

On The Understanding of Agile Methods and Their Practice in Brazil

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Abstract. *To maximize the benefits of adopting agile methods professionals need a deep understanding of their concepts. Literature reports discrepancies between agile methods' practical adoptions and their theoretical proposals. While it is still unknown if such discrepancies are harmful, we are interested to learn whether these divergences come from the lack of knowledge about what agile theories propose. The goal of our work is to empirically identify what is the extent of the knowledge of the Brazilian market about what agile methods are and how much they are used in practice. In this paper we report on our initial exploratory investigation with a small sample of 24 IT professionals distributed across 5 states of Brazil. Our preliminary results show that the participants are familiar with agile principles. However, we also found that these professionals adopt fewer practices than described in literature. More specifically, we identified that although there is an interest in using XP, the participants are more adherent to Scrum. We discuss the implications of these preliminary findings to research and industry, and introduce our next steps towards broadening our investigation.*

1. Introduction

Agile methods have been gaining ground in the Information Technology (IT) market. These methods promise to assist self-organizing teams and to continuously add value to the customer. They are also less bureaucratic and more flexible to changes. Many companies are interested on those benefits and look forward to adopt them. To maximize the benefits of adopting these methods and having the organization innovating its work processes, however, IT professionals need to understand their foundations and concepts.

Literature reports discrepancies between the adoption of agile methods in practice and their original theoretical proposals. For instance, companies decide to adopt agile methods and do it by simply introducing Scrum stand-up meetings in their traditional routines (Hackett 2011). Heikkilä *et al.* (2013) report that the average time to developing requirements in a large Scrum organization was considerably longer than the one proposed by Scrum (Schwaber and Sutherland, 2011). While it is still to be found whether such discrepancies are harmful to the results produced by software

organizations, we are interested to learn whether these divergences come from the lack of knowledge about what the core of agile theories propose. A first step is then to understand how much software development professionals (e.g., developers, testers, managers, etc) know about what agile methods are and what practices they adopt to support their daily work.

Therefore, the goal of our work-in-progress is two-fold. We aim *to identify what is the extent of knowledge about agile methods in the Brazilian market and how much of them is used in practice*. To this end, we sought to initially explore the following: (i) the understanding of IT professionals about the conceptualization of agile methods; (ii) whether these methods are actually being used in practice by Brazilian professionals; and (iii) what is the set of skills a professional needs to work with such methods. We used a questionnaire answered by 24 professionals from 5 states of Brazil. This initial phase is exploratory and aimed to allow us to identify initial directions before moving on to a large-scale survey covering the entire country. In this paper we present the findings of this initial exploratory investigation.

The remainder of this paper is organized as follows: Section 2 briefly introduces agile methods and highlights four of the most used ones: Scrum, Extreme Programming, Kanban, and Lean. Section 3 introduces related work. Section 4 presents our research methodology while Section 5 reports our preliminary findings. Section 6 concludes the paper with a discussion of our findings and with final considerations about future work.

2. Theoretical Background

In this section we introduce theoretical background on Agile Methods that supported and is relevant to our work.

2.1 Agile Methods

Many IT companies are moving to agile methods because of the software industry emphasis on agility and time-to-market. Unlike more traditional approaches (e.g., the waterfall model), these methods focus on generating early releases of working products using mostly collaborative techniques such as pair programming, and having customers working on site as team members (Reifer, 2002). Furthermore, the market demands and expects innovative, high-quality software that meets its needs (Highsmith and Cockburn, 2002).

Agile methods are incremental development methods in which the increments are small. Typically, new releases of the system are created and made available to customers every two or three weeks. They involve customers in the development process to get rapid feedback on changing requirements. They minimize documentation by using informal communications rather than formal meetings with written documents (Sommerville, 2011).

2.2 Agile Manifesto

It all started in February 2001, in an informal meeting with the major supporters of the different Agile methods. The meeting had the purpose of discussing the need to draw up a new guide on software development processes. A group of 17 people who were taking part of the meeting realized it would be difficult to reach an agreement on this new document in a single meeting. Instead, they decided on a symbolic document named the

Manifesto for Agile Software Development (Agile Manifesto, 2001). This document suggested points to be valued more than others in the software development process such as: **Individuals and interactions** over processes and tools; **Working software** over comprehensive documentation; **Customer collaboration** over contract negotiation; and **Responding to change** over following a plan. While there is value in the items on the right, they value the items on the left more (Agile Manifesto, 2001).

2.3 Scrum

Scrum is a framework for developing and sustaining complex products and was, according to the Scrum Guide (Schwaber and Sutherland, 2011), founded on empirical process control theory, or empiricism, that is, based on the experience of its founders. In 1995, Ken Schwaber joined Jeff Sutherland and his team at Easel Corporation, assisting in the formalization of the concepts of Scrum and later publishing the first article on the subject entitled *The Scrum Development Process* (Schwaber, 1995). Since then, Jeff Sutherland and Ken Schwaber worked together defining this new method and, in 2011, they wrote the first version of the Scrum Guide (Schwaber and Sutherland, 2011), which defines the best practices to using Scrum.

The Scrum Guide indicates that Scrum agile teams shall have the following roles: Product Owner, Scrum Master and Team Development (keeping in mind that the customer is always treated as a team member). Furthermore, it also identifies the Sprint as a short period, where, at the end of this time, the team should meet with the value established in the beginning of the Sprint and deliver something usable for the client. Scrum also has well defined rules for how to conduct the project and its life cycle, namely: Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective (Schwaber and Sutherland 2011).

2.4 Extreme Programming

Founded by Kent Beck in mid-1980, it was only used effectively in a project for the first time in 1996. Besides being a method of iterative and incremental development, as the word programming suggests, it provides explicit methods for programmers so they can more confidently respond to changing requirements, even late in the project, and still produce a quality code (Larman, 2010).

For XP to be used correctly, besides the application of the practices indicated by the method, there is the need of having a mature team to comply with such practices. This team shall have well-defined roles, namely: the customer, the development team, the coach, and the tracker (Larman, 2010). Unlike other methods - such as Scrum, for example - XP has all the practices focused on the development team. Some of the main practices are: customer is always available, game planning, test-driven development, continuous integration, pair programming, refactoring, among others (Extreme Programming, 2009).

2.5 Kanban

Taiichi Ohno, an industrial executive of Toyota in Japan, by observing the supply system from the shelves of an American supermarket concluded that such a process could be used in the manufacturing lines, thus creating the supermarket system supply. Later his concept came to be known worldwide as Kanban. In Japanese, Kanban means

“card”. It was chosen to represent the system because the visual control of inventories was made using cards to represent the current state of the product (Lu, 1986).

The most common way to use Kanban is through a framework which can be physical or virtual, with easy access and viewing by all team members. Each stage of the product development process is separated and modelled (analysis, development, testing, etc). Each of these stages must be placed and kept in a card, representing the work that is in progress. Each of these cards should contain detailed information about the activity, as well as who is developing the item and when it started (Ghisi, 2012).

Agile methods provide transparency about ongoing and completed activities, and also report metrics very quickly. Kanban, however, goes a step further, and provides transparency to the process and its flow, exposing bottlenecks, queues, variability, and waste making everything that impacts on the performance of the team’s production and on the delivering of the value to stay explicit in this model (Mariotti, 2012).

2.6 Lean

After World War II, Kiichiro Toyoda, Taiichi Ohno and others, from the Toyota Company, noted that a number of simple innovations could provide an improvement in the continuity of the process flow. One of these innovations came about doing an analysis and review of the operation methods used at Ford - Henry Ford was the first person to actually integrate a production process and named it as we know today as the production’s flow -, inventing the Toyota Production System, which gave rise to Lean.

In 1990, the book entitled “The Machine that Changed the World” (Womack, Roos and Jones, 1990) was published. The book tells, in a simple way, the history of the automobile industry combining with a comparative study of Japanese, American and European automobile assembly, introducing the concept of “Lean Manufacturing”. This concept caught the attention of many people in several countries and currently the concept is commonly implemented in software development (Strategos, 2007).

Behind such a practice, there is a set of principles to be followed that can be found in more detail in the book *Lean Thinking* (Womack and Jones, 1996), namely: value, value stream, continuous flow, respond to client requests, and perfection.

3. Related Work

Rodríguez and colleagues (2012) conducted a survey about the adoption of Agile in the Finnish software industry. The study aimed to identify what is the current stage of adoption of agile practices in that industry. Results indicated that 60% (out of 408 responses) of participating companies adopt agile methods. They also found that main reasons for adopting the methods were: to increase productivity (67%), to increase product quality and service (62%), and to reduce development cycle time and time-to-market (58%). The main expected reported benefits were: to improve team communication (50%), to increase ability to work with changes made to the requests (50%), to increase productivity (50%), to improve the development process (49%), and to improve the knowledge needed to develop work (49%). The most reported factors that challenge the adoption of the methods were: top management commitment (50%), collaboration between staff and client (48%), and difficulty in measuring the success of the adoption of the methods (48%). And, the most reported reasons for choosing to not

adopt agile methods were: lack of knowledge and training in the subject (47%), and traditional organizational culture (43%).

The annual survey developed by Version One seeks to identify the state-of-the-art of the adoption of agile methods worldwide. The 2011 edition (Version One, 2011) found that 80% of 6,042 respondents use agile methods. Scrum was reported as the most widely-adopted method (53%). Daily Meetings (78%), Planning Sprint (74%), and Unit Testing (70%) are the most used practices. Begel and Nagappan (2007) found that 32% of Microsoft’s projects adopt Agile, Scrum being the most used method (65% out of the 32%). Code Standards and Continuous Integration practices were the most reported as the most adopted and Pair Programming and Test-Driven Development (TDD) as the least used.

4. Research Methodology

This ongoing research is organized in two phases: a qualitative phase to explore the topic (Phase 1) and a quantitative phase to confirm and generalize the preliminary findings (Phase 2). This paper reports on Phase 1. This phase aimed to collect initial insights on the topic. It is important to highlight that we did not aim to generalize the results, i.e., we do not claim that our preliminary findings characterize the behavior of the Brazilian market. They are indicative of what takes place in the referred market and also shed some light on what to investigate in a large-scale during Phase 2. We chose to administer an online questionnaire in Portuguese because we wanted to reach software professionals across the country. Questionnaires are time and cost effective, and allow data collection from geographically dispersed respondents (Singer et al., 2008). Figure 1 shows the research design for Phase 1. This phase is organized in 4 steps as follows below.

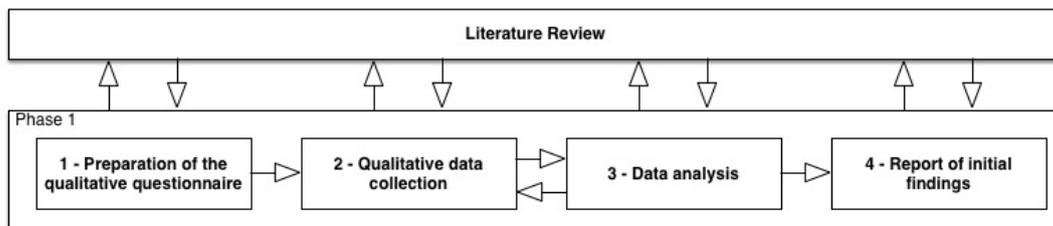


Figure 1. Research Design for Phase 1

1. *Preparation of the qualitative questionnaire:* The questionnaire is organized in two parts: content-related and demographics questions. The first set of questions was derived from the posed research objectives. The questionnaire was reviewed with three specialists (two Computer Science professors and one professional with 5 years of experience in agile). The final version of the questions is presented below.

Question 1. How do you define "Agile Software Development"? Provide principles, values and common features describing them to the best of your knowledge.

Question 2. Do you adopt agile methodologies in your day-to-day work?

Question 2a. If you have answered ‘yes’ for Question 2, about agile methods: Which practices, methods, artifacts or processes do you adopt? Please, for each of them provide a brief description.

See the example below: "*Kanban: I understand that it is a technique that allows the evolution of the activities defined for the project, facilitating the understanding of what needs to be done*".

Question 3. About agile methods: Which practices, methods, artifacts or processes would you like to adopt if you had the freedom to make decisions in your company or project? Please, for each of them provide a brief description.

Question 4. Which skills do you believe that a person must have to work in an agile team? Please, provide a brief description of your understanding for each skill or competency you indicate.

The second set of questions was about the respondent's background. For instance, we asked about their education level, years of experience in IT, years of experience with Agile Methods, how did they acquire knowledge in Agile Methods, etc.

2. *Qualitative data collection*: A small sample of professionals selected by convenience working in the IT market in different Brazilian states was invited to respond the questionnaire. We selected the following capitals: Manaus; Recife; Rio de Janeiro; São Paulo; and Porto Alegre. These 5 cities were chosen for hosting the largest technology parks in Brazil or for being known as technology centers within the country. The contact with the prospective respondents was made by e-mail. The questionnaire was deployed using the Qualtrics tool¹ and it was open for 3 weeks.
3. *Data analysis*: the qualitative content analysis of the responses was done incrementally. At first, two of the authors did their own analysis individually and then the results were discussed together with one of the senior authors. The final results represent the consolidation of the individual analyses. Patterns across the responses per question were identified. Subsequently, the list of patterns found was discussed together and consolidated to form a single list.
4. *Report of initial findings*: this paper reports on the findings from Phase 1.

5. Preliminary Findings

In this section we present our preliminary results organized per question. For this phase of the study, 24 IT professionals recruited by convenience through word of the mouth and snowballing from our initial sample participated. The criteria for participation was to be a software professional working in one of the referred cities and to work in a company. Their distribution is as follows: 4 in Manaus, 5 in Recife, 3 in Rio de Janeiro, 2 in São Paulo, and 10 in Porto Alegre. The respondents hold different job positions: 10 are software developers; 8 are managers; 4 are systems analysts, and 2 are quality assurance analysts. Their educational levels vary from PhD (1) and Master (9) to Specialization (6), Undergraduate (9), and Technical education (1). Their average age is of 30 years old, and they have about 10 years in average of experience in IT and 3 years of average experience working with agile.

5.1 The Understanding about Agile Methods

For the first question asked to the respondents (herein identified with the letter "R" and an ID number, for example, *R15* – representing respondent number 15) - "How do you define 'Agile Software Development'?" - there was a consensus among some of the aspects that define agile methods as described in the literature. Larman (2010) says it is

¹ qualtrics.com

not possible to define exactly agile methods, since practices vary, however iterations of short duration with adaptation, redesigned plans and objectives are basic practices used by different methodologies. Such statements were extensively mentioned by our respondents, with 18 of the 24 respondents indicating "short and frequent deliveries" as one of the points that define what agile methods are: "... *small cycles of time between deliveries, instead of long phases ...*" (R22). Complementing Larman's sentence, "adapting to change", 11 respondents reported in simple and direct quotes like: "*Scope changes late in the project are welcome*" (R14), or "... *to identify the changes needed as quickly as possible and to adapt in the best way ...*" (R5), as well as more elaborate responses, such as: "*As the product is delivered in parts, it is easier to accept changes in the product, so that changes are incorporated in new deliveries and are seen not as rework*" (R10) were mentioned.

"*Adding value to the customer*" and "*Have the customer closer to the team*" were very well placed for the respondents, both reported 12 times. Another important characteristic—"communication between the team and the client"—was mentioned by 8 respondents. "Reduction of documentation" was reported by 7 professionals as the excerpt shows: "... *aim to reduce unnecessary documentation and to add greater value. They include a greater focus on people and direct communication*" (R18). Also with 7 of the 24 respondents mentioning it, "fast feedback" usually appears in conjunction with other characteristics, as shown in this example: "*It involves collaboration, knowledge sharing, fast feedback, and adaptation to change*" (R3).

5.2 Practices Adopted in a Daily Basis

For questions 2 and 2a, on the practices, methods, artifacts or processes adopted by the respondents in a daily basis, the adoption of a kanban wall had a great representation of the results, with 12 of 24 respondents reporting as using it. Besides the use of kanban, some practices of Scrum as "Sprints" were reported by 10 respondents and defined for one of them as: "*Sprint – Iteration. Has a time-box between 1 to 4 weeks, after which it delivers working software*" (R8). "Review meeting" was also mentioned by respondents, where 7 of them pointed out to as one of the main agile practices, with the definition, according to one of the respondents as follows "*meeting in which the Scrum team presents to the Product Owner (PO) what was developed during the sprint*" (R7). "Daily meetings" are used in work routines of 6 of the respondents, while "Retrospective meeting" and "Sprint planning" are practiced by 5 of them.

The practice of "Planning poker" was reported by 4 respondents, with the definition of one of the respondents: "... *estimation method that assesses the complexity of the functionality without necessarily setting the deadline for its completion*" (R19). Other practices, such as "TDD", "Continuous Integration" and "Pair Programming", for example, were mentioned by at most two of the respondents.

5.3. Practices which would be Adopted

Knowing the practices used in a daily basis by the respondents, the questionnaire asked about what practices they would use, if they could choose. "Continuous Integration" and "Pair Programming" were mentioned by 4 respondents as the most desired practice they wish to adopt. Continuous integration was defined by respondents as a "*Server for tests and deploys automation*" (R22), while pair programming was described as: "... *monitoring and evolving code together with another programmer*"(R6). TDD was

mentioned by 3 respondents as something that they would like to implement in their daily work. Finally, with only two or fewer of the respondents pointing them out, other practices were reported such as: "Kanban", "Retrospective meeting", "Daily meeting", and "Planning meeting".

5.4. Skills Considered Necessary

Given the understanding observed on agile methods, practices that are being adopted by professionals and what they would like to adopt in their work routines, it was then asked about the personal skills or competencies they believe to be important for a professional be able to work with agile methods. "Team spirit" topped the skills mentioned, with 12 of respondents reporting it. Skills such as "self-management", which is cited in literature as one of the fundamental skills for working with Scrum; and "collaborative" and "communicative", cited as fundamental to Extreme Programming (XP), had 7 responses each, while "proactive" came next with 6 respondents. "Responsibility" and "commitment" were also relevant responses, with 4 occurrences each. The other skills were reported at most twice. These are: "simplicity", "ease of learning", "leadership", and "adapt to changes".

Table 1 summarizes our findings per question.

1. Understanding about agile	2 and 2a. Practices adopted	3. Wished practices	4. Required skills or competencies
Short iterations	Kanban	Continuous integration	Team spirit
Adapt to changes	Sprints	Pair programming	Self-management
Add customer value	Review meetings	TDD	Collaborative
Customer closer to the team	Daily meetings	Kanban	Communicative
Closer communication between team and customer	Retrospective meetings	Retrospective meetings	Proactive
Documentation reduction	Sprint planning	Daily meetings	Responsibility
Fast feedback	Planning poker	Planning meetings	Commitment
	TDD		Simplicity
	Continuous integration		Ease of learning
	Pair programming		Leadership
			Adopt to changes

Table 1. Summary of findings

6. Discussion and Final Considerations

This paper presents preliminary findings of a research in-progress that aims to identify what is the extent of understanding of the Brazilian market about what agile methods are and how much they are used in practice in contrast to the methods theoretically proposed. In this initial exploratory phase, 24 respondents answered an online questionnaire about the topic. Preliminary findings indicate a similar trend of responses with those reported by Rodríguez *et al.* (2012).

Agile practices used in a daily basis by the respondents, as well as skills they believe are necessary to work with were not as present as proposed by the literature. For example, only a few practices of Agile Methods were reported as used by the respondents. Most of the practices mentioned as used in their day-to-day activities are related to Scrum, namely: Sprints, Retrospectives, and Planning Meetings; whereas XP's practices had been rarely reported, namely: Planning Poker, Continuous

Integration, and Pair Programming. This leads us to believe that practices linked to software engineering are less used in Brazil than practices related to project management. It also indicates that the methods are not used in their full capabilities, suggesting there is room to promote their adoption increasing the diffusion of an innovative and collaborative way of developing software.

When they were asked about the practices they would like to use in their day-to-day routine, an interest in using practices related to XP prevailed. These practices were rarely mentioned as currently used in their companies, like: Continuous Integration, Pair Programming and TDD. This finding makes us believe that those practices are more difficult to be applied and institutionalized as most of them require tool support (e.g., Continuous Integration) and not just a behavioral or process changes (e.g., Stand up meeting), as typically happens in Scrum. We also need to investigate this further in Phase 2.

Skills cited in the literature as important to professionals who work with agile were partly mentioned by the respondents, as for example, communicative and self-management. However, characteristics like multifunctionality and knowing how to handle feedback, which are so mentioned in literature, were not mentioned by the respondents. Most of the respondents' responses, such as responsibility, proactiveness, team spirit, and collaborativeness, for example, are personal characteristics expected of every professional working in teams.

We will use the insights from this exploratory study to design Phase 2, which aims to survey the Brazilian market in large scale. For now, our findings indicate that Brazilian companies need to further explore practices related to software engineering and that they need to better train their employees in developing agile-oriented skills.

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