new understandings better. Mechanisms of knowledge and KS application features for coordinating organization effectiveness are complex. Indeed, it has been acknowledged that requirement to represent activities into application in business process is broad and complex to be covered. Organizations recognize the important of knowledge asset belong to their employees. Therefore, it needs to develop KS application in order to help and support the easiest communication and collaboration. Depending on the KM process that is most directly supported, KM systems can be classified into four types: knowledge-discovery systems, knowledge-capture systems, knowledge-sharing systems, and knowledge-application systems [4, 5]. This paper will explore and describe the potential of ICT used by the organization for increasing effectiveness and efficiency process through the deployment of knowledge sharing system and developed specific feature application.

2   ICTs for Knowledge Sharing

Technology plays a fundamental role in creating an organizational culture (OC) for KS and an infrastructure to stimulate and enable access to internal knowledge and expertise existing in the organization. According to [10], the access to internal organizational knowledge sources was predicted as intranets. It will also play a dominant role in supporting internal knowledge due to cost-effective technical capabilities including: "*access to the legacy systems, platform independence, access to multimedia data formats, a uniform and easy-to-use, point-and-click interface, and capability for easy multi-media publication for knowledge sharing*".

According to [11], KS is defined as the exchange or transfer process of facts, opinions, ideas, theories, principles and models within and between organizations include trial and error, feedback and mutual adjustment of both the sender and receiver of knowledge. In order to improve KS, generating new knowledge depends on the OC, and generating an interactive context must be developed and maintained. It happens when OC allows and encourages change, participation, expression of ideas, communication, and dialogue, then learning and KS are possible. For an increased efficiency, an online discussion forum may be created, which certainly will improve the processes sharing of knowledge and expertise. Managers must involve and take appropriate measures so that KS takes place, perhaps leading to the establishment of organizational changes and trust to encourage greater use of online discussion forum [12]. In terms of KS, ICTs (portals) can be useful for knowledge application. Portals (internet base) are well suited for publishing and sharing collection of documents based on the intellectual products of many subgroups.

Further, because of their flexibility in combining a variety of tools and services, portals can be customized to create a rich KS environment. In addition, [3] mentioned that knowledge-sharing systems also utilize mechanisms and ICTs that facilitate exchange. Some of the mechanisms that facilitate exchange are document minute of meeting, news, memos, manuals, progress reports, letters, and presentations. ICTs that facilitating exchange include groupware and other team collaboration mechanisms, Web-based access to data, databases, and repositories of information, including best-practice databases, lessons-learned systems, and expertise-locator systems.

3   Organizational Trust

The organization consists of a number of people connected to each other in different ways (business unit, departments, structural hierarchies, tasks, role, rules etc.). The willingness of individuals to share their knowledge in an organization heavily depends on the OC and trust. As mentioned [6], definitions of trust are various and sometimes confusing, it depends on each discipline viewing trust and from its own perspective. Organization trust will influence in KS frequency and sharing effort, that is the factor of successful applied ICTs as claimed of [7]. They also identified 14 KMS success factors, one of which is "*An organizational culture that supports learning and the sharing and use of knowledge*".

According to [8], the facilities of infrastructure are suggested to invest on smart people and providing incentives for sharing information, besides providing enough unstructured time to communicate to each other (talk face to face). In motivating people towards KS, the according activities must be encouraged and rewarded from the top and middle management level (highest hierarchical). It is clear that sharing of knowledge is something important for the whole organization. Without this, the natural tendency will become barriers to the flow of knowledge. Since the success of a KM relies heavily on people to share their knowledge, it can be assumed that if the level of organizational trust is high, then people will have fewer barriers to share their knowledge, and consequently, the level of success of the KM should be highest [6].

Enabling factors that facilitating KM activities, should be existed on sharing of knowledge assets among individuals. Specifically, for the enabler is organizational trust which becoming attitude and mindset of people, and also is critical for facilitating KS and learning motivation in organization. Refer to [9] KM effectiveness is an integration of people relationship and technology. He states that employees' enthusiasm and trust in others have direct influence on the ability of ICT to transfer knowledge across various departments.

4   Research Methods

The main focus of this research is to explore the underlying typical of ICTs which is used to KS application and identified the organizational categories. This study used in-depth literature review and methods to collect document report of practices KM

implementation in organizations. The analyzed object of document reports are as following: the organizational categories, field of KM areas, KM analysis and approach, and ICTs enabler as solution. All of those were conducted to diagnose the causes of organizational preference to adopt ICTs and what kind of requirements to apply the possible directions of KM's needed programs. Discussion and clarification were made with the expertise in iterative rounds in order to develop a common discourse on KM issues. The discussion results in respect to knowledge categorization and ICTs solution were to be features in KS applications. The objects of document including paper, dissertation, thesis, etc. were collected and classified. They were used to analyze the concept and theory aligned with KM in organization. Taking into account the complexity of the issues, we sought insights from the document in various purposes and scopes. From August 2012 to November 2014, we had 108 documents collection. Based on the guidance in conducting benchmarking and qualitative research methods, the data were transcribed and analyzed to identify similarities and varieties of ICTs adoption.

5   Findings

We have collected several tools applications related to KM sharing. Its offers valuable supports for sharing of knowledge in organization. Some researcher mentioned and lists ICTs technologies in varying KM life cycle phase, here we presented the KS phase.

(a) Indeed, many ICTs contributing to KS activities are e-mail and video conferencing, virtual whiteboard and brainstorming tools, content management system, personalization tools, visualization tools and automatic recommendation tools, e-learning environment, authoring tools, technologies for automatically generating new content, mind mapping, bibliography management, artificial intelligence, networking technologies, format and standards for file transfer formats and meta data standards, and hardware by providing the necessary infrastructure for all the above mentioned [13].

(b) Like [14] presents an alternative of enabling technologies, from decision support tools to database tools, that can be used to enable various phases of the KM life cycle. These technologies provide the connectivity needed to efficiently transfer information among knowledge workers. Authoring, interface, data capture, decision support, simulations, professional database, pattern matching, groupware, controlled vocabularies, graphic, application specific, web, cataloging, and infrastructure.

(c) Further [15] classify the KMS technologies, specifically IT/ICTs tools being implemented, based on the Knowledge Life Cycle stage. This model has 4 stages, i.e. knowledge creation, knowledge storage/retrieval, knowledge transfer, and knowledge application. It is expected that the KMS will use specific technologies to support each stage for which the KMS was created to support.

(d) Next [16] depicts four layers of KM. One of layers is supporting and enabling technologies including knowledge representation, semantics and ontology, unstructured

data indexing and storage, software agents, networks, knowledge organization and indexing, data mining, information retrieval, meta-knowledge and metadata, knowledge discovery, storage and retrieval, mobility, presentation and application integration, computational experimentation, artificial intelligence, data mining, security, computer mediated communication, networks, portals, encryption access control, interface, human factors, and other specific technologies impacting KM.

(e) Moreover [17] stated internet features or technologies that support KM are common architecture and interface, easy to use front-end systems (browser user interface), internet based processes, XML wrapping of documents and other data, back-end systems that provide database access to users, Search Engines, and Virtual Private Networks.

(f) Agreed with [18], three major KM technologies classification are acquisition and application phase, creation and capture phase, sharing and dissemination phase. KS and dissemination phase includes communication and collaboration technologies (i.e. telephone, fax, videoconferencing, chat rooms, instant messaging, internet telephony, e-mail, discussion forum, groupware, wikis, and workflow management) and networking technologies (i.e. intranets, extranets, web servers, browsers, knowledge repository, and portal).

After all, we summarized and categorized ICTs tools related to our work, and create synthesis matrix across organization KM sharing deployment. From in-depth literature review of documents, we have collected 108 and created from 2001 to 2014. All topics are representing KM implementation in organization. Concerning the object of study, Table 1 depicts the organization categories and focus on KM areas. The organization categories include government, association, industries, media, services, education, IT companies, and services, banking, manufacture, and etc.

Table 1. Percentages of organizational categories and KM areas

Organization categories	KM areas:
- Industry (33.33%)	- KM Initiatives (6.48%)
- Government (17.59%)	- KM Sharing (56.48%)
- Education (16.67%)	- KM Repository (23.15%)
- IT service (7.41%)	- KM Evaluation (5.56%)
- Media (6.48%)	- KM Distribution (2.78%)
- Banking (4.63%)	- KM Transfer (0.93%)
- Insurance (3.70%)	- Unidentified (4.63%)
- Association (0.93%)	
- Communication (2.78%)	
- Hospital (0.93%)	
- Property (0.93%)	
- Pharmacy (0.93%)	
- Service (3.70%)	

Table 1 shows the complete organization categories in Indonesia, and the relevant of KM areas based on title in the document and journals published. It depicted the total number of document collected and analyses over the period in this study. The organization categories are banking, association, communication, educational, government, hospital, industry, insurance, IT, media, property, pharmacy, services. Thus, KM areas are dominated by initiatives, sharing, repository, evaluation, distribution, transfer, and unidentified. It reflects the amount of the documents for specific organization and KM construction. The percentage of number shows on the coverage of each organizational categories and KM areas constructed. The organization is classified to industry if initial letter is "PT. XYZ", and unidentified KM areas represented for non ICTs such as barriers of KM etc.

Table 2 shows top seven of organizations that is applying of KS applications. It is dominated with common applications, and network technologies. Several advanced technologies applied to e-learning system, content management system, decision supports, personalization tools, and limited of artificial intelligent in seeking expertise. The applications are classified to common, network, and advanced technologies. Based on Table 2, advanced technologies for sophisticated applications are still rare. It is caused by infrastructure and the development of KMS that is low and moderate. Moreover, the KM field study in Indonesia is a new concept and theory.

Table 2. Top seven organizations with knowledge sharing applications

Organizations/ applications	Ind. (33%)	Gov. (17%)	Educ. (16%)	IT (7,4%)	Med. (6.4%)	Bank (4.6%)	Ins. (3.7%)
Common applications							
Telephone/Fax	v	v	v	v	v	v	v
E-mail & video conferencing	v	v	v	v	v	v	v
Chat rooms	v		v				
Instant messaging	v	v	v	v	v	v	v
Discussion forum	v	v	v	v	v	v	v
Groupware	v		v	v		v	
Wikis	v	v	v			v	
Workflow management	v		v	v	v	v	v
Networking technologies							
Intranets	v	v	v	v	v	v	v
Extranets	v	v	v	v	v	v	v
Web Servers	v	v	v	v	v	v	v
Browsers	v	v	v	v	v	v	v
Knowledge repository	v	v	v	v	v	v	v
Portal	v	v	v	v	v	v	v
Advanced technologies							
Virtual whiteboard & brainstorming							
Content management system	v	v	v	v	v	v	v
Personalization	v		v	v		v	v
Visualization tools & automatic recommendation	v					v	v

Table 2. (*continued*)

Organizations/ applications	Ind. (33%)	Gov. (17%)	Educ. (16%)	IT (7,4%)	Med. (6.4%)	Bank (4.6%)	Ins. (3.7%)
E-Learning environment	v	v	v	v		v	
Authoring tools							
Automatically generating new content	v					v	
Mind mapping							
Bibliography management							
Artificial intelligence	v	v	v			v	
Format & standards for file transfer	v			v		v	v
Meta data standards							
Authoring							
Interface	v	v	v	v	v	v	v
Data capture	v		v			v	v
Decision support	v					v	v
Simulations							
Professional database	v		v			v	v
Pattern matching							
Groupware							
Controlled vocabularies							
Graphic							
Application specific							
Cataloging	v					v	v
Infrastructure	v	v	v	v	v	v	v
Knowledge discovery							
Mobility						v	
Computer mediated communication						v	
Security	v		v	v		v	
Encryption access control	v						
Human factors							
Data mining							
Software agents							
Semantics and ontology							
Unstructured data indexing and storage							
Knowledge representation							
Information Retrieval							
Meta knowledge							

Note: Ind. = Industry; Gov. = Government; Educ. = Education; IT = IT; Med = Media; Bank = Banking; and Ins. = Insurance.

The reason for organization to adopt ICTs is to get easier in collecting data, manipulating, restoring and distributing individual knowledge. Most of all are preparing to keep and maintain individual knowledge to get solution on their existing problems. The purpose of applications is for communicating among individual or employee. The commonly used ICTs in KS application are dominated by networking

Table 3. ICTs features mostly applying in knowledge sharing applications

Knowledge sharing features:	ICTs enabler for knowledge sharing:
- Forum discussion	- Intranets
- Minute of meeting	- Network
- Question and answer	- Blog
- Email (mailing lists)	- Portals
- Find expertise	- Email
- Chat room	- Forum Group (chat, seminar, discussion,
- News	monitoring, alert etc.)
- Documentation managements	- Search/seek expertise
(procedure, material training etc.)	- Artificial intelligent
- Reports	- Data warehouse
- Voting/monitoring	- Information repositories (video, content document
- Library/Repository (employee,	management, voice conferencing etc.)
products, e-book, etc.)	

technologies (i.e. portal, web server, intranets, and knowledge repository). Table 3 shows the summary of KS application features. It mostly preferred to apply in organizations, due to condition, situation, and available of infrastructure.

6   Discussion and Conclusion

Several points can be drawn from the documents which are:

(a) KM is emerging in Indonesia to improve their business processes and competitiveness, even though it is starting with KS using ICTs. It represents the field of KM that has been growing since academic intensity to research and its application in organization were evident.

(b) Most of the documents present analysis and design of KM implementation, which are expressed by various methods and approach. However, in the most cases authors do not have enough collection to represent individual knowledge in fully meeting for knowledge requirement of the work they do. Of course, in an ideal situation, each employee in a unit of organization would know which activities and tasks to all members are involved. The larger the organization, the more complex to this process becomes.

(c) In subsequent KM process, it covers by initiation, analysis, and design phase. In most of the initiation phase, the authors would like to improve business process, how to make possible using ICTs based on KM. The analysis phase identifies the requirements of individual knowledge mostly dominated; afterwards it analyzes by knowledge mapping within tools, and the last phase the authors will design and develop application.

(d) Requirement analysis is dominated evaluation factors externally and internally, then it leveraged by SWOT (strengthen, weakness, opportunities, threat) method for mapping core knowledge and classifying individuals knowledge needed.

(e) Web based application are preferred to develop in order to spread on location organization and extended sophisticated technology.

(f) It is important to develop metrics to assess benefits of application in the future, with focus on organization, human resources, technologies, culture, and trust.

This article explored the possibilities and limitations of the ICTs in supporting KS in Indonesia organization. As shown above, the ICTs can support such management in solving problems through online discussion, disseminating of documents of tasks or procedures, trusting among employees, understanding of the organization needed to increase, and establishing against to competitiveness.

References

1. Skyrme, D.J., Amidon, D.M.: New measures of success. J. Bus. Strategy **19**(1), 20–24 (1998)
2. Dalkir, K.: Knowledge Management in Theory and Practice, pp. 1–21. Elsevier Butterworth-Heinemann, Amsterdam (2005)
3. Becerra-Fernandez, I., Sabherwal, R.: ICT and knowledge management systems. In: Schwartz, D.G. (ed.) Encyclopedia of Knowledge Management, pp. 230–236. IDEA Group Reference (2006)
4. Becerra-Fernandez, I., Gonzalez, A., Sabherwal, R.: Knowledge Management: Challenges, Solutions and Technologies. Prentice Hall, Upper Saddle River (2004). 386 p.
5. Becerra-Fernandez, I, Sabherwal, R.: ICT and knowledge management systems. In: Jennex, M.E. (ed.) Knowledge Management: Concepts, Methodologies, Tools, and Applications, pp. 1042–1050 (2008)
6. Ribie're, V., Tuggle, F.D.: The role of organizational trust in knowledge management: tool & technology use & success. In: Jennex, M.E. (ed.) Knowledge Management: Concepts, Methodologies, Tools, and Applications, pp. 1137–1154 (2008)
7. Jennex, M.E., Olfman, L.: Assessing knowledge management success/effectiveness models. In: Proceedings of the 37th Hawaii International Conference on System Sciences (2004)
8. Kucza, T.: Knowledge management process model. VTT Electronics. Technical research centre of finland ESPOO 2001, 10 December 2012. http://www.inf.vtt.fi/pdf/
9. Chan, I., Chau, P.Y.K.: Knowledge management gap: determined initiatives, unsuccessful results. In: Jennex, M.E. (ed.) Knowledge Management in Modern Organizations, pp. 354–370 (2007)
10. Alavi, M., Leidner, D.: Knowledge management system: issues, challenges and benefits. Commun. Assoc. Inf. Syst. **1**(7), 2–41 (1999)
11. Szulanski, G.: Exploring internal stickiness: impediments to the transfer of best practice within the firm. Strateg. Manag. J. **17**, 27–43 (1996)
12. Madge, O.L.P.: Creating a culture of learning and knowledge sharing in libraries and information services. In: Hou, H.-T. (ed.) New Research on Knowledge Management Models and Methods, pp. 245–268. Techopen, Croatia (2012)
13. Marwick, A.D.: Knowledge management technology. IBM Syst. J. **40**(4), 814–830 (2001)
14. Bergeron, B.: Essentials of Knowledge Management, pp. 111–132. Wiley, Hoboken (2003)
15. Alavi, M., Leidner, D.: Knowledge management and knowledge management systems: conceptual foundations and research issues. MIS Quart. **25**(1), 107–136 (2001)

16. Schwartz, D.: A bird-eye view of knowledge management: creating a disciplined whole from many interdisciplinary parts. In: Jennex, M.E. (ed.) Knowledge Management in Modern Organizations, pp. 18–29 (2007)
17. Jennex, M.E.: Internet support for knowledge management systems. In: Jennex M.E. (ed.) Knowledge Management: Concepts, Methodologies, Tools, and Applications, pp. 564–570 (2008)
18. Dalkir, K.: Knowledge Management in Theory and Practice, vol. 2, pp. 267–306. Massachusetts Institute of Technology Press, Cambridge (2011)