

Knowledge Management in Agile Testing Teams: a Survey

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Abstract. Context: Software testing activities are considered as knowledge intensive and therefore Knowledge Management (KM) principles and techniques can be applied to efficiently manage the knowledge generated. In agile development, agile testing practices can benefit the companies in terms of KM, specially in the knowledge sharing. However, there is still little empirical knowledge about the state of practice as well as contemporary problems with respect to agile testing and KM. **Objective:** This study aims to understand how knowledge is shared in Brazilian companies that incorporated agile methodology. **Method:** In order to create an empirical basis on the aspects of agile testing and KM, a survey was conducted with professionals working with agile tests. The survey received 150 replies. **Results:** The results with more highlight are: knowledge is, in fact, shared into the team (89.3%), informal communication is most used (52%), tools are used to share knowledge, the future decisions are based on past problems (88%) and the success stories are stored by team (70.9%). **Conclusion:** Knowledge is recognized as extremely important in any area. Its extraction and publication are of fundamental importance, as can be proven in this research. Agile practices support companies to make use of KM principles.

1 Introduction

In the last years, the agile methods have been received considerable appreciation. The agile developers claim that knowledge sharing is one of the solutions to problems and challenges of software development today [1]. Advances in technology and the emergence of increasingly complex and critical applications require using better strategies, as the software testing, in order to achieve high quality and reliability of software products. In agile development, testing practices are considerably different than in traditional processes. First, agile development recognizes that testing is not a separate phase, but an integral part of software

development. Agile is iterative and incremental, so this means that testers test each increment of coding as soon as it is finished. Programmers never get ahead of the testers. In an agile project, there is a quick testing feedback. The agile tester should look for unique ways to facilitate communication in the team [2].

Regardless of the approach, traditional or agile development, software testing activities are considered a knowledge intensive process and, therefore Knowledge Management (KM) principles and techniques can be applied to efficiently manage the knowledge generated. During software testing, a significant amount of information and knowledge are generated becoming important to provide support for tasks of acquiring, processing, analyzing and disseminating testing knowledge for reuse. In this context, testing knowledge should be captured and represented in an affordable and manageable way, and therefore, could make use of principles of KM [3].

The incorporation of KM in software testing has been deployed aiming knowledge items reuse (e.g., lessons learned or test cases) to improve the enactment of software processes [3, 4]. Since several studies show that agile practices and KM principles have an important connection [1], we want to understand this relation in the agile testing activities, mainly with respect to knowledge sharing. However, there is still little empirical knowledge about the state of the practice as well as contemporary problems with respect to agile testing and knowledge sharing.

A clear understanding of the practice state of agile teams and its problems would be needed to steer future research. Therefore, this work has an objective to understand how knowledge is shared in Brazilian companies that incorporated agile methodology in software testing teams. Furthermore, in this research, we try to understand the practices, tools and factors that assist in the storage and share of knowledge in the agile test domain. In order to achieve the proposed objective, a survey was conducted with employees from different companies working with agile tests. The survey received 150 replies in order to provide a deep understanding of their answers. We believe that this study should be interesting to industry practitioners as well as academics whose interests are software testing from KM perspective, since the discussion is around how the knowledge is shared, the communication type most used in the team, the tools used to provide knowledge storage and sharing, among other aspects.

The remainder of this paper is structured as follows. Section 2 presents a brief overview of KM and agile testing, as well as related research. Section 3 presents the methods and procedures used to conduct the research. Section 4 shows the results and discussions with respect to survey. Section 5 presents a general discussion to highlight some points of our research. Finally, Section 6 presents conclusions, the potential threats to the study validity and future directions for this research.

2 Background

In this section, the main concepts of this study and related works are discussed briefly.

2.1 Knowledge Management

The main goal of KM is to promote knowledge storage and sharing, as well as the emergence of new knowledge [5]. KM formally manages knowledge resources in order to facilitate access and reuse. KM can be viewed as the development and leveraging of organizational knowledge to increase organization's competitive advantage [6]. In general, KM entails formally managing the increase of knowledge in organizations, in order to facilitate access and reuse of this knowledge, typically by using more efficacious information systems or Knowledge Management Systems (KMS) [7].

There are two main types of knowledge [8]: tacit and explicit. Tacit knowledge typically remains only in people's minds involving intangible factors such as beliefs, perspectives, values and intuition. Tacit knowledge covers knowledge that is unarticulated and associated to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb. On the other hand, explicit knowledge can be documented, and, thus can be shared by several individuals. With respect to KM in software development, the main difference between agile and traditional methods, is the traditional method acts mainly on managing explicit knowledge, while the agile methods, primarily rely on managing tacit knowledge [9].

The concept of "knowledge conversion" explains how tacit and explicit knowledge interact along a continuum [10, 8]. According to Nonaka [8], the creation of knowledge can be considered as a continuous and dynamic interaction between tacit and explicit knowledge. This iteration can occur by four different modes of knowledge conversion: Socialization (transmission of tacit knowledge from one individual to another); Externalization (transformation of tacit knowledge into explicit knowledge through the symbolic representation); Combination (combining different sets of explicit knowledge to generate new explicit knowledge); and Internalization (incorporation of explicit knowledge to tacit knowledge).

Organizational knowledge creation aims at making knowledge created by individuals available and amplifies it as well as materializes and connects it to an organization's knowledge system [10]. Bukowitz and Williams [11] conclude that KM is the process by which the organization generates wealth from its knowledge or intellectual capital. Simply put, KM is the process through which organizations generate value from their intellectual assets (tacit and explicit knowledge). Most often, generating value from such assets involves sharing them among employees, departments and even with other companies in an effort to devise best practices.

In the context of software testing, KM has recently been heavily investigated and new approaches to managing software test knowledge have been proposed [3, 4]. KM can be used to capture knowledge generated during software testing activities in order to share and consequently improve the software development processes. In this work, we want to understand the relationship between KM and software testing in the context of agile development, mainly in relation to knowledge sharing.

2.2 Agile Testing

In the context of Agile Software Development (ASD), software testing is carried out iteratively during the entire development process instead of only during a closed phase in the end. In agile projects, testers do more than just perform tasks of testing. Agile testing involves all members of a cross-functional agile team, with special expertise contributed by testers, to ensure delivering the business value desired by the customer at frequent intervals, working at a sustainable pace [2].

Agile approach describes the testers as professionals who embrace change, collaborate well with both technical and business people, in special the customer, and understand the concepts of using tests to document requirements and drive development. In addition, agile testers know how to collaborate with team. This professional is ready to gather and share information on project progress to everyone [2].

Agile values and principles promote a focus on the people involved in a project and how they interact and communicate. Crispin and Gregory [2] discuss the following principles as being important for an agile tester: provide continuous feedback, deliver value to the customer, enable face-to-face communication, have courage, keep it simple, practice continuous improvement, respond to change, self-organize, focus on people and enjoy. In particular, the communication principle is strongly related to KM, and in agile teams the focus is the tacit knowledge.

On the practices used by agile teams in software testing, the agile programmers use Test-Driven Development (TDD) to write the testing before writing the code. TDD strategy helps in better understanding the system under development and when teams practice TDD, they minimize the number of bugs that could appear later on. Most unit-level bugs are prevented by writing the test before the code. The testers test each increment of coding as soon as it is finished in an iterative and incremental form [2]. Another practice used in the context of agile tests is Acceptance Test Driven Development (ATDD). ATDD is a development methodology based on communication among the business customers, the developers, and the testers. Instead of creating code-focused tests from the developer's perspective (which is the focus of TDD), ATDD advocates that the test be an acceptance test with a direct view of the business from a user's point of view [12].

2.3 Related Work

In the last years, the research in KM and ASD has drawn lot of attention in both industrial and academia. Some of this research is presented below.

In [13], Kuusinen et al. present the results of a survey with 81 responses on organizational knowledge sharing in a multinational agile company. The survey focuses on knowledge sharing practices, ease of knowledge sharing and motivation for knowledge sharing. Some results found by Kuusinen et al. are: knowledge sharing with team members is easier than with customers; using agile practices

improves ease of knowledge sharing within teams but not with customers or colleagues; sharing knowledge with colleagues is most often done informally whereas with customers the most common means is in meetings; respondents cited more motivators for sharing with team members than with company colleagues or customers; the regression analysis shows that using agile techniques improves ease of knowledge sharing within agile teams but not with company colleagues or with customer; and knowledge sharing is easier if face-to-face and informal contact is used, whereas one-way presentations decrease the perceived ease of knowledge sharing. Similarly to Kuusinen et al., we also deal with aspects of knowledge sharing, but in agile test teams.

In Andriyani [14], specific knowledge types (i.e. product, project and process knowledge) were investigated in agile practices day to day. KM strategies applied by agile teams and actual knowledge involved in the meetings also were investigated. A case study was conducted using data collected from interviews of sixteen software practitioners from four agile teams and observations of their retrospective meetings. The study showed that identifying and discussing obstacles, discussing feelings, analyzing previous action points, identifying background reasons, identifying future action points and generating a plan are important aspects involved in a retrospective meeting, which is useful for agile team reflection. In our study, we also have the intention of identifying KM and everyday agile practice in software companies. However, our scope is limited to agile testing domain.

In relation to software testing domain, Souza et al. (a) [3] presented a systematic mapping on KM initiatives in software testing, in order to identify the state of the art in the area as well as the future research. Aspects such as purpose, types of knowledge, technologies and research type were investigated. As main results, the mapping study presented that reuse of test cases is the perspective that has received more attention. From the KM point of view, most of the studies discuss aspects related to providing automated support for managing testing knowledge by means of a KM system. Moreover, as a main conclusion, the results show that KM is pointed out as an important strategy for increasing test effectiveness, as well as for improving the selection and application of suited techniques, methods and test cases. Out of the 15 studies returned in the mapping conducted by Souza et al., only one mention agile development. In this study returned in the mapping, Xu-Xiang and Wen-Ning [15], present a PDCA-based testing improvement framework based on the analysis of agile process, benchmarking process and KM.

Finally, Souza et al. (b) [4] presented a survey in order to identify the main knowledge items to be shared and reused in software testing. The purpose of the survey was to identify which is the most appropriate scenario in the software testing domain, from the point of view of testing stakeholders, for starting a KM initiative. From the survey results, Souza et al. presented the following conclusions: (i) test cases and test plans are considered the most useful artifacts to be reused; and (ii) explicit knowledge was considered more important than tacit knowledge. In a similar way this study approached, we also conducted a

survey on KM and software testing. However, our focus was on understanding how Brazilian companies are using KM practices in order to share the knowledge in agile testing team.

3 Research Planning

Survey is an empirical study method to provide a description of a specific population during the process of collecting data from questions [16]. A survey is carried out to identify the opinion of a specific population. We conducted the survey following the phases proposed by Kitchenham and Pflieger [16]: (i) research objective definition; (ii) target audience identification that will respond to the survey; (iii) sampling planning, that is, how the questionnaire will be applied; (iv) survey design (definition of questionnaire type, questions and structure); (v) survey application; and (vi) results analysis and presentation. The following are the main survey characteristics conducted in this work:

Research objective: the main objective of this survey is to understand how Brazilian companies that incorporated agile methodology are using KM practices in order to share the knowledge in agile testing team.

Target audience: professionals who work with software testing in environments that use agile development process.

Sampling: groups interested in ASD were invited to answer the survey in the following ways: (i) personal e-mails were sent to ASD professionals and the participants were asked to share the survey with their acquaintances; and (ii) a request was sent to *LinkedIn*¹ network focusing in ASD professionals. *LinkedIn* is considered the world's largest professional network on the Internet.

Survey project: Fifteen questions were created and divided in four parts. The first part of the survey was composed of questions in order to identify the participants' profile. The second part gathers information about the testing team's profile. The third part identifies how the transformation and sharing of test knowledge occurs within the company in which the survey participants works. Finally, the fourth part is composed of one discursive question to complement the other parts. The format for answering the questions were open and closed questions. All questions used for this study are summarized in Table 1. The complete survey can be seen through the link <https://goo.gl/aJHXHt> (in Portuguese).

Is important to note that this study is part of a master's research project. This project involves the use of KM in agile development. Several secondary studies (systematic reviews or systematic mapping) have been considered as the basis for this project, for example, the reviews conducted in [17] and [18]. The research questions generated to conduct our survey in agile testing teams were based on the main findings of these secondary studies.

¹ <http://www.linkedin.com/>

Table 1: Survey Questions

PART 1 - Participant's current profile
1. Education level: (high school, specialization, undergraduate, MSc, PhD)
2. Job title (e.g., tester, test analyst, test designer, among others)
3. Time experience (in years)
4. Knowledge level in agile development (basic, intermediate and advanced)
5. Knowledge level in software testing (basic, intermediate and advanced)
PART 2 - Test team's current profile
6. Agile method used (XP, Scrum, others)
7. Test team size
8. Frequency of team meetings (Daily, weekly, fortnightly, monthly, never)
PART 3 - Knowledge sharing
9. Do you have an overview of what the other team members are doing?
10. Do team members transfer the acquired knowledge?
11. How is knowledge transferred within the team?
12. What are the tools used to record testing information?
13. Are success stories recorded?
14. Are future decisions made based on past problems?
PART 4 - General question
15. In your opinion, what could be done to improve KM in software testing in your team?

Survey application: Before making it available on the Web, the survey was validated by means of a pilot test. For this, a small sample was selected from the target audience to answer the survey. The questionnaire was also evaluated by one experienced researcher in software engineering and KM. The goal of this validation was to mitigate potential threats to validity (e.g., identifying possible difficulties users could have) and correcting eventual mistakes. After these evaluations, questions were improved to make them clearer. The survey was available for answers during April and May 2017. At the end, 150 ASD professionals answered our survey.

4 Research Outcomes

In the following, we describe the main outcomes, according to the parties highlighted in Table 1.

4.1 PART 1 - Participant's current profile

The answers to questions of Part 1 were used to assure that respondents were representative of the population study. Out of 150 survey participants, 91 (60.7%) are undergraduate, 48 (32.0%) specialization, 7 (4.7%) masters and 4 (2.7%) have selected others. In relation to job title, 102 (68.0%) work as test analyst, 17 (11.3%) are managers, 5 (3.3%) are testers, 15 (10.0%) are system analysts, 7

(4.7%) are quality analysts and 4 (2.7%) said that they work in other functions, such as consultants, for example. Participants have an average of 5.4 years of experience in the positions they occupy. However, this aspect changes when we question the experience time with agile development which results in 2.3 years.

From the analysis made in relation to the participant's current profile in Part 1, 8 (5.3%) participants mentioned to have a basic level of knowledge regarding agile development, 113 (75.3%) answered to possess an intermediate knowledge and 29 (19.3%) participants mentioned advanced knowledge in agile development. Regarding the knowledge level in software testing, 2 (1.3%) participants answered to have a basic level, 101 (67.3%) intermediate knowledge and 47 (31.3%) advanced knowledge in software testing.

4.2 PART 2 - Test team's current profile

In survey Part 2, we analyzed the test team's current profile. Among the existing agile development methods, Scrum is the most adopted by the participants (Question 6). Scrum method was mentioned by 137 (91.3%) participants as a method adopted in the company in which they work. 8.7% of participants mentioned other methods, such as XP, Kanban and Scrumban. Regarding the test team size (Question 7), 22 (14.7%) participants mentioned working alone, that is, they apply practices related to agile testing. 54 (36%) work in a team with three members. 23 (15.3%) work in a team consisting of 5 members and 51 (34%) responders work on test teams composed of more than 5 members.

In order to know the level of communication among test team members through meetings (face-to-face), we asked how often these meetings are held. Figure 1 presents the results of this question. Most participants mentioned that they hold meetings daily (53%). However, while agile guidelines support the communication efficiency when conducted face-to-face, 17 (11%) mentioned that they never held meetings. We have decided to identify whether these 17 respondents are related to responders who work alone in Question 7. 9 of them responded that they worked alone, therefore, it makes sense that there are no team meetings. However, there are still 8 responders who are part of a team (teams with 3 and 5 members) and still responded that they never had formal meetings. This is, in fact, a result of concern, since these 9 people do not follow one of the main agile principles: face-to-face conversation. The face-to-face conversation is the most efficient and effective method of conveying information within a development team. However, it is worth pointing out that our question is in relation to face-to-face meetings, and this does not mean that these 9 people do not hold informal meetings.

4.3 PART 3 - Knowledge sharing

Part 3 of this survey is directly related to KM. From the questions of this part it was possible to identify how actions related to the knowledge sharing among agile test teams occur in practice. First, we tried to identify whether the participant was aware of what the other test team members were working on. With respect

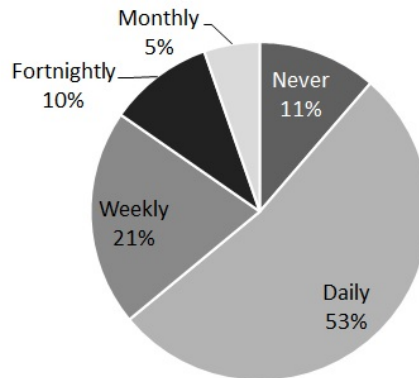


Fig. 1. Frequency that occurs in team meetings

to Question 9, 88.7% of participants responded that they have knowledge about what everyone on the test team is doing. This is a valuable result, since the agile tester is part of a self-organizing agile team and prioritize the communication. The communication and interaction between team members reduces the time spent on non-oral communication [2, 19].

Regarding Question 10, we asked if all team members shared the knowledge they gained. 134 (89.3%) respondents said yes and 16 (10.7%) responded that team members do not pass on knowledge to be shared. Although it seems to be a small number, 16 participants confirmed that team members do not share their knowledge. In the study conducted by Souza et al. (a) [3] about KM and traditional software testing, the authors concluded that employees are normally reluctant to share their knowledge, that is, the experiences are grasped by only a few people and not become public knowledge. This fact disables knowledge transfer in testing.

In relation to how knowledge can be shared, in Question 11 we tried to identify which approaches or tools are used for this purpose. Figure 2 shows the approaches and tools mentioned by the participants. Most of them mentioned approaches such as: informal communication (52%), formal meetings (17%) and systems for management and defect tracking (17%). No team works well without communication (formal or informal) to share experience or lessons learned [3]. This result corroborates the study conducted by Kuusinen et al. [13] which showed in their survey that the most common techniques for knowledge sharing in general were informally, in meetings, and by email. Today, when so many teams are distributed in multiple geographical locations, communication is even more vital and more of a challenge. The agile tester should look for unique ways to facilitate communication.

Systems for management and defect tracking that were mentioned are important to manage the life cycle of a defect. However, many agile practitioners say that it is not necessary to do this anymore, since it is possible to track defects based on user cards or some other simple mechanism proposed by ASD practices.

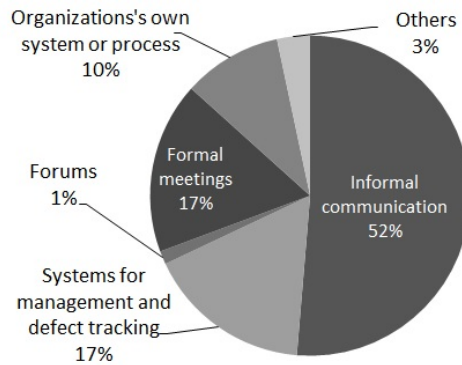


Fig. 2. Approaches and tools used to share knowledge

On the other hand, 17% of practitioners said there were reasons to prefer using a tool to record defects and track how they were fixed. One of the main reasons for preferring tools for this purpose is to create a knowledge base. Systems for management and defect tracking can be used to transfer and share information, turning it into a knowledge base. The information in knowledge base can be used for several purposes, such as to track defect rates in order to generate metrics or traceability to link defects to test cases.

Crispin and Gregory [2] describe that systems for management and defect tracking certainly do not promote communication between programmers and testers, and that ASD provides other practices and principles that help reducing the need for systems for management and defect tracking. Although these systems have not been created for this purpose, the number of participants who mentioned this type of system was considerable. So, from the pilot test results of the survey, we decided to add a new question about which tools are used to record information about the test management and defect tracking (Question 12). A variety of tools were mentioned. Most participants mentioned using tools such as Mantis, TestLink and Jira. The list of tools, purpose of each one and number of participants who mentioned the tool are presented in Table 2. It is worth mentioning that some respondents used more than one tool.

One of KM's main principles is to store knowledge for reuse, especially successful actions. According to Souza et al. (a) [3], KM entails formally managing knowledge resources in order to facilitate access and reuse of knowledge. Based on this context, in Question 13, we asked if success stories are recorded. 105 (70.9%) of respondents said yes in recording success stories. Many of them mentioned that success stories are often presented at meetings and are often recorded in some of the tools presented in Table 2 or informal notes. In a new agile team, for instance, past experiences from user stories will also affect the success of company. Past experiences can be recorded for reuse. This statement is directly related to our survey in Question 14. 132 (88%) participants said that future decisions are made based on past problems.

Table 2: Systems for management and defect tracking

Tools	Purpose	Amount
Jira Software	Bug Tracker	44
TestLink	Test Management	33
Mantis	Bug Tracker	29
Rational Quality Manager (RQM)	Test Management	15
HP Application Lifecycle Management (HP ALM)	Test and Defect Management	10
Team Foundation Server (TFS)	Test Management	9

4.4 PART 4 - General question

Finally, in the last part we composed a single long question, to be answered in writing a text and not a multiple choice, in order to externalize the participants opinion about what could be done to improve KM of software testing in their team. Many participants mentioned that they did not have knowledge about KM as a research area, but they knew the importance of working with the knowledge generated in the test teams. The following are some of the most mentioned actions by the participants to improve KM in software testing: (i) necessity to acquire the culture of sharing information; (ii) maintain traceability of information, such as lessons learned and suggestions for improvement; (iii) create an internal Wiki with the main project evidence; (iv) offer training on how to manage knowledge generated in the company; (v) create a knowledge base aimed at storing good practices and lessons learned; and (vi) create a process for sharing and reusing information about software testing.

5 Discussion

Software has become more and more widespread and indispensable in critical and complex application domains, making testing knowledge increasingly important. Sharing knowledge and experience can provide several benefits. Agile practices can benefit organizations in terms of KM, mainly in the management and transfer of knowledge produced. Some respondents mentioned the importance of KM and suggested that the adoption of practices and methodologies for tasks of acquiring, processing, analyzing and disseminating testing knowledge for reuse could help in the acceptance of this practice so that the knowledge was not only among the people who participate in the meetings, but also enable others to explore this knowledge in the future.

From conducting this survey, we realize that in practice many of the values advocated by the ASD community have helped testing teams to improve work with knowledge, such as: enable communication, especially face-to-face from daily meetings; depend on a self-organizing team that knows what each one is doing; share knowledge; store knowledge; give value to past experiences

and information reuse. However, we still found results that were negative drawing attention. For example, some participants said they did not hold meetings and others said that there were team members who were reluctant to transfer knowledge.

Although it is not considered an agile practice by some authors [2], it is still widely common employing management test and defect tracking tools. It was possible to verify by the survey that the use of a subject tracking system is very important to software project. These tools maintain knowledge bases to keep track of not only the defect but also the priorities, severities, and status, and to see to whom they are assigned.

Several survey participants, knowledgeable of agile practices, emphasized the importance of values such as communication, self-organizing teams and knowledge sharing. This confirms findings from Kuusinen et al. [13], that provide evidence to support claims that knowledge sharing is easier within agile teams. Communication and knowledge sharing, in particular, are of the most important principles of KM [3]. Communication is directly related to tacit knowledge transfer. According to Nonaka and Takeuchi [8], tacit knowledge really is hard to be acquired, and it requires good strategies to acquire and process this knowledge; however, it is much more valuable.

Communication and dialog allow the organization to have a more complete world-view, and to appreciate a richer sense of the existing realities in the organization as well as the external environment, bringing the unknown to the surface [20]. In the survey it was possible to perceive that there is reluctance for a dialog and transmit knowledge. The participants mentioned that they try to minimize this problem with constant meetings, but they lack the knowledge of dealing with KM processes to improve this problem.

Based on the results, it is noticeable that agile testing team, in fact, uses in practice the values defended by agile methodologies, although some traditional practices are still recognized by them as important, for example, the use of defect tracking systems. Furthermore, the participants in the survey recognize that agile practices can support companies to make use of KM principles.

6 Conclusion

In this paper, we showed how knowledge is shared in Brazilian companies that incorporated agile methodology in testing teams. In order to attain this objective, an empirical analysis was conducted. The method used was a survey that received 150 answers.

From the analysis of the survey' answers, the aspects most mentioned by participants were: knowledge is shared into the team (89.3%), informal communication is most used (52%), tools are used to share knowledge (e.g. Jira, TestLink, Mantis), future decisions are based on past problems (88%) and success stories are stored (70.9%). The participants of this survey acknowledge the importance that agile practices can bring to the company in relation to KM. However, it is still necessary to promote a culture so that these practices are given a major importance within companies.

The results of this survey can be used by researchers and professionals in the field in order to develop studies and solutions on the addressed issues. Evaluating the practices effectiveness used for KM mentioned in the research responses can point out to results that promote, for example, an adaptation of existing agile methods to highlight where to stress or prioritize the application of KM in companies.

6.1 Threats to Validity

One threat to validity in this work could be poor instrumentation, which could affect subjects' understanding of concepts and questions. For this reason, a pilot study was performed as well as a survey validation by a KM researcher, so any problem could be identified and corrected before the survey was opened for answers.

Concerning survey project validity, the questions were created based in systematic literature reviews about KM in agile software projects, such as the reviews conducted by [17] and [18]. In additional, one open text question was included to allow triangulating the results.

The agile philosophy has a very fuzzy notion. No company faithfully follows all the agile principles. It is natural that customizations are made according to the profile of each organization, and this can influence the participant responses. Although our goal in the survey is broader in the sense of knowing the ways of knowledge sharing, it is still important to deepen this research in order to better understand if the companies and/or project characteristics could influence the research responses. Thus, as future work we intend to conduct interviews in companies to obtain a better understanding of the practices, techniques and approaches used by a agile testing team. We intend to apply interviews in the companies because we believe that this can enrich even more the results obtained in the research as a whole and evidence us important facts that in a research maybe not arise.

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