

Review of Studies on Agility in Knowledge Management

Ferdi Sönmez, Başak Buluz

Abstract—Agility in Knowledge Management (AKM) tries to capture agility requirements and their respective answers within the framework of knowledge and learning for organizations. Since it is rather a new construct, it is difficult to claim that it has been sufficiently discussed and analyzed in practical and theoretical realms. Like the term ‘agile learning’, it is also commonly addressed in the software development and information technology fields and across the related areas where those technologies can be applied. The organizational perspective towards AKM, seems to need some more time to become scholarly mature. Nevertheless, in the literature one can come across some implicit usages of this term occasionally. This research is aimed to explore the conceptual background of agility in KM, re-conceptualize it and extend it to business applications with a special focus on e-business.

Keywords—Knowledge management, agility requirements, agility in knowledge management, knowledge.

I. INTRODUCTION

EVERY organization, no matter what their scales and types are, endeavors to adapt to a continuously changing environment. And, it is commonly accepted that change is not temporary and will not disappear. In that respect, companies have comprehend that agility is vital for their survival and competitiveness [1]. In such a volatile environment, sustainability of any organization requires high level of adaptation capacity and capability. But, this capability may not even be sufficient by itself. It might also require prompt responsiveness in order to comply with the high speed of change in the environment. If the organizations cannot keep up with the change of the environment, although they can realize their organizational adaptation, they might still remain obsolete due to the slow rate of adaptation capability.

Firms ought to be courting their own radical transformation, rather than continuing to do what they have always done in the way that they have always done it [2]. In that respect, organizations put tremendous effort, and allocate big amount of budget in order to adapt themselves quickly and correctly. In other words, they strive to be agile.

Agility has already become and apparently will remain as one of the most important challenges for the organizations. Although its importance is only now starting to be recognized, big question marks still remain about how to achieve it. That is why organizations also need to consider the dynamic environment conditions, and should realize the process of KM

in an agile manner.

Agility and adaptiveness coexist within the context of the complex and changing environment [3].

II. DEFINITION OF AGILITY

In information technology, it is proclaimed that agile development is the ability of ‘fitting the process to the people, rather than people to the process’ [4]. This expression may not be limited to the field of information technology; it can be valid for all the fields in terms of agility. It is generally suggested that the abilities of knowledge and learning constitute significant domain for agility.

III. APPLICATION AND THEORIES OF AGILITY TOWARDS AKM

The literature presents a little information in terms of explicitly addressing AKM applications and theories. However, there are plenty of practical and theoretical studies - those imply different aspects of AKM.

A. Agile Enterprises

The reason being of the enterprises are not just to respond to the requests for the services. They are also driven by the internal events of the enterprise and business environment in which the enterprise functions. It might be the reason that in most of the companies/enterprises Chief Information Officers (CIOs) are the ones who are managing the transformation. Vandergiff, on the other hand, takes attention to the decision support systems in enterprises. Moreover, Vandergiff argues that enterprises need more aware, comprehensive and active decision support systems [5].

B. Agile Project Management

Various researchers studied the relation of KM with project management.

According to Landaeta, the understanding of projects as complex adaptive systems has brought about the idea of agile project management [6]. Inside this domain, Scrum (an agile software development technique) has become the choice of many organizations which have struggled for years on how to endure in business while meeting project objectives. Per the generic idea of agility, Scrum also seeks to respond to changes rapidly and effectively.

C. Agile Learning

Agile learning is mostly mentioned and practiced in the field of electronic learning and information technologies. For that reason it is to some extent addressed along with some software programs such as knowledge-based process asset libraries, agile learning portals (Intrepid Systems), electronic teaching

Ferdi Sönmez is with the Istanbul Arel University, Computer Engineering Department, Istanbul, Turkey (e-mail: ferdisonmez@arel.edu.tr).

Başak Buluz is with the Gebze Technical University, Kocaeli, Turkey (e-mail: bbuluz@gtu.edu.tr).

portals, Wiki's. In this context, agile learning is referred by the learners for reaching exactly to what they need and precisely when they need.

Within the organizational perspective, agile learning understanding can be traced back to Peter Senge in 1997, with his book called 'The Fifth Discipline: The Art and Practice of the Learning Organization', in which he challenges organizations to develop the capability of learning and adapting quickly [7]. Along with that idea, agile learning understanding has been mainly acknowledged with its importance to respond to the need of complying with the speed of change in order to improve competitiveness.

Clark and Gottfredson, as the CEO and the Chief Learning Officer of TRClark Company, respectively, direct a question for the companies and then try to find some responses for that question. The question is: 'How can organizations sustain competitiveness?' They suggest the answer would be in the pursuit of learning agility, and proposed that organizations must hasten knowledge cycles to maintain competitive cycles

[8].

D. Agile Software Development (ASD) and Agile Manifesto

Both software practitioners and scholars admittedly agree on the importance of knowledge and that software development is a knowledge exhaustive process. Dove and Holz, Melnik and Schaaf have first acknowledged the similarities and the connection between the ASD and KM where they emphasize that both disciplines handle organizational culture and change management [9].

Agility in software development was first recognized by the practitioners, like the other disciplines. As one of the most eminent initiatives, in 2001 the core values and principles of agile development were officially announced and approved in the declaration of the Agile Manifesto by some of the outstanding agile community members [10]. This manifesto declares 12 principles for ASD [11]. Table I depicts the examples of agile approaches/methods [10]:

TABLE I
EXAMPLES OF AGILE APPROACHES

Approach or Method	Principles Highlighting Agility in Software Development
DSDM [8]	<ul style="list-style-type: none"> • Development is incremental, iterative, and driven by feedback from user. • Delivering a perfect system is less important than delivering a system which addresses the current business needs.
FDD [7]	<ul style="list-style-type: none"> • Customer and feature centered iterative cycles. • Regular build and inspection to assure timely systems.
Agile Alliance Manifesto [11]	<ul style="list-style-type: none"> • Welcome to changing requirements, even it is late in development. • Agile processes promote sustainable development. • Deliver working software frequently. • Continuous attention to technical excellence advances agility.
Scrum [9]	<ul style="list-style-type: none"> • Software developer team determines features of each sprint from an evolving product backlog. • Create an increment of potentially shippable software during each sprint.
XP [10]	<ul style="list-style-type: none"> • The highest priority is to satisfy the changing customer needs deliberately. • Rapid user review and feedback.

IV. EXAMPLES OF AGILE STUDIES IMPLYING KM

Along with mentioned fields, there are also some other areas those imply AKM as well. Table II below indicates the summary of these examples along with the agile applications mentioned before. Youssef et al. introduce time as the new norm for competing along with the quality and cost, in their study regarding Time-Based Technologies and on the operations and manufacturing of the small and medium size firms. They assert that the organizations adopting time as an ambitious advantage are agile and learning organizations [18]. That is the reason that such organizations are supposed to introduce change and ready for the challenges which come up with it.

Singh et al. issued different tests as a part of a questionnaire. They determined that the Indian software industry selected to work with agile practices, needs support on KM deployment. Meanwhile, organizations in India do not have a formal head that is able to provide the guidelines of agile practices [20].

Ramsin and Dehghani proposed an evaluation framework that provides an exhaustive and extensive set of criteria for assessing general, area and context specific features of KMS development methodologies. KMS developers, based on the evaluation results, can select the methodology for their

requirements. Additionally, method engineers can extend current methodologies or engineer new ones to appease the specific requirements of the project [21].

Ghobadi and Mathiassen identify the problems with maintaining and evolving the data warehouse to be error prone, complex, and time consuming. They claimed that a data warehouse environment is in constant change. On the other hand, the warehouse requires to provide a balanced and regular interface to information stretching over a lengthened period of time. They proposed an agile knowledge modeling technique which promotes non-destructive extensibility mechanisms, through providing flexible and healthy change management [22].

V. AGILE KNOWLEDGE MANAGEMENT

The literature review exposes that there is very little background about AKM in the literature except for some theoretic studies and applications in the area of software development and information technologies [21], [23]. However, some studies in the KM literature imply the need for AKM, although none of them explicitly designates the term of AKM [21]-[23].

TABLE II
AGILITY STUDIES ADDRESSING THE KM

Author	Agility Specifics	Solution
Kundu et al.	- Challenge of flexibility - Customer focus of mass customization [12]	- Agile Supply chain operation strategies [12]
Jain et al.	- Complex process [1]	- Agile Supply Chain management (SCM) [1]
Lee et al.	- Rapidly digitalized management environment - In a complex situation [13]	- a New Type of ES (expert system) called IMIXAO [13]
Blake and Singh	- The need for light-weight process and responsiveness [14]	- Model driven software engineering process [14]
Genero et al.	- Highly dynamic business environment - Flexibility - Incorporate changes [15]	- Conceptual data models [15]
Macris et al.	- Active user participation - Reusable, flexible, and adaptable training [16]	- User training material [16]
Macdonald and Matinez-Uribe	- The need to increase the affectivity [17]	- Research data repository by employing agile community [17];
Youssef et al.	- Time as the new norm for competence - To be ready for the challenges of change [18]	- Time-based- technology [18]
Ronnback et al.	- Instant change - Complexity - Robust and flexible management of changes [19]	- Agile information modeling technique [19]
Singh et al.	- Agile practices for software development [20]	- Agile software development [20]
Ramsin and Dehghani	- A criteria-based evaluation framework for assessing KMS development methodologies. [21]	- Evaluation for a successful KMS [21]
Ghobadi and Mathiassen	- Knowledge sharing in agile development [22]	- Create shared understanding in software teams [22]

A. Specifics

It is very rare to encounter with the complete term of AKM in the literature except for some software and project management practices and theoretic studies. The studies and practices are not sufficient to address the conceptual basis of the construct in the scholarly literature. Actually, it is hardly possible to find peer-reviewed publications which explicitly address AKM related or agility integrated with KM. Meanwhile, some studies use the term 'AKM' which is derived from ASD and KM practices.

Levy and Hazzan are the two first scholars who introduced the term 'AKM' out of the scope of project management and software development, with the assumption that KM is vital for any project [23]. But still their study is more projects oriented rather than focusing on organizational knowledge and learning. They assert an Agile KM manifesto by using the background of ASD. However, they do not really provide a comprehensive conceptual framework for AKM.

Studies reveal that establishment of ASD and KM processes increases capacity, shortens the length of time it takes from the product being assumed and results in a featured product [24].

B. KM versus AKM Studies

Although we cannot explicitly find the term 'AKM' in the literature of KM, various scholars implicitly point at it by identifying the specifics of the environment, conditions or process of the KM.

Nonaka does not specifically identify the name of AKM but hints to agile knowledge management in one of his most well-known articles titled: 'The Knowledge-Creating Companies' [25]. In a sense, this understanding can be assumed as the root of AKM.

It was seemed to be one of the newest ideas after that KM was newly started to attract the attention of companies with the idea of capturing the knowledge gained by individuals and spreading this knowledge to others in the organization [26].

Meanwhile, O'Byrne also mentioned the need for the 'agile strategies' to make it more effective based on the comments of Daniel G. Simpson, Director of Strategy and Planning at Clorox Co. and Bain's 1997 surveys. He quoted 'agile strategies' as the encouraging managers' strategy to wait for profitable courses to emerge and then outrun the competition.

In 2005, the 'Third Biennial Conference of Professional Knowledge Management' discussed integration of the Just-In-Time (JIT) concept into the KM discipline in Kaiserslautren, Germany. In the conference, while various scholars shared their perspectives with conceptual understanding, some scholars introduced practical usages of JIT. In the conference (later published as a book), Evans et al. introduces the concept of JIT [27] for adapting to the KM discipline. Siebert also asserts JIT information delivery as a knowledge creation process and acquires a framework where he claims this framework enables intelligent technologies. He further posits that JIT information delivery starts with multi-agent environments [27].

McKellar implies AKM, although he does not explicitly name it [28]. In his study, he exemplifies a list of companies embracing KM. Landaeta et al. also addresses the need for agility, while defining the KM as 'the processes, techniques and tools which offer the right knowledge to the right knowledge worker, at the right time' [6].

C. AKE (Agile Knowledge-Based Enterprises)

Table III gives a summary of the KM studies implying AKM.

VI. RESULTS

A. Knowledge

It is hard to comprehend all definitions of knowledge published in the literature. It is equivalently difficult to reach a definition that covers all of the perspectives or has a clear

consensus on it.

TABLE III
KM STUDIES IMPLYING AKM

Year	Author (s)	Relevance to AKM
2009	Landaeta et al.	- KM is the processes, techniques and tools which offer the right knowledge to the right knowledge worker, at the apparent time [6]
2013	Neveln et al.	-KM activities always contribute to better performance and the greater the investment in KM [29]
2014	Patil and Kant	- a fuzzy framework are provided for ranking KM the solutions adoption in supply chain, -solutions ranking is comparatively observant to the barriers weights [30]
2015	Self et al.	-use of knowledge management as a possible method for improving the alignment of organizations with the external environment. [31]
2016	Cegarra-Navarro et al.	-effectiveness of a specific set, -sequence of knowledge management processes [32]

In a sense, in terms of its importance, knowledge is a very valuable intellectual asset for any organization. The literature review on knowledge revealed that 'the construct of knowledge' is at the necessary level of maturity [20], [21], [23], [33]-[35].

B. Knowledge Management

The two significant domains for KM are 'learning' and 'knowledge'. While individual knowledge and learning would rather be assumed as a manageable process, organizational aspects of learning and knowledge require significant management capability.

KM, with the idea of capturing knowledge gained by individuals and spreading it to the others in the organization is an idea, about which a lot of organizations have interest including the e-business.

The literature review poses that the KM discipline has gradually moved towards its academic maturity [20], [23]. Academic debates gave rise to concern both to the theories and practices of KM by including different perspectives, with the advances in the discipline.

C. Need for Agility

The need for agility stems from the specifics of the environment (including external and internal human factors); rapidly changing environment, uncertainty, changing customer requirements necessitate agility.

In the literature, it has been elaborated that different disciplines use and study agility with respect to their specific needs [23], [33]-[35]. Both the academic literature and the practices provide quite a number of examples of agile applications and theories. Among them, those related with KM have been exemplified in this research. Moreover, these examples clearly indicate that there exist many theoretical and practical studies about agility in different disciplines which are beneficial for contribution to KM.

D. Agility in Knowledge Management

The literature review reveals that there is very little background about AKM in the present literature except for some theoretic studies and applications in the area of software development and information technologies. However, some studies [33]-[35] in the KM literature imply the need for KM, although none of them explicitly designates the term 'AKM'.

E. Literature Review Analysis

The literature about KM and knowledge within the scope of this research is at the level of academic maturity. The literature also shows that interaction of KM with other disciplines and its inevitable expansion moves toward AKM. On the other hand, the specifics of the dynamic and complex environment necessitate agility, and hence, AKM in consideration of adaption with the changing environment immediately and handle ensuing challenges effectively.

There are numerous agile applications and theoretic studies in different disciplines. Some of them seek for the contribution of KM, which leads us to AKM.

The literature lack sufficient AKM conceptual works and practices, with the only exceptions some studies and practices about software development and information technologies.

When looking from the perspective of e-business, it is observed that limited understanding and applications of KM and unsatisfactory applications of AKM lead e-business organizations to work on AKM. On the other hand, the e-business environment reflects similar specifics to the real market environment (sometimes even more challenging). Those specifics of the environment dictate that e-business be more adaptive and agile, which actually requires AKM.

Upon those considerations it can be concluded that, the expansion direction of KM, the needs stemming from both the civilian and e-business environment, the expectations of the other agile disciplines for KM contribution and the insufficient literature about AKM, clearly address that in the current body of knowledge.

REFERENCES

- [1] Jain, V., Benyoucef, L., and Deshmukh, S. G., "A new approach for evaluating agility in supply chains using fuzzy association rules mining", *Engineering Applications of Artificial Intelligence*, 21(3), 367-385, 2008.
- [2] M. Demarest, "Understanding knowledge management", *Long Range Planning*, 30(3), pp. 374-384, 1997.
- [3] J. Moffat; Atkinson, S. R. (2005). *The Agile Organization*.
- [4] K. D., Fenstermacher, "Revealed process in knowledge management", *Professional Knowledge Management, Third Biennial Conference* (pp. 443-454). Kaiserslautern, Germany, 2005.
- [5] Vandergiff, L. J. "Unified approach to agile knowledge-based enterprise decision support. VINE": *The Journal of Information and Knowledge Management Systems*, 36(2), 199-210, 2006.
- [6] Landaeta, R. E.; Viscardi, S.; Tolk, A., "Strategic management of SCRUM projects: An Organizational Learning Perspective", In *Proceedings of IEEE International Technology Management Conference*, 27-30 June 2011, San Jose, CA, (pp 651-656). Curran Associates, Inc, 2011.

- [7] Senge, P., Kleiner, A., Roberts, C., Ross, R. and Smith, B., "The fifth discipline field book: Strategies and tools for building a learning organization", London, UK: Nicholas Brealey Publishing Limited, 1994.
- [8] Clark, T. R., & Gottfredson, C. A. (2009). Agile Learning: Thriving in the New Normal. Chief learning officer, 8(12), 18-21.
- [9] Holz, H., Melnik, G., & Schaaf, M. (2003, June). Knowledge management for distributed agile processes: Models, techniques, and infrastructure. In Enabling Technologies: Infrastructure for Collaborative Enterprises, 2003. WET ICE 2003. Proceedings. Twelfth IEEE International Workshops on (pp. 291-294). IEEE.
- [10] Lee G. and W. Xia, "Toward Agile: An Integrated Analysis of Quantitative and Qualitative Field Data on Software Development Agility", MIS Quarterly 34(1), pp. 87-114, March 2010.
- [11] Fowler, M., & Highsmith, J. (2001). The agile manifesto. Software Development, 9(8), 28-35.
- [12] Kundu, S., McKay, A., & de Pennington, A. (2008). Selection of decoupling points in supply chains using a knowledge-based approach. Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture, 222(11), 1529-1549.
- [13] Cho, B., Hahm, M. G., Choi, M., Yoon, J., Kim, A. R., Lee, Y. J. ... & Jeong, Y. (2015). Charge-transfer-based gas sensing using atomic-layer MoS₂. Scientific reports, 5, 8052.
- [14] Blake, M. B., & Singh, L. (2008). Software engineering for web services workflow systems. International Journal of Software Engineering and Knowledge Engineering, 18(02), 157-178.
- [15] Genero, M., Poels, G., & Piattini, M. (2008). Defining and validating metrics for assessing the understandability of entity-relationship diagrams. Data & Knowledge Engineering, 64(3), 534-557.
- [16] Macris, A., Papakonstantinou, D., Malamateniou, F., & Vassilacopoulos, G. (2009). Using ontology-based knowledge networks for user training in managing healthcare processes. International Journal of Technology Management, 47(1-3), 5-21.
- [17] Macdonald, S., & Martinez-Urbe, L. (2010). Collaboration to data curation: Harnessing institutional expertise. New Review of Academic Librarianship, 16(S1), 4-16.
- [18] Youssef, M. A., Mohamed, Z., Sawyer Jr, G., & Whaley, G. L., Testing the impact of integrating TQM and DFM on the ability of small to medium size firms to respond to their customer needs. Total Quality Management, 13(3), 301-313, 2010.
- [19] Rönnbäck, L., Regardt, O., Bergholtz, M., Johannesson, P., & Wohed, P. (2010). Anchor modeling—Agile information modeling in evolving data environments. Data & Knowledge Engineering, 69(12), 1229-1253.
- [20] Singh A., K. Singh and Neeraj Sharma, "Agile knowledge management: a survey of Indian perceptions", innovations in Systems and Software Engineering, 10(4), pp 297–315, 2014.
- [21] Deghani, R., & Ramsin, R. (2015). Methodologies for developing knowledge management systems: an evaluation framework. Journal of Knowledge Management, 19(4), 682-710.
- [22] Ghobadi, S., and Mathiassen, L., "Perceived barriers to effective knowledge sharing in agile software teams. Info Systems J, 26: 95–125, 2016.
- [23] Levy, M., & Hazzan, O. (2009, May). Knowledge management in practice: The case of agile software development. In Cooperative and Human Aspects on Software Engineering, 2009. CHASE'09. ICSE Workshop on (pp. 60-65). IEEE.
- [24] Reifer, D. J. (2002, August). How to get the most out of extreme programming/agile methods? In Conference on Extreme Programming and Agile Methods (pp. 185-196). Springer Berlin Heidelberg.
- [25] Nonaka, I., The knowledge-creating company. Harvard Business Review on Knowledge Management. 21(2), 96-104, 1991.
- [26] O'Byrne, W. T., Weavind, L., & Selby, J. (2008). The science and economics of improving clinical communication. Anesthesiology Clinics, 26(4), 729-744.
- [27] Evans, T. E., Moyer, R. A., Watkins, J. G., Thomas, P. R., Osborne, T. H., Boedo, J. A., ... & Harris, J. (2005). Suppression of large edge localized modes in high confinement DIII-D plasmas with a stochastic magnetic boundary. Journal of nuclear materials, 337, 691-696.
- [28] McKellar, H., KM world 100 companies that matter in knowledge management. KM World, 16(3), 18-19., 2007.
- [29] Neveln, I. D., Bai, Y., Snyder, J. B., Solberg, J. R., Curet, O. M., Lynch, K. M., & MacIver, M. A. (2013). Biomimetic and bio-inspired robotics in electric fish research. Journal of experimental Biology, 216(13), 2501-2514.
- [30] Sachin K. Patil, Ravi Kant, A fuzzy AHP-TOPSIS framework for ranking the solutions of Knowledge Management adoption in Supply Chain to overcome its barriers, Expert Systems with Applications, Volume 41, Issue 2, pp. 679-693, February 2014.
- [31] Self, D. R., Self, T., Matuszek, T., and Schraeder, M., "Improving organizational alignment by enhancing strategic thinking", Development and Learning in Organizations: An International Journal, 29(1), 11-14, 2015.
- [32] Juan-Gabriel Cegarra-Navarro, Pedro Soto-Acosta, Anthony K. P. Wensley, Structured knowledge processes and firm performance: The role of organizational agility, Journal of Business Research, Volume 69, Issue 5, pp.1544-1549, May 2016.
- [33] O. Dogan, Agile knowledge management; A review, reconceptualization, and extension to military applications, Old Dominion University, 2012.
- [34] V. Llamas, T. Coudert, L. Geneste, J. C. Romero-Bejarano, A. de Valroger, Proposition of an agile knowledge-based process model, IFAC-PapersOnLine, 49 (12), 2016, pp. 1092-1097.
- [35] H. D. Doran, Agile Knowledge Management in Practice. In: Melnik G., Holz H. (eds) Advances in Learning Software Organizations. LSO 2004. Lecture Notes in Computer Science, vol 3096, 2014, Springer, Berlin, Heidelberg.