

Investigating Knowledge Management in the Software Industry: The Proof of Concept's Findings of a Questionnaire Addressed to Small and Medium-sized Companies

Danieli Pinto¹, Mariana Oliveira¹, Flávio Bortolozzi^{1,2}, Nada Matta³ and Nelson Tenório^{1,2,3}

¹*Knowledge Management Master's Program of UniCesumar, Av. Guedner, 1218, build 7, Maringá, Paraná, Brazil*

²*Institute Cesumar of Science, Technology, and Innovation, Av. Guedner, 1218, build 11, Maringá, Paraná, Brazil*

³*University of Troyes, 12 rue Marie Curie, Troyes, France*

Keywords: Knowledge Management, Proof of Concept, Questionnaire, Software Industry.

Abstract: The software industry is dynamic and complex, so they need to use the knowledge to excel in a highly competitive market. Thus, the knowledge well managed brings the organization a sustainable and competitive advantage. Knowledge Management (KM) processes can avoid knowledge lost since they provide knowledge flow for the whole organization. These processes are supported by practices and tools promoting the creation, retention, and dissemination of the knowledge within the organizational environment. The objective of this study was to validate, through a proof of concept (POC), a questionnaire to investigate the processes, practices, and tools of KM in SME-Soft. The questionnaire was evaluated by fifty-one professionals and KM experts from the software industry. Our findings point out that the questionnaire is suitable for the software industry.

1 INTRODUCTION

Over the last few years, the organizations recognize the knowledge as an asset which adds value to products and services. In this sense, the knowledge has been considered relevant for the business advantage (Del Giudice and Maggioni, 2014). Thus, the individuals are responsible for encouraging content creation and the updating of existing knowledge (Chang and Lin, 2015). The Knowledge Management (KM) sets an approach to ensure the full usage of the organization's knowledge base (Dalkir, 2011). So, KM is crucial to maintaining and enhancing the performance of organizations (Muthuvveloo et al., 2017), becoming relevant to integration between developing software and its operational deployment (Colomo-Palacios et al., 2018).

The software industry companies are characterized as highly-competitive, dynamic, and activities that use knowledge intensively (Nawinna, 2011). Aurum et al. (2008) state that the knowledge circulating within a software development teams is dynamic and evolves according to technology,

organizational culture, and changes in software development processes. Thus, KM prevents those organizations of knowledge loss (Bjornson and Dingsoyr, 2008). Therefore, regardless of the size of the company successful results in creating and maintaining software depends on the KM since the individuals' knowledge is directly related to the product development, management, and technology (Aurum et al., 2008).

In this scenario, small and medium-sized software industry companies (SME-Soft) which their success is directly related to the knowledge, experience, and skills of their owners and employees (Wee and Chua, 2013). Thus, SME-Soft is not able to practice KM in the same way as large organizations due to its organizational culture and structure. Like that, it is relevant to investigate the practices, processes, and tools that SME-Soft to keep their knowledge flowing.

Previous research has established means to investigate KM process within organizations, providing a diagnosis of the KM processes and practices such as Bukowitz and Willians (1999), Vestal (2002), Fonseca (2006), and Nair and Prakash

(2009). However, those works were not mainly designed to investigate KM within the SME-Soft. Besides, the proposals follow specific methodologies to be carried on and too overwhelming to be answered, requiring the help of an expert. Moreover, the outcomes of those proposals also require much time to be understood and interpreted.

Therefore, this paper aims to validate and refine a questionnaire to investigate the processes, practices, and tools of KM within SME-Soft. For this, we carried out a proof of concept (POC). The POC is a best practice to improve questionnaires or tools in both experimental studies and commercialization of new technology products, helping to identify problems which compromises the results of studies (Kendig, 2016). The POC works as 'pre-test' of the questionnaire, evidencing deficiencies, such as ambiguous, poorly designed or double (Aaker et al., 2001). Thus, the POC provides the sense concerned its structure, content, applicability, and of how long each participant takes to answer it.

The remainder of this paper is structured as follows. In the next section, we present the related works of investigating KM in the organizations through the questionnaires. Section 3 presents our method to design the questionnaire and to perform the POC. Section 4 presents the results of our paper and, finally, section 5 presents our conclusions followed by the references.

2 RELATED WORKS

A way to find out where is the knowledge and how individuals use it within the organization is identifying the KM process. According to Oliva (2014), as important as understanding where knowledge is revealed, is to understand where knowledge is established. In this sense, evaluating KM practices in an organization means measuring what has been done by it (Khatibian et al., 2010).

Demchig (2015) states that KM means understanding and deepening knowledge about organizational processes and what their contributions to knowledge generation are. The author emphasizes that knowledge is an asset of constant evolution and as organizations share new experiences, they learn, and advance and then the new understandings are gained.

Siadat et al. (2016) state the need to map the relationship between theory and KM practices carried out by the organization to show how it works, how it performs its operations and also the

path covered by the information and knowledge.

Khatibian et al. (2010) show that many organizations are practicing KM, but they do not recognize their practices as a relevant context organizational, while other organizations even speak about practices but use minimal efforts to achieve success. Freeze and Kulkarni (2005) go on that KM is not just a management of intellectual assets, but also the processes that act on them including the development, storage, use and, especially, sharing knowledge which, in this case, involves the identification and analysis of availability and desirable assets, with the sole purpose of achieving the organizational objectives.

Bukowitz and Willians (1999), Vestal (2002), Fonseca (2006), Nair and Prakash (2009), and APO (2009) propose different models to investigate KM process and practices within the organizations. Those models aim to diagnosis how the organization manages and controls its knowledge (Freeze and Kulkarni, 2005) through an organizational knowledge overview (Siadat et al., 2016).

In this sense, Bukowitz and Willians (1999) propose a KM diagnosis through a set of subjective questions to the organization. All the questions are then later ranked, tabulated, interpreted, and discussed. The authors divide the KM diagnostic model into two dimensions namely tactical and strategic. The tactical dimension is consisting of the knowledge obtaining, using, learning, and contributing. The strategic dimension consisting of the evaluate, build and maintain the knowledge within the organization.

Vestal (2002) provides a detailed roadmap to help organizations design, implement, and sustain their knowledge addressed either by organizations that are implementing or have already implemented KM. First, the model provides the step-by-step for the development and implementation of the strategy. Second, the model acts as an adjustment tool, providing a diagnosis of the knowledge situation in the organization. For this, the model presents four phases namely call to action, development of the KM strategy, design and implementation, and expansion and support.

Fonseca (2006) proposes the model called Organizational Knowledge Assessment Methodology (OKA) in which aims to assess and measure the performance of an organization concerning KM through a questionnaire. The model has three dimensions based on people, processes, and systems, and the results, presented in a radar chart, show the strengths and weaknesses of the KM in the organization.

Nair and Prakash (2009) propose the Knowledge Management Facilitators' Guide. The authors suggest a methodology for the implementation of KM addressed to small and medium-sized. The method consists of three levels namely accelerators, KM processes, and results.

While supporting KM investigation and diagnosis through the questionnaires, most of the models are split into different dimensions. Those dimensions aim to identify some improvement points categorizing the results of the KM models used for facilitating its interpretation and understanding. In this sense, Pinto et al., (2016) suggest six dimensions to investigate KM within SME-Soft as follows.

KM Perception Dimension. According to Davenport and Prusak (1998), KM has to support companies' strategic plans explicitly. Moreover, KM establishes the understanding regarding individuals' knowledge to be used and aid the decision-making processes within the companies (Serna et al., 2017). Thus, this dimension aims to investigate the participant's perception regarding KM within their organization.

Organizational Knowledge Identification Dimension. This dimension is essential to investigate if the individuals know where they find the knowledge which they need. The companies' knowledge is unique, i.e., there are not two or more companies with the same knowledge (Capaldo and Petruzzelli, 2015). In this sense, it is crucial to identify the organizational knowledge and map it in the organizational environment. Therefore, this dimension aims to investigate the flow of the organizational knowledge and shows its origin.

Organizational Knowledge Storage Dimension. This is addressed to store individual knowledge getting it explicit through different means such as documents, manuals, databases, etc. Wiig (1993) states that the companies' knowledge must be stored in knowledge bases or repositories to become explicit. Thus, knowledge associated with abstract concepts is coding by experts and indexing in databases to make it more tangible for the whole members of the organization. Thus, this dimension aims to investigate 'where' and 'how' the knowledge is stored, and what kind of tools the companies use to store their knowledge.

Organizational Knowledge Recovery Dimension. This dimension consists of retrieving the stored knowledge to supply the individual's needs regarding information (Yagüe et al., 2016). Moreover, the information retrieved give the individuals means to build a new knowledge (Choo,

2006). Thus, this dimension presented aims to investigate the knowledge recovery checking whether individuals usually recover the knowledge stored in the organization.

Organizational Knowledge Sharing Dimension. It considers that the organizational knowledge is dynamic and dependent on social relationships for knowledge creation, sharing, and use (Ipe, 2003). Furthermore, the organizations have different individuals with different expertise, experience, and necessities. So, the knowledge cannot be lost, and it is necessary for the organizations to stimulate sharing practices offering favorable conditions for creation, sharing and use of the knowledge (Zhang and Jiang, 2015). So, this dimension aims to enhance the organizational knowledge among the individuals.

Finally, *KM Practices and Tools Dimension.* KM practices are a set of activities conducted by the organization to improve the effectiveness and efficiency of the organizational knowledge resources (Andreeva and Kianto, 2011). On the other hand, the tools aim to support those practices. Perez-Aros et al. (2007), go on that "tools must support communication appropriately, collaboration, sharing and searching activities related to relevant information and knowledge". Therefore, this dimension aims to identify how often which companies use the KM practices and also what sort of tools are used to subsidize these practices.

While offering useful means to investigate and diagnosis KM within the organizations, the questionnaires suggested by the previous works are too complex, extensible, and not focused on SME-Soft once they not contain specific questions to software development companies. In this sense, we present our questionnaire addressed to SME-Soft, and validated and refined by a POC.

3 METHOD

The questionnaire was grounded based on previous works by Bukowitz and Willians (1999), Vestal (2002), Fonseca (2006), Nair and Prakash (2009), and Pinto et al. (2016), and the questions are addressed investigate KM processes, practices, and tools within SME-Soft. We present the complete questionnaire in the Appendix.

3.1 Questionnaire Design

We designed the questionnaire according to steps suggested by Aaker et al. (2001). Afterward, we organized the questionnaire in Google Forms tool

arranging it in two sections to facilitate data collection and analysis. The first section brings questions about the profile of the participants through sixteen questions regarding education, age, gender, how long the participant works in the organization, and position. The second section in six dimensions proposed by Pinto et al., (2016). The dimensions were structured considering that the knowledge of the organizations is inside the people and needs to be identified, organized and stored so that it is not lost, and can be recovered and shared whenever necessary. Table 1 presents an overview of the questionnaire before the POC showing the sections and dimensions followed by its goals and a description of the questions. Finally, the Appendix presents the complete questionnaire.

3.2 Data Collection

The participants were invited to cooperate with this research during a software local productive arrangement meeting attended by companies' members located in the Northwest Region of Paraná, Brazil. The local productive arrangement has more than three hundred small and medium-sized companies associated. At the meeting were present members of fifty-three companies in which ten of them got interested in collaborating with the research. All participating companies are software vendors having between 10 and 25 years old operating in the market with local clients and also clients across Brazil. After the meeting, we e-mailed the participants a brief of the research containing goals, methods, data needs to collect, and the time estimation for each participant to answer and assess the questionnaire. The companies could point out the individuals to participate in the POC according to their availability. The questionnaire was assessed following a scheduled. We designed seven questions which were used as a driver of the questionnaire assessment as follows.

1. How long did you take to answer the questionnaire? Do you think this time to respond was reasonable?
2. Do the questions fit for the software industry?
3. Does the questionnaire fit for the software industry?
4. Would you rule out a question? Why?
5. Would you add any questions? Why?
6. Is the questionnaire relevant to your organization?

We carried on data collection between July and August of 2016. We visited each company, we accessed the questionnaire in the Google Forms, and then we 'gave' the questionnaire to each participant answer it by themselves in a private room. All participants data were kept in secrecy, and we cannot identify them through the answers. Each participant also received a hard copy of the questionnaire, which made it possible to follow up the questions and some notes during the POC. We also invited a KM expert to assess the questionnaire in which we just emailed it to this person.

3.3 Data Analysis

We organized all the data into spreadsheets. Firstly, we analyzed the first section of the questionnaire regarding the profile of the participants, e.g., education, age, gender. Secondly, we analyzed the answers to the six dimensions in order to identify the processes, practices, and tools of the participants. Finally, we analyzed the questionnaire assessment by the participants carefully through the content analysis technique as suggested by Neuendorf (2016) and our empirical findings are described following.

4 RESULTS

The POC was answered by fifty-one workers from different software companies and one KM expert with over 20 years of experience in academic research. The profile of the POC participants is presented in Figure 1.

The Figure 1(a) shows the age of participants ranged between 24 and 50 years old. The largest age group was between 36 and 40 years, i.e., 38% of the participants. The Figure 1(b) presents the degree of education of the participants in which 28% are bachelors, 57% have MBA in the area in which they work, and 8% have master's or Ph.D.

Moreover, the Figure 1(c) shows that 37% of the participants are project managers, 16% are software development, and 28% is responsible for any area, e.g., leadership team, director, and CEO. Finally, the Figure 1(d) shows that 85% of them have worked for the current company for more than three years, and 43% of them have experience in their current position for more than seven years. Therefore, all research participants have a precise knowledge of their position within the organization.

Table 1: Overview of the questionnaire before the POC.

Section	Dimension	Goal	Description
Background questions	Sample characteristics	Identify the profile of the participants.	There were sixteen questions related to age, gender, education, the position held in the company, time of experience in the position, and working time.
KM within SME-Soft	KM Perception (KMP)	This dimension aims to show the participant's perception of the knowledge and the KM within the organizational environment.	There were thirteen yes or no affirmations and one open question to investigate the perception of the KM's concept, relevance of the knowledge for the organization, knowledge usage within the organization, practice of KM, areas/department/sectors where KM is practiced, KM practices and monitoring by the organization, and whether KM is a part of the management organization strategy.
	Organizational Knowledge Identification (OKI)	This dimension aims to verify if knowledge identification is a practice within the organization.	There were eight questions which six adapted Likert Scale (Likert, 1932), two yes or no, and two open questions. All of them addressed to investigate the frequency in which the organizational problems are solved, how often problem solvers use the sources of knowledge, whether team members know where to get a knowledge required, whether all team members express their ideas, and whether ideas are used in the software development process.
	Organizational Knowledge Storage (OKST)	This dimension aims to investigate if the organization stores a knowledge acquired.	There was one open question, one adapted Likert Scale question (Likert, 1932), and two yes or no questions. All of them related to the storage and maintenance of knowledge within the organization.
	Organizational Knowledge Recovery (OKR)	This dimension shows if stored knowledge is recovered within the organization.	There was one adapted Likert Scale question (Likert, 1932), and one open question to investigate knowledge recovery by the individuals.
	Organizational Knowledge Sharing (OKSH)	This dimension investigates if the knowledge is shared and comprehensive among the team members within the organization.	There were five yes or no questions and one adapted Likert Scale question (Likert, 1932) regarding organizational motivation to store knowledge, exchange information between team members and other individuals in the organization or the external environment.
	KM Practices and Tools (KMPT)	This dimension presents which practices and tools, currently used by people, are aligned with KM within the organization.	There were twenty classic Likert Scale affirmations (Likert, 1932) related to the KM practices carried out in the organization (e.g., knowledge coffee, capturing ideas, coaching, a bank of individual skills, as well as the evaluation of the competency management system and reporting questions). Also, there were nineteen classic Likert Scale (Likert, 1932) affirmations regarding tools to support the practices of KM (e.g., database, blogs, skype, handbooks, notice board, chat, facebook messenger, reports, virtual bulletin board, video, virtual forums, Kanban, virtual collaboration, text, intranet, Canvas, e-mail, WhatsApp, official documents).

Source: The authors.

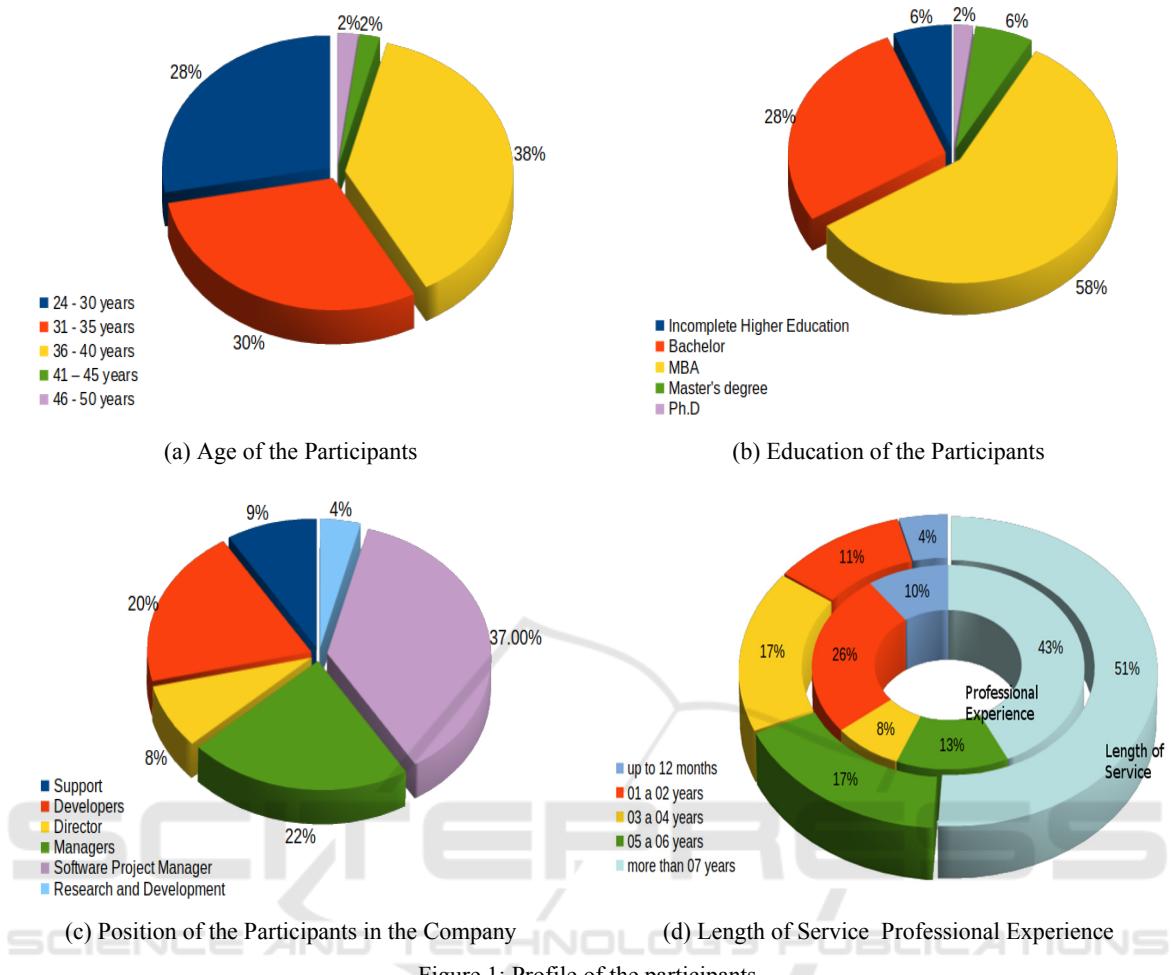


Figure 1: Profile of the participants.

4.1 POC Findings

The POC of the questionnaire resulted in interesting findings in which we divided in five categories as *answer time*, *remove questions*, *add questions*, *relevance of the question*, *relevance SME-Soft*, and *further considerations*.

Answer time. One of questionnaire strength reported by the participant is its answer time. We took the answer time of the participants, and they took around 18 minutes to answer all questions on average. The shortest recorded time was of 14 minutes (P13, project manager) and the highest of was 42 minutes (P14, user support manager). Considering the questionnaire's answer time, the KM expert pointed out that it was quite reasonable.

Removing questions. The participants suggested removing questions in the dimension OKI. A development leader observed two questions investigating similar subjects, i.e., questions 2.4 and 2.8 (see Appendix). A human resource manager and

a project manager also observed those similar questions, and the project manager highlighted that “similar questions could discourage the participants to continue answering the questionnaire”. Moreover, three of the participants suggested to keep one of the questions and discard the other, since both were similar, but none of them indicated which question to exclude. Inversely, the KM expert observed that, although some questions are similar, there were no reasons to take out those questions since they appear in different dimensions with different goals. However, the KM expert suggested changing the order of the questions in the first dimension, observing that the sequence could be more systematic and logical.

Adding questions. When we asked the participants regarding the needs to add questions, a project manager suggested adding one question exploring which companies adapt to address the problems that arise when performing their daily activities. An operation manager said he would not

add anything, however, stressed that the terms used to investigate actions and practices sometimes confuse. Still, for that manager, this is a disadvantage for those who do not know what KM is. An administrative leader said that some open question should be added in the KMPT dimension to investigate the use of other practices that are not listed in the questionnaire. Also, another project manager missed some questions about the results obtained with the KM tools usage and the performing of KM practices. Inversely, the KM expert did not miss any questions.

Relevance for SME-Soft. All participants observed that the questionnaire is entirely relevant for SME-Soft. For instance, one of the project managers considered conducting the questionnaire to his team to 'perceived what needs to be improved'. In this context, the participant human resource manager stressed that the questionnaire provides a step forward. Another project manager and administrative manager pointed out that the questionnaire is provocative once they need to think about whole organizational processes.

Further considerations. The participants made further considerations regarding the questionnaire. A software developer observed that the questions in dimension OKST and OKSH looked like similar, and those dimensions could be unified. Besides, a support manager suggested changing the word 'organization' for all questions by 'your department' or 'your team' to be more specific and to get the questions clearer. Curiously, all the participants observed that they got some insights while answering the questionnaire. For them, the questionnaire increases the visibility of the respondents regarding KM processes, practices, and tools leading them to reflect about the organization processes, recognizing KM tools usage, and getting ideas how the KM could open new grounds if applied within their team. It reinforces the importance of a questionnaire addressed specifically for SME-Soft.

4.2 Refining the Questionnaire

After the POC, we analyzed all the participants' considerations and carried out following adjustments in order to refine the questionnaire.

Firstly, we updated the *question's order*. We changed the order of the questions in the dimension KMP following the KM expert's suggestion facilitating the understanding of the questions once it begins from the specific to the general theme. Also, the question 2.5 in the OKI dimension was moved to

dimension OKSH once that question was related to knowledge dissemination (see Appendix).

Secondly, we removed some questions. Based on our analysis, we decided to remove from the questionnaire three questions as follows. The question 2.4 from dimension OKI once it was similar to the question 2.8 of the same dimension. Also, we removed the question 2.2 from dimension OKI because it was similar to question 4.2, the dimension OKR (see Appendix).

Thirdly, we *added two new questions* in the dimension KMPT. The questions enable the participant informs other practices and tools adopted by the organization and also not listed in that dimension. Thus, the question added is 'Could you inform other practices/tools which your team use daily and are not listed above?' (see Appendix).

Finally, we decided do not unify the dimensions OKST and OKSH once they have different objectives, as observed by the KM expert. Moreover, while KM requires a holistic view, we also decided not to change the term 'organization' by different terms as suggested one of the participants.

Therefore, the results achieved here show that the questionnaire is relevant and adequate for the SME-Soft. The participants highlighted that the questionnaire helps them to understand KM processes, practices, and tools within SME-Soft, getting some insights to carry on KM with their team within the organization.

5 CONCLUSIONS

This research carried out a POC to refine and validate a questionnaire addressed to investigate KM processes, practices, and tools in SME-Soft. As results, the participants suggested some improve points in which we analyzed and accepted several of them. Curiously, we also find out that while the participants were assessing the questionnaire, they had some insights regarding KM processes and practices performed by their organization. In addition, the strength of the questionnaire was the answer time. Moreover, all the participants considered the questionnaire very relevant to investigate KM within SME-Soft. However, one limitation of this work was the lack of conducting interviews with participants. For the future work, we intend to broaden our sampling and also conduct mixed methods performing interviews with KM experts and practitioners and with software industry workers aiming to refine further our questionnaire.

ACKNOWLEDGMENTS

Our special thanks to Cesumar Institute of Science, Technology, and Innovation (ICETI - *Instituto Cesumar de Ciência, Tecnologia e Inovação*), Maringá, Paraná, Brazil. We also thanks to *Programa de Suporte a Pós-Graduação de Instituições de Ensino Particulares* (PROSUP) of Coordination for the Improvement of Higher Education Personnel (CAPES - *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*), Brazil.

REFERENCES

- Aaker, D. A., Kumar, V., Day, G. (2001). *Marketing Research*. John Wiley & Sons.
- Andreeva, T., Kianto, A. (2011). Knowledge processes, knowledge intensity and innovation: a moderated mediation analysis. *Journal of Knowledge Management*, 15(6), 1016–1034.
- Aurum, A., Daneshgar, F., Ward, J. (2008). Investigating Knowledge Management practices in software development organisations - an Australian experience. *Information and Software Technology*, 50(6), 511–533.
- APO. (2009). *Knowledge management: facilitator's guide*. Retrieved from <http://www.apo-tokyo.org/00e-books/IS-39_APO-KM-FG.htm>
- Bjornson, F. O., Dingsoyr, T. (2008). Knowledge management in software engineering: a systematic review of studied concepts, findings and research methods used. *Information and Software Technology*, 50(11), 1055–1068.
- Bukowitz, W. R., Williams, R. L. (1999). *The knowledge management fieldbook*. London: Pearson Education Limited.
- Capaldo, A., Petruzzelli, A. M. (2015). Origins of knowledge and innovation in R&D alliances: a contingency approach. *Technology Analysis and Strategic Management*, 27(4), 461–483.
- Chang, C. L., Lin, T. C. (2015). The Role of Organizational Culture in the Knowledge Management Process. *Journal of Knowledge Management*, 19(3), 433–455.
- Choo, C. W. (2006). *The knowing organization as learning organization*. Education + Training 2nd ed., Vol. 43. New York: Oxford University Press.
- Colomo-Palacios R., Fernandes E., Soto-Acosta P., Larruea, X. (2018). A case analysis of enabling continuous software deployment through knowledge management. *International Journal of Information Management*, 40, 186–189.
- Dalkir, K. (2011). *Knowledge Management in Theory and Practice*. 2 ed. Massachusetts: The MIT Press.
- Davenport, T. H., Prusak, L. (1998). *Working knowledge: how organizations manage what they know*. Boston: Harvard Business School Press.
- Del Giudice, M., Maggioni, V. (2014). Managerial practices and operative directions of knowledge management within inter-firm networks: a global view. *Journal of Knowledge Management*, 18(5), 841–846.
- Demchig, B. (2015). Knowledge Management Capability Level Assessment of the Higher Education Institutions: Case Study from Mongolia. *Procedia - Social and Behavioral Sciences*, 174, 3633–3640.
- Fonseca, A. F. (2006). *Organizational knowledge assessment methodology*. Washington: Word Bank Institute.
- Freeze, R., Kulkarni, U. (2005). Knowledge Management Capability Assessment: Validating a Knowledge Assets Measurement Instrument. *Proceedings of the 38th Annual Hawaii International Conference on System Sciences*, 0(C), 1–10.
- Ipe, M. (2003). Knowledge sharing in Organizations: a conceptual framework. *Human Resource Development Review*, 2(4), 337–359.
- Kendig, C. E. (2016). What is Proof of Concept Research and how does it Generate Epistemic and Ethical Categories for Future Scientific Practice? *Science and Engineering Ethics*, 22(3), 735–753.
- Khatibian, N., Hasan, T., Jafari, H. A. (2010). Measurement of knowledge management maturity level within organizations Measurement of knowledge management maturity level within organizations. *Business Strategy Series Business Process Management Journal Iss Journal of Knowledge Management*, 11(6), 793–808.
- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 22(140), 5–55.
- Muthuveloo, R., Shanmugam, N., Teoh, A. P. (2017). The impact of tacit knowledge management on organizational performance: Evidence from Malaysia. *Asia Pacific Management Review*, 22(4), 192–201.
- Nair, P.; Prakash, K. (2009). *Knowledge management: Facilitator's guide*. APO: Tokyo.
- Nawinna, D. P. (2011). A model of knowledge management: delivering competitive advantage to small & medium Scale Software Industry in Sri Lanka. *6th International Conference on Industrial and Information Systems*, 414–419.
- Neuendorf, K.A. (2016). *The content analysis guidebook*. Sage.
- Oliva, F. L. (2014). Knowledge management barriers, practices and maturity model. *Journal of Knowledge Management*, 18(6).
- Perez-Aros, A., Barber, K. D., Munive-Hernandez, J. E., Eldridge, S. (2007). Designing a knowledge management tool to support knowledge sharing networks. *Journal of Manufacturing Technology Management*, 18(2), 153–168.
- Pinto, D., Bortolozzi, F., Menegassi, C. H. M., Pegino, P. M. F., Tenório, N. (2016). Design das etapas a serem seguidas em um instrumento para a coleta de dados para organizações do setor de TI. In: *VI Congresso Internacional de Conhecimento e Inovação – CIKI*.
- Serna, E., Bachiller, O., Serna, A. (2017). Knowledge meaning and management in requirements

- engineering. *International Journal of Information Management*, 37, 155–161.
- Siadat, S. H., Kalantari, H., Shafahi, S. (2016). Assessing knowledge management maturity level based on APO approach (a case study in Iran). *International Journal of Social Science and Humanities Research*, 4(3), 629–638.
- Vestal, W. (2002). *Measuring Knowledge Management*, APQC (American Productivity & Quality Center, Houston, TX).
- Wiig, K. (1993). *Knowledge management foundations*. Arlington, TX: Schema Press.
- Wee, J. C. N., Chua, A. Y. K. (2013). The peculiarities of knowledge management processes in SMEs: the case of Singapore. *Journal of Knowledge Management*, 17(6), 958–972.
- Yagüe, A., Garbajosa, J., Díaz, J., González, E. (2016). An exploratory study in communication in Agile Global Software Development. *Computer Standards and Interfaces*, 48, 184–197.
- Zhang, X., Jiang, J. Y. (2015). With whom shall I share my knowledge? A recipient perspective of knowledge sharing. *Journal of Knowledge Management*, 19(2), 277–295.

APPENDIX

KM Questionnaire to SME-Soft

KM Perception Dimension (KMP)

- 1.1 Have you heard about knowledge management in any lecture, course, meeting, or conference? Y/N
1.2 Do you know what knowledge management is? Y/N

- 1.3 Is knowledge management currently a topic of interest to the organization? Y/N
1.4 Does the organization understand that knowledge is a resource of the organization? Y/N
1.5 Is it fact that knowledge is stored in people? Y/N
1.6 Does conduct knowledge management practices by the organization? Y/N

If the answer is YES

- 1.6.1 How long are knowledge management practices in the organization?
1.6.2 Are all areas aware of the organization's knowledge management practices? Y/N
1.6.3 Are knowledge management practices carried out in all areas of the organization? Y/N
1.6.4 Does the organization have a defined vision or justification for the practice of knowledge management? Y/N
1.6.5 Knowledge management is aligned with and is part of the organization's management model? Y/N
1.6.6 Does the organization continually and systematically assess knowledge management

practices, identify weaknesses, and define and use methods to eliminate them? Y/N

If the answer is NO:

- 1.6.7 Do you know if there are plans to implement projects on knowledge management in the organization? Y/N

- 1.6.8 How soon will the project be implemented?

Organizational Knowledge Identification Dimension (OKI)

- 2.1 How often do employees often turn to colleagues within the organization to solve problems? Always/Frequently/Sometimes/Rarely/Never

- * ~~2.2 How often do employees use other sources of knowledge (intranet, internet, database, manuals) to solve their problems?~~ Always/Frequently/Sometimes/Rarely/Never

- 2.3 Employees know “who knows what” within the organization, making it clear where to look for specific information? Y/N

- * ~~2.4 What resources do employees use to obtain information?~~

- ~~2.5 Do all employees express their ideas?~~ Always/Frequently/Sometimes/Rarely/Never

- 2.6 Are employees' ideas taken into account for the organization's decision-making? Always/Frequently/Sometimes/Rarely/Never

- 2.7 Is the involvement of customers in the process of creating and developing new products and services a well-established practice in the organization? Always/Frequently/Sometimes/Rarely/Never

- 2.8 How does the organization disseminate information or knowledge to its employees?

Organizational Knowledge Storage Dimension (OKST)

- 3.1 What resources does the organization use to store knowledge?

- 3.2 Knowledge storage media is updated: Always/Frequently/Sometimes/Rarely/Never

- 3.3 Does the knowledge storage space in the organization have a structure that enables everyone to contribute? Y/N

- 3.4 Is the knowledge stored in the organization intended for all sectors of the organization? Y/N

Organizational Knowledge Recovery Dimension (OKR)

- 4.1 When people are given the task of researching information in the organization, are they able to do it? Always/Frequently/Sometimes/Rarely/Never

- 4.2 Where do people usually look for information on the company?

Organizational Knowledge Sharing Dimension (OKSH)

- 5.1 Does the organization motivate its employees to share information with each other? Y/N
5.2 Do all employees in the organization share information with each other? Y/N
5.3 Is the workspace designed to promote the flow of ideas between workgroups? Y/N
5.4 Are people afraid to share their knowledge with other colleagues in the organization? Y/N
5.5 Does the organization support group activities? Y/N
† 5.6 (previously 2.5) Do all employees express their ideas? Always/Frequently/Sometimes/Rarely/Never

KM Practices and Tools Dimension (KMPT)

‡ *KM Practices*

- Knowledge coffee (1/2/3/4/5)
Communities of practice (1/2/3/4/5)
Knowledge map (1/2/3/4/5)
Mentoring (1/2/3/4/5)
Brainstorming (1/2/3/4/5)
Capturing ideas (1/2/3/4/5)
Adoption of best practice (1/2/3/4/5)
Peer Assist (1/2/3/4/5)
Peer Review (1/2/3/4/5)
Storytelling (1/2/3/4/5)
Coaching (1/2/3/4/5)
Internal Benchmarking (1/2/3/4/5)
External Benchmarking (1/2/3/4/5)
Meetings (1/2/3/4/5)
Competency management system (1/2/3/4/5)
Bank of individual skills (1/2/3/4/5)
Technical improvement courses (1/2/3/4/5)
Lectures, training and workshops (1/2/3/4/5)
Balanced Scorecard (1/2/3/4/5)
Reporting (1/2/3/4/5)
Δ Could you inform other practices which your team use daily and are not listed above?

‡ *KM Tools*

- Database (1/2/3/4/5)
Noticeboard (1/2/3/4/5)
Virtual bulletin board (1/2/3/4/5)
Virtual collaboration spaces (1/2/3/4/5)
E-mail (1/2/3/4/5)
Blogs (1/2/3/4/5)
Chat (1/2/3/4/5)
Video (1/2/3/4/5)
Text (1/2/3/4/5)
WhatsApp (1/2/3/4/5)
Skype (1/2/3/4/5)
Facebook Messenger (1/2/3/4/5)

Virtual forums or discussion lists (1/2/3/4/5)

Intranet (1/2/3/4/5)

Official documents (1/2/3/4/5)

Handbooks (1/2/3/4/5)

Reports (1/2/3/4/5)

Kanban (1/2/3/4/5)

Canvas (1/2/3/4/5)

Δ Could you inform other tools which your team use daily and are not listed above?

* Questions removed (strikethrough).

Δ Questions added.

● Questions moved to another dimension.

† Questions coming from another dimension.

‡ Likert Scale: (1) Strongly disagree; (2) Disagree;

(3) Neither agree nor disagree; (4) Agree; (5) Strongly agree