Communication and Documentation Practices in Agile Requirements Engineering: A Survey in Polish Software Industry

Aleksander Jarzębowicz[0000-0003-3181-4210] and Natalia Sitko

Department of Software Engineering, Faculty of Electronics, Telecommunications and Informatics, Gdańsk University of Technology, Gdańsk, Poland
olek@eti.pg.edu.pl

Abstract. Requirements engineering, system analysis and other analytical activities form the basis of every IT project. Such activities are not clearly defined in Agile development methods, but it does not mean that they are absent in an agile project. The aim of our work was to determine which practices related to requirements-related communication and which requirements documenting techniques are used in agile software projects. For this reason we carried out a survey study targeting agile practitioners from Polish IT industry. The paper presents survey results, discusses the noticed differences with respect to the general Agile values and principles and provides a comparison to results of similar studies described in the related work. The main observation about communication practices is that frequent, face to face communication is the most common, but many respondents also declare use of other, remote communication means or exchanging SRS documents. The investigation of requirements documentation techniques revealed differences between the techniques used while describing requirements for developers and those used to elicit requirements from stakeholders and to comprehend them.

Keywords: Requirements Engineering, Software Projects, Agile Requirements, Agile Development, Scrum.

1 Introduction

To provide an effective solution, it is first necessary to understand the problem, thus analytical activities form the basis of every IT project. Such activities are known under the names of requirements engineering (RE), business analysis (BA) or system analysis (SA), which somewhat differ with respect to scope and focus, but all include capturing and exploring the needs of the customer and relevant stakeholders. A large body of knowledge is available in e.g. international standards [1] and industrial guides [2-4]. Such sources provide comprehensive guidelines on processes, roles, techniques

and recommended practices. It is worth to note an increased interest of the industry, especially on the topics of RE and BA, which resulted in publishing the abovementioned guides in recent years.

At the same time, in the last 10-15 years the IT industry has increasingly adopted Agile development approach [5], which is currently commonly used in software projects worldwide [6]. The generic Agile approach and particular Agile development methods like Scrum or Extreme Programming do not distinguish RE, BA, SA or other analytical activities as a separate phase, area or discipline of a software project. Moreover, the Agile values suggest "light" processes and minimizing software project artefacts (documentation). As analysis is not emphasized, an initial impression can arise that RE is not important in agile projects, especially considering that e.g. Scrum or XP do not define any "analyst" role and encourage the direct, face to face communication between customer representatives and all members of the development team. It would be a wrong conclusion though, as Agile and RE practices can and should be used together [7-9]. Moreover, in practice the role of an analyst is often present in agile software projects and is of crucial importance [10,11].

The term of "Agile Requirements Engineering" (ARE) was defined [12] to describe RE activities and practices tailored to be used in an Agile context. ARE expands the guidelines included in Agile methods like Scrum, by covering in more detail RE practices (which are not comprehensively defined in those methods). In some cases where such guidelines turn out to be insufficient in practice, ARE provides additional solutions. For example, an assumption that a single customer representative (covering all stakeholders' viewpoints) would be available to work on site with development team on daily basis is often hard to satisfy [12]. A possible solution is that an analyst serves as an "interface" between stakeholders from the customer side and the development team from the supplier side. Another example is the problem of minimal documentation and simplified representation of requirements like user stories [13], which can e.g. drive an analyst to create user stories for the inclusion in Product Backlog, but additionally document requirements using another specification technique that allows him/her a better comprehension of requirements and facilitates cooperation with stakeholders. On the other hand, ARE introduces concepts differing from more traditional RE e.g. agile requirements quality criteria [14] or less formal RE techniques including collaborative games [15].

To summarize - ARE uses its dedicated practices [13], utilizes so called agile mindset [16] and encounters some specific problems and challenges, different from RE in projects that use plan-driven development methods [17]. An ongoing research efforts are dedicated to both ARE practices [18-21] and challenges [18, 20, 22].

In our research we intended to identify the status quo of RE practices in agile software projects conducted in an IT industry in Poland. A number of surveys on Agile adoption in the industry (addressing the topic of RE or at least including it within scope) were conducted in several countries [6, 20, 23, 24]. However, to the best of our knowledge, there are no scientific papers about such study in the context of Polish IT industry. It is a research gap we intended to address. In particular, the work we report here focused on the following research questions:

- RQ1 – Which practices related to cooperation and communication between various project participants are used in agile software projects in Polish IT industry?
- RQ2 – Which requirements documentation techniques are used in agile software projects in Polish IT industry?
- RQ3 – Are such practices and techniques consistent with Agile guidelines?

This paper is structured as follows. Section 2 outlines the way we designed and conducted the industrial survey study. In Section 3 the results of this study are presented, together with the accompanying discussion, moreover threats to validity are addressed. In Section 4 we summarize related work and compare our results to those presented in the literature. The paper is concluded in Section 5.

2   Survey Study

We planned and designed a questionnaire-based survey study investigating the RE practices in agile software development projects. We defined our target population as the participants of agile projects conducted in Polish IT industry. We did not limit our focus to any specific domains nor types of software products. We used a web questionnaire developed using GoogleForms[1]. The language used was Polish, in this paper we provide English translations of questions and answers. The questionnaire consisted of two main parts: questions about respondent's background and demographics (e.g. role/responsibility, experience in industrial agile projects, Agile methods used) and questions about RE practices and techniques the respondent uses in projects he/she participates. The following questions about communication and requirements documentation were included:

- (Q1) What is the source of requirements in most agile projects?
- (Q2) How frequent is the contact between analysts (or other development team members) and customer representatives?
- (Q3) How do analysts cooperate with customer representatives?
- (Q4) How are the requirements communicated to the development team?
- (Q5) Which techniques do analysts use to document requirements for the purposes of comprehending them and analyst-customer cooperation?
- (Q6) Which techniques do analysts use to document requirements for the purpose of analyst-development team cooperation?

All of questions Q1-Q6 were a multiple choice questions. The available responses included pre-defined answers prepared on the basis of literature review (to cover all popular practices) and additionally "Other" answer, followed by a text field to input additional feedback. The questionnaire was developed iteratively and reviewed several times, finally a pilot study involving 3 people belonging to the target population was conducted as the final verification activity.

---

[1]   https://www.google.com/forms/about/

We are not aware of any means we could recruit a representative sample of the investigated target population in a systematic way. As result, we could only rely on non-systematic sampling methods, and therefore we used convenience sampling. We distributed invitations to participate in our survey to Agile interest groups in social network media (LinkedIn, Facebook, GoldenLine). We also sent direct messages with invitations using the contacts established at the software engineering beIT[2] conference and practitioners identified by their CV contents at LinkedIn. The survey was anonymous, no questions about respondent's identity were asked.

The responses were gathered in the period of April-June 2018. We verified them against pre-defined criteria and removed 4 of them that were either incomplete (only some questions answered) or indicated that the respondent had no industrial experience (e.g. participated in agile projects done as part of university studies only). After verification, the number of responses left was 69.

The responses were then processed and analyzed. Visualizations depicting the distribution of answers are included in Section 3. We also paid attention to potential differences in answers regarding less experienced respondents (up to 2 years of experience in agile development) and analysts (and Product Owners), who are more committed to RE and can be considered more aware of RE practices. We do not provide any separate visualization of answers provided by such sub-groups, but in cases such differences were spotted, we mention them while discussing results.

After the survey was completed and its results processed, we invited two experienced analysts (of 10 and 15 years of experience in RE and BA, respectively) to review the results with us and share their interpretations, especially in cases the results were found surprising. Their feedback is also included in Section 3 discussion.

3   Results

As already mentioned, after removing questionable answers, we were left with the data provided by 69 respondents. The background questions allowed us to determine some context information about the sample of population we received responses from. Most of our respondents worked as developers (49,3%), followed by analysts (36,2%). The remaining 14,5% identified themselves mostly as Product Owners and project managers. It is not surprising that majority of respondents were developers as it is the most common role in agile projects (and not only agile), however the percentage of analysts seems to be higher than in most teams and companies – this can be explained though by the fact that they were probably the most interested in the survey on ARE.

The experience in agile development the respondents declared is shown on the left part of **Fig. 1**. About half of them had a limited experience (less than 2 years) thus their answers can be challenged as less reliable, however we decided to use them, but with additional attention to spot anomalies (questions for which answers of less experienced respondents were significantly different than the answers of remaining survey

---

[2]   www.konferencjabeit.pl/

participants). About 40% declared experience between 2 and 5 years and only a small group claimed more than 5 years in agile development. This can be explained in two ways: first - that Agile adoption as the "mainstream" approach in Polish industry can be dated only a few years back; second – that more experienced people have more professional responsibilities and less time to spare for answering survey question-naires. As for Agile development methods, depicted on the right side of **Fig. 1**, it is clear that the most popular method is Scrum. Another popular method is Kanban, which however is used together with Scrum, not as the only development method followed.
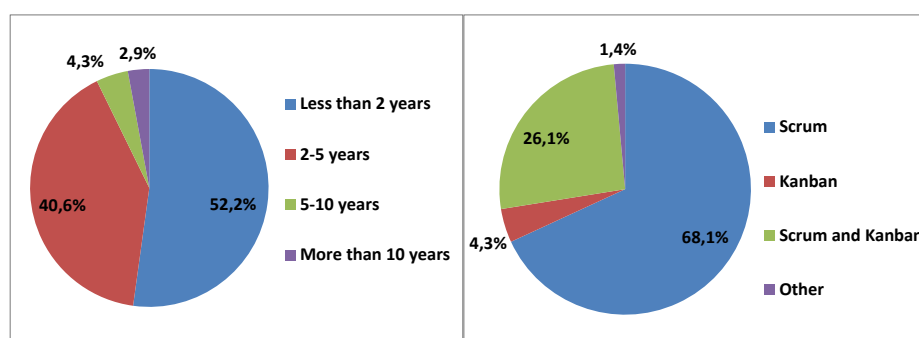

Fig. 1. Survey respondents' experience in agile development (left) and Agile methods used by them (right).

In the following part of this section we report answers to questions about agile re-quirements processes and techniques (Q1-Q6). Please note, that they were multiple choice questions, therefore we use numbers not percentages when presenting them.
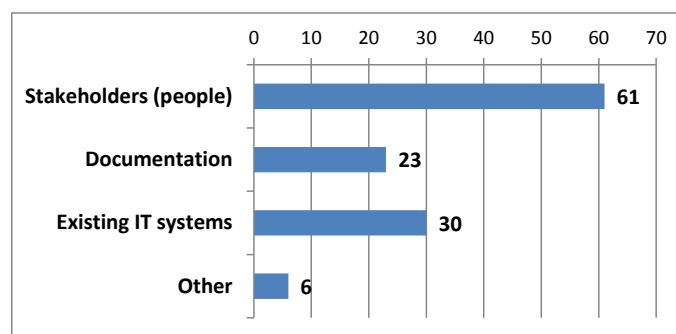

Fig. 2. Sources of requirements in agile projects (Q1).

According to our respondents, the most common source of requirements in agile pro-jects are stakeholders - people from whom the requirements are elicited. It is interest-ing though that almost half of respondents identified existing IT systems as require-ment sources and one third the written documentation (see **Fig. 2**). This deviates to some extent from Agile values which emphasize direct, face to face communication,

but can likely be attributed to the reality software developers meet – legacy systems without any person able to explain how they were designed, "terms of reference" documents required by law in projects in public sector etc.

As shown in **Fig. 3**, most of respondents (almost half) declare that the contact with customer representatives is maintained on daily basis, which is consistent with Agile approach and its close collaboration themes. Nevertheless, the remaining respondents admitted that such contact is less frequent e.g. before and/or after each sprint/iteration. We also received a number of "Other" choices, followed by free text answers, most of which declared that such contact takes place: when needed, once a week, a few times a week or depending on the project/the customer. The possible explanation is that when analyst acts as a Scrum's Product Owner (or supports the Product Owner) he/she is responsible for explaining requirements to developers as well as answering their questions and the involvement of customer representatives or other business stakeholders is not necessary every day. Moreover, low availability of stakeholders is a commonly encountered requirements-related problem in software projects (including agile ones), according to surveys both in Poland [25] and in other countries [17].
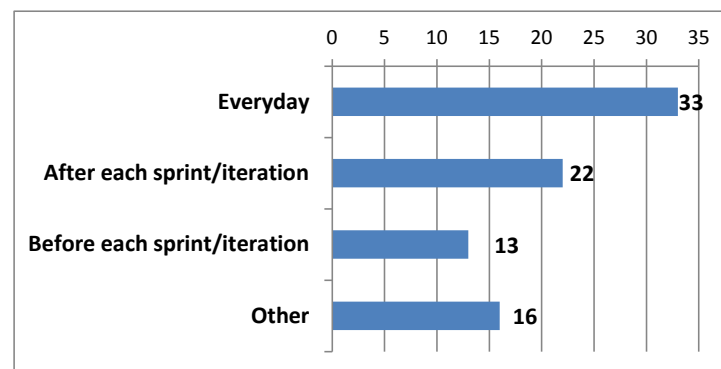

Fig. 3. Frequency of contact with customer representatives (Q2).

The cooperation between analysts and customer representatives (see **Fig. 4**) is mostly based on direct, face to face meetings with individual or multiple stakeholders, which fits well into Agile "people and interactions" value. Still, e-mails, teleconferences and phone calls are quite commonly practiced, which can stem from stakeholders' low availability or from the fact that to answer a well-defined question it is not necessary to arrange a meeting. Interestingly, over one third of our respondents work in agile projects using software requirements specification (SRS) documents, shared with customer representatives.

An essential task in analyst-developer cooperation is the communication of requirements to the developers, in order to be implemented. The answers we collected (**Fig. 5**) are in line with Scrum recommended practices – the requirements are communicated directly at the meetings and registered in Product Backlog, moreover dedi-

cated supporting tools like Confluence[3] are used. A group of respondents (of about the same size as in the previous question) declares using SRS documents though.
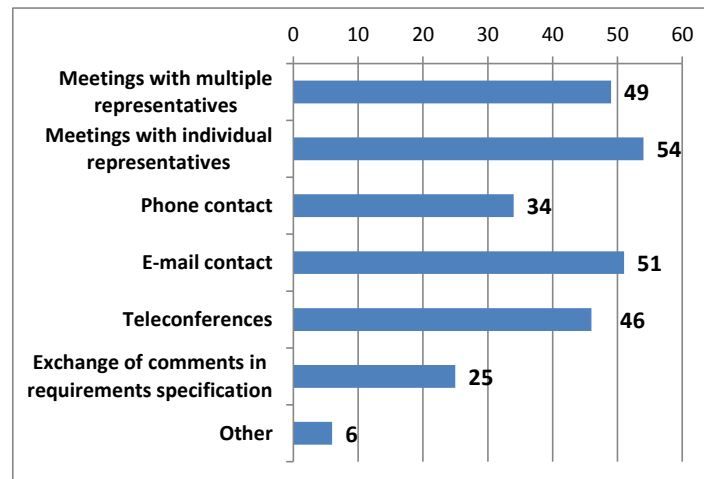
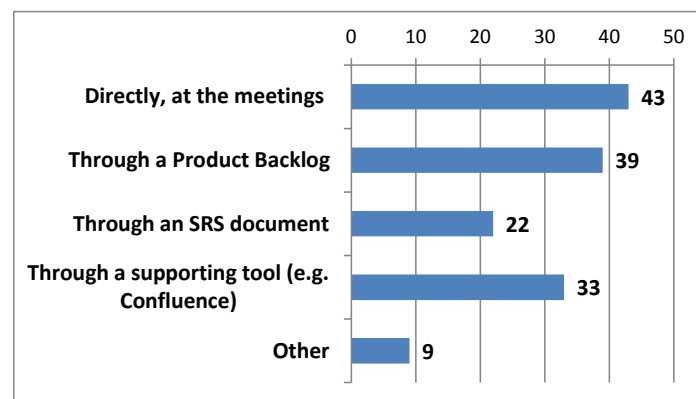**Fig. 4.** The means of cooperation between analysts and customer representatives (Q3).

Fig. 5. The means of communicating requirements to the development team (Q4).

As for requirement documentation techniques used in agile projects, we asked two separate questions (Q5 and Q6). The rationale was that we intended to verify whether different documentation techniques are used for different purposes. Agile methods like Scrum make use of simplified representations of requirements (user stories, features) and it is likely that such representations would be delivered to developers, included in Product Backlog and, when necessary, such requirements would be refined and explained as part of a meeting and direct communication. We were however curious if other documentation techniques are used by analysts for the purpose of com-

---

[3] https://www.atlassian.com/software/confluence

prehending requirements (a necessary condition to be able to explain them to developers) and/or for the purpose of the cooperation between the analyst and customer representatives (e.g. requirements elicitation or validation).
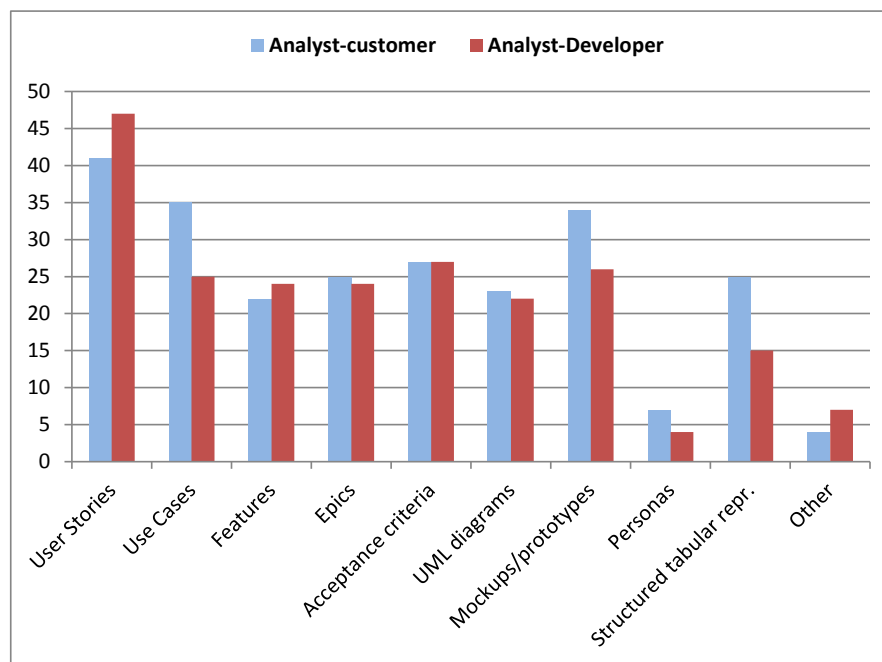

Fig. 6. The comparison of requirements documentation techniques used by analysts in cooperation with customer representatives and with development team (Q5 and Q6).

As in both questions the respondents could choose from the same set of techniques, we present answers to Q5 and Q6 jointly in **Fig. 6**. The results seem to confirm our hypothesis – user stories are more often created for developers than as a working representation of requirements used by analysts when cooperating with customer representatives. For the latter purpose, analysts tend to choose use cases, mockups/ prototypes and structured tabular representations of requirements. It is also worth mentioning, that in responses given by analysts and Product Owners only, the most common documentation technique used in analyst-customer cooperation were mockups/prototypes, followed by use cases and user stories.

We are aware of several limitations of our study and potential threats to validity, they are discussed below with respect to 3 main categories of threats.

Construct validity: Agile practices can differ among organizations, moreover the names used to describe them can differ as well. The possible threats are that we could omit some relevant practices/techniques (and not include them among predefined answers) and that the names we used could not be clear to our respondents. We mitigated the first threat by preparing the questionnaire on the basis of a literature review and by providing the opportunity to enter manually another answer ("Other" option).

We have not noticed any pattern in manually entered answers that the same themes were repeated by numerous respondents. The second threat of possible misunderstanding of terms used was mitigated by several reviews and corrections of the questionnaire, the reviews were conducted not only by us, but also by pilot respondents.

Internal validity: The main threat we recognize here is the participation of people were not qualified enough to provide information we expected – it was mitigated by reviewing answers and removing those indicating lack of industrial experience. The answers were also checked for signs of fatigue or lack of commitment, but we did not found any.

External validity: The convenience sampling we used to involve survey respondents and the particular actions we took for this purpose (using social media groups, direct messages, respondents' anonymity) do not allow us to determine exactly how many people read our invitations and what subgroup of them participated in the survey. It is possible that a bias concerning respondents' representativeness was introduced here i.e. that people of a given profile were more likely to participate than others. A significant share of analysts and Product Owners as well as practitioners with low experience seem to confirm possibility of this threat. It is the threat we have to accept and acknowledge.

4   Related Work

Although a significant body of knowledge on ARE exists, we will only refer to directly related work. A more comprehensive review of ARE research can be found in systematic mapping studies by Heikkilä et al. [12], Inayat et al. [18] or Schön et al. [19].

Cao and Ramesh [13] described 7 ARE practices most common to 16 software organizations they analyzed, together with discussion of benefits and challenges of each practice. Among those practices were: face-to-face communication, iterative RE and prototyping, which correspond to our findings. It is also worth to note that heavy or medium usage of prototyping was reported by 11 organizations, while the remaining ones did not use it at all, which resembles our results on mackups/prototypes.

Kassab [6] presented the results of a U.S. survey on RE practices. It was not limited to agile software development, but some results concern agile practices / techniques. Kassab notes the emergence of user stories and informal requirements representations and at the same time a slight decline of prototyping (even in agile projects). Simply comparing the numbers (response ratios), his and our results look similar, however, as he did not distinguish the purpose of the documentation techniques, we cannot make a more detailed comparison of our findings on RQ2 and his work.

Jarzębowicz and Połocka [26] focused on requirements documentation techniques and their applicability to different software project contexts. The respondents of the survey they conducted, selected: user stories, use cases (and scenarios), prototypes and process models as the techniques most applicable to projects developed using Agile methods. All techniques, except the last one, appeared in the questionnaire described in this paper and were among the most commonly used techniques, which suggest that these two studies corroborate each other.

Wagner et al. [20] report partial results of a large family of surveys dedicated to RE practices and problems, focusing on the data provided by respondents working in agile setting. They enumerate interviews, prototyping and facilitated meetings (including workshops) as most popular techniques of cooperating with customer representatives to elicit requirements. As for requirements documentation techniques, they report: free-form textual domain/business process models, free-form textual structured requirements lists and use case models as most popular techniques, while formal and semi-formal models are rarely used.

Ochodek and Kopczyńska [21] conducted an international survey on ARE practices with a significantly wider scope of processes and practices than our study. They processed the results to create the ranking of relative importance of the practices. Among practices corresponding to our study's scope, "Available/on-site customer" and "Provide easy access to requirements" were ranked as most important, while "Notation easy to understand by all stakeholders" and "Write short, negotiable requirements" were considered as significantly less essential, which seems to be in line with our findings.

5   Conclusions

In this paper we reported the research study aimed at investigating requirements-related communication practices and requirement documentation techniques used in agile software development projects in Polish IT industry.

As for RQ1 and communication practices, we can observe that frequent, face to face communication is the most common, however many respondents also declare use of remote communication means or exchanging SRS documents. Investigation of RQ2 and requirements documentation techniques revealed differences between the techniques used while describing requirements for developers (user stories) and those used to elicit requirements from stakeholders and to comprehend them (mockups/ prototypes, use cases and structured tabular descriptions). To answer RQ3, we identified some discrepancies between the theory (Agile values and principles) and reality (survey answers). We believe our research can have some implications.

The implications for practitioners – the practitioners can evaluate their current agile requirements engineering practices/techniques and position themselves with respect to the picture of Polish IT industry that was revealed by survey results. This can also be an input to decisions about introducing other practices/techniques to their agile development processes.

The implications for researchers – despite the fact that many surveys and other research studies investigating the practice of agile requirements engineering were conducted, none of them was dedicated to Polish IT industry. This can aid researchers, especially related to the domestic IT industry to steer their research and investigate further e.g. the benefits, limitations and challenges of particular practices and techniques. These are also the possible directions of further research we are considering ourselves.

References

1. ISO/IEC/IEEE: ISO/IEC/IEEE 29148:2011, Systems and software engineering Life cycle processes. Requirements engineering (2011).
2. International Institute of Business Analysis: Business Analysis Body of Knowledge (BABOK Guide) version 3 (2015).
3. Project Management Institute: Business Analysis for Practitioners A Practice Guide (2015).
4. International Requirements Engineering Board: IREB CPRE Foundation Level Syllabus ver. 2.2.2 (2017).
5. Fowler, M., Highsmith, J.: The Agile Manifesto, Software Development, 9(8), 28-35 (2001).
6. Kassab, M.: The changing landscape of requirements engineering practices over the past decade, in 5th International Workshop on Empirical Requirements Engineering (EmpiRE), pp. 1-8, IEEE (2015).
7. Paetsch, F., Eberlein, A., Maurer, F.: Requirements engineering and agile software development. In 12th IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE), pp. 308-313, IEEE (2003).
8. Sillitti, A., Ceschi, M., Russo, B., Succi, G., Managing uncertainty in requirements: a survey in documentation-driven and agile companies. In 11th IEEE International Software Metrics Symposium (METRICS'05), pp. 10-17, IEEE (2005).
9. International Institute of Business Analysis: Agile Extension to the BABOK Guide, version 2 (2017).
10. Gregorio, D.: How the Business Analyst supports and encourages collaboration on agile projects, IEEE International Systems Conference (SysCon), pp. 1-4, IEEE (2012).
11. Rogers G.: RE in Agile Projects: Survey Results, Requirements Engineering Magazine, IREB, available: https://re-magazine.ireb.org/articles/re-in-agile-projects-survey-results (2016).
12. Heikkilä, V. T., Damian, D., Lassenius, C., Paasivaara, M.: A mapping study on requirements engineering in agile software development, In 41st Euromicro Conference on Software Engineering and Advanced Applications, pp. 199-207, IEEE (2015).
13. Cao, L., Ramesh, B.: Agile requirements engineering practices: An empirical study, IEEE Software, 25(1), 60-67 (2008).
14. Heck, P., Zaidman, A.: A systematic literature review on quality criteria for agile requirements specifications. Software Quality Journal, 26(1), 127-160, (2018).
15. Przybyłek, A., Zakrzewski, M.: Adopting collaborative games into agile requirements engineering, In 13th International Conference on Evaluation of Novel Approaches to Software Engineering (ENASE'18), pp. 54-64 (2018).
16. Miler, J., Gaida P.: On the Agile Mindset of an Effective Team – an Industrial Opinion Survey, In: Federated Conference on Computer Science and Information Systems (FedCSIS 2019), Leipzig, Germany (2019).
17. Méndez Fernández, D. et al.: Naming the pain in requirements engineering: Contemporary problems, causes, and effects in practice, Empir. Softw. Eng. 22, 2298–2338, DOI 10.1007/s10664-016-9451-7 (2017).
18. Inayat, I., Salim, S. S., Marczak, S., Daneva, M., Shamshirband, S.: A systematic literature review on agile requirements engineering practices and challenges. Computers in Human Behavior, 51, 915-929 (2015).
19. Schön, E. M., Thomaschewski, J., Escalona, M. J.: Agile Requirements Engineering: A systematic literature review, Computer Standards & Interfaces, 49, pp. 79-91 (2017).

20. Wagner, S., Méndez Fernández, D., Kalinowski, M., Felderer, M.: Agile requirements engineering in practice: Status quo and critical problems. CLEI Electronic Journal, 21(1), (2018).
21. Ochodek, M., Kopczyńska, S.: Perceived importance of agile requirements engineering practices – A survey, Journal of Systems and Software, 143, 29-43, (2018).
22. Alsaqaf, W., Daneva, M., Wieringa, R.,: Quality requirements challenges in the context of large-scale distributed Agile: An empirical study, in Proc. of 24th Requirements Engineering: Foundation for Software Quality Conference (REFSQ), pp. 139-154 (2018).
23. Rodríguez, P., Markkula, J., Oivo, M., Turula, K.: Survey on agile and lean usage in Finnish software industry. In ACM-IEEE International Symposium on Empirical Software Engineering and Measurement (ESEM), pp. 139-148, IEEE (2012).
24. Diel, E., Bergmann, M., Marczak, S., Luciano, E.: What is agile, which practices are used, and which skills are necessary according to Brazilian professionals: findings of an initial survey, In 6th Brazilian Workshop on Agile Methods (WBMA), pp. 18-24, IEEE (2015).
25. Jarzębowicz A., Ślesiński W.: What Is Troubling IT Analysts? A Survey Report from Poland on Requirements-Related Problems. In: Kosiuczenko P., Zieliński Z. (eds) Engineering Software Systems: Research and Praxis. KKIO 2018. Advances in Intelligent Systems and Computing, vol 830, pp. 3-19, Springer, Cham (2019).
26. Jarzębowicz A., Połocka K.: Selecting Requirements Documentation Techniques for Software Projects: a Survey Study, In: Federated Conference on Computer Science and Information Systems (FedCSIS 2017), pp. 1205-1214 (2017).