Concerns and Limitations in Agile Software Development: A Survey with Paraguayan Companies

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Abstract. The Agile Manifesto has been around form more than fifteen years and, all over the world, companies and researchers seek for understand their adoption stage, as well as the benefits, barriers, and limitations of agile methods. Although there are some survey studies at the global level, we know little about how the Paraguayan software community is adopting agile methods. The present work conducted a research to characterize the current stage of adoption, initial concerns and barriers on the implementation of agile methods in software development companies in Paraguay. An online survey was sent to managers of 53 Paraguayan companies. Of these, 9 (17%) managers responded. The main concern about adopting agile methods (44.44% of respondents) was the lack of reliability in product quality if developed using agile methods. The main barrier was the lack of experience (66.66%) of the companies.

Keywords: Agile methods · Agile Adoption · Survey
Software development enterprise

1 Introduction

Agile Software Development (ASD) was formally presented to the software engineering community in 2001 in a document called "Agile Manifesto", which mentions a set of core values and principles that emphasized Agility, in other words, the ability to adapt to fast volatile requirements [1]. However, agile principles don't suggest specific activities or artifacts; these are defined in a number of methods and practices such as Scrum, Extreme Programming (XP), Test Driven Development, Lean Software Development, Kanban etc. Practices vary and focus on different aspects of agile principles and address different problems in software development.

Since then, development with agile methods has attracted the attention of many researchers. Most of the available studies report experiences, generally positive, with their application in specific organizations and projects and, therefore, are hardly generalizable.

Motivated by the current popularity of agile methods and the interest of the first author (of Paraguayan nationality), we decided to investigate the concerns and

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limitations to the adoption of agile methods. The remainder of this paper is organized as follows. Section 2 is the literature review followed by Sect. 3, which outlines objectives and research methodology. In Sect. 4, we analyse the results, and Sect. 5 presents the conclusion.

2 Literature Review

The term "Agile Methodologies" emerged in 2001, when a group of software development practitioners decided to meet in the US to discuss ways to improve the performance of their projects. They wrote a document entitled *The Agile Manifesto*. Methods and practices like TDD [21], Pair Programming [22] and Planning Poker [23], related to this manifesto, have been increasingly adopted in recent years.

Several authors have pointed out the advantages of agile methods, with their emphasis on individuals and iterative processes, client collaboration on formal contracts and negotiations, and responsiveness to rigid planning [8–12, 15–18]. However, there are few studies on adoption difficulties [8, 13, 14, 19, 20].

A survey conducted by VersionOne in 2016 suggested the main difficulties in adopting agile methods are: organizational culture in disagreement with agile values, (63%) and lack of skills or experience with agile methods (47%).

Another research [3, 13] was conducted in 2013 to characterize the current stage of adoption and adaptation of agile methods in Brazil. The results showed that the main concern in adopting the agile methods was the lack of documentation. In addition, the major barrier to broad adoption was the ability to change organizational culture.

In February 2015, both Gartner and Software Advice [4, 5] launched research and analysis on agile life-cycle management or project management tools. Of the project managers who responded, 49% say that coaching others is a common challenge they face, especially when adopting agile culture.

Another literature review study [6] focused on the current challenges of this agile movement. The most significant were team management, agility in distributed teams, prioritization of requirements, documentation, change requirement, organizational culture, process and monitoring, and feedback.

3 Objectives and Methodology

3.1 Definition of Goals

The main objective of our study was to characterize the current adoption stage, barriers and limitations regarding the use of agile methods in software development companies in Paraguay.

3.2 Methodology

For the accomplishment of the study a research was prepared by means of an online survey. The following are the steps performed in the study (Fig. 1):

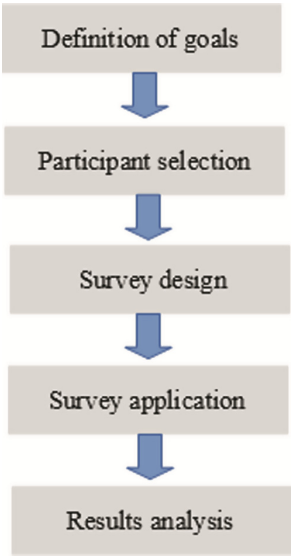

Fig. 1. Methodology adopted

Participant selection. A common problem when conducting an online survey is finding the right respondents and collecting enough answers so that you have relevant data. Our primary concern, therefore, was to find the right respondents, whose response is valuable enough to analyse the end result as managers and development managers. In our research, the questionnaire was disseminated directly to the directors or development managers of the companies.

According to the list provided by the Directorio de la Red de Inversiones y Exportaciones (REDIEX), which belongs to the Ministerio de Industria y Comercio de Paraguay, there are 53 companies registered in the Software Development category in Paraguay. The questionnaire was sent to all the companies on the list and 9 of them answered.

Survey design. We created an online questionnaire that consisted of ten multiple-choice questions.

The first section of this survey has general information. The details sought include the name of the organization to which the respondent belongs, the position, and how many people in total are employed in the company.

The second section deals with the adoption of agile methods, in which the questions were structured in such a way as to answer the main issues of adoption: concerns and barriers. The questions were, for instance, how many years of experience do you have using agile methods (to understand the extent of company familiarity with agile development) and what were the difficulties of adoption (to identify the reasons).

The last section complements previous data with the percentage of projects developed using agile methods.

Survey application. The research survey was directly disclosed to the directors or development managers of the companies through an e-mail, to which they responded by filling out the online questionnaire.

The participants were mainly representatives who had full knowledge of the company policies, the various methods used and the time the company has been using process development.

Result analysis. The analysis of the results was based on the answers that we received through the online questionnaire. Responses were carefully analysed in order to get accurate results based on the research. The main concern was to interpret the information in the wrong way, which would definitely not serve the purpose of our investigation.

4 Results

The data collected with the help of the form gave us a clear idea of the respondent and his position. Most of the participants are Project Managers or President of the Company, 33.33% in both cases, which ensures a responsible and official response (Fig. 2) and also confirms the current use of agile methods by 100% of the participants (Fig. 3).

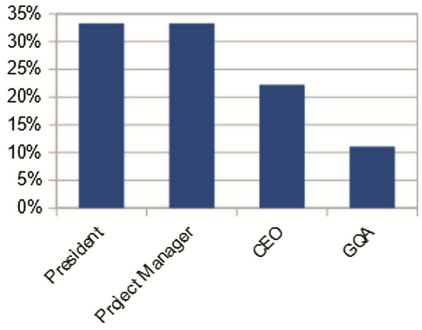

Fig. 2. Participant's role

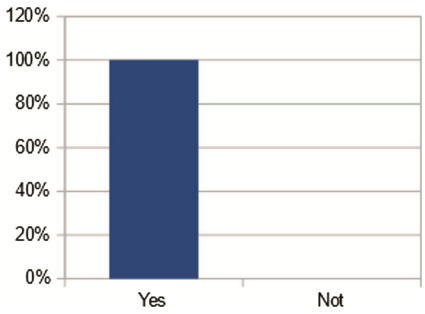

Fig. 3. Does the company use agile methods?

Another important feature is the size of the software development team. Most (66.66%) of the companies have up to 20 employees in their team (Fig. 4).

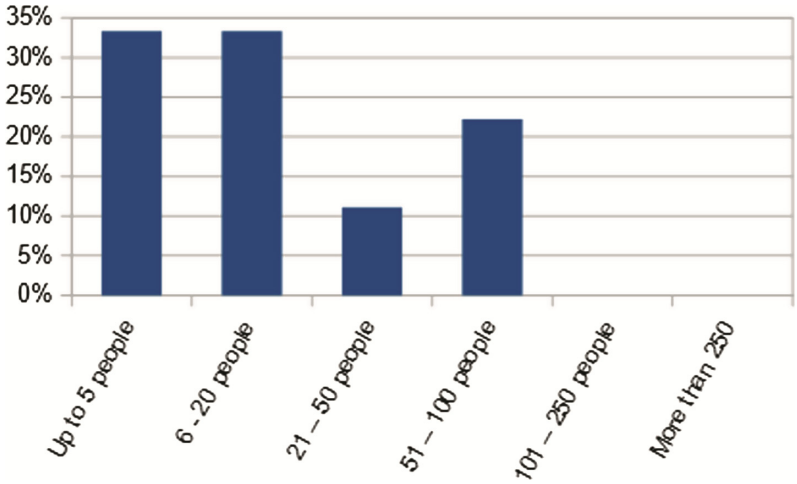

Fig. 4. Size of organization

One of the main themes of this research details the following concerns (Fig. 5):

- Inability to scale: Corresponds to the lack of organizational capacity to make the shift to agile methods.
- Reduced software quality: It's the perception of lack of reliability in delivering a quality product or ensuring customer satisfaction.
- Development team opposed to change: Occurs when developers are not convinced or motivated to make the move to agile methods.
- Lack of early planning: When participants are unaware of the activities needed to make the change because of lack of planning.
- Internal company regulations: When standards or company rules don't conform to the principles of the methods.
- No concerns: They had no concerns about adopting the methods.

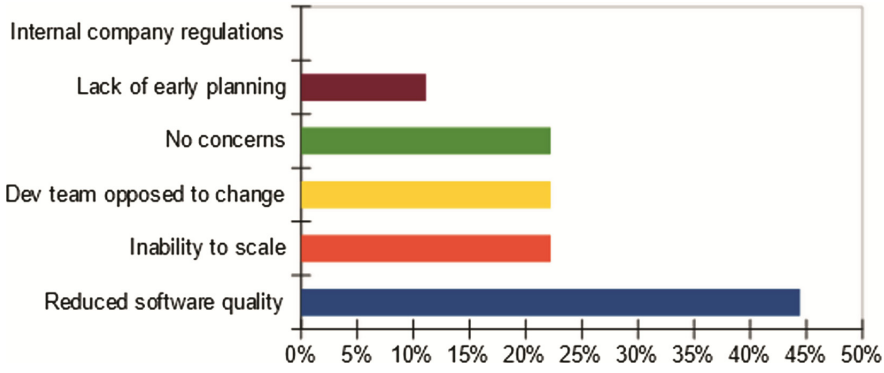

Fig. 5. Concerns about adopting agile

The data show that 44.44% of the participants had concerns about software quality when adopting agile methods. Other significant reasons are: inability to escalate, with 22.22%, and development team resistant to changes, with 22.22%.

Other important theme is identifying barriers to further adoption in the enterprise (Fig. 6). The reasons are detailed as follows:

- Company's internal rules or standards: When the company's rules don't match with the principles of agile methods.
- Budget constraints: The company has no budget for the broad adoption, but it has already implemented agile methods in some of its projects.
- Project complexity: The company also works with large and complex projects and uses agile methods to develop small projects.
- Customer collaboration: The client has no interest in participating in meetings and other activities appropriate to the agile methods or techniques used.
- Confidence in the ability to scale: Corresponds to difficulties to make the change to agile methods in order to increase its scale. That is, the difficulty in using agile methods in more projects and/or bigger projects.
- Lack of experience: The team does not have sufficient experience for the wide adoption of agile methods.
- Other: Other reasons not mentioned on the list.
- None: They had no barriers in adopting agile methods.

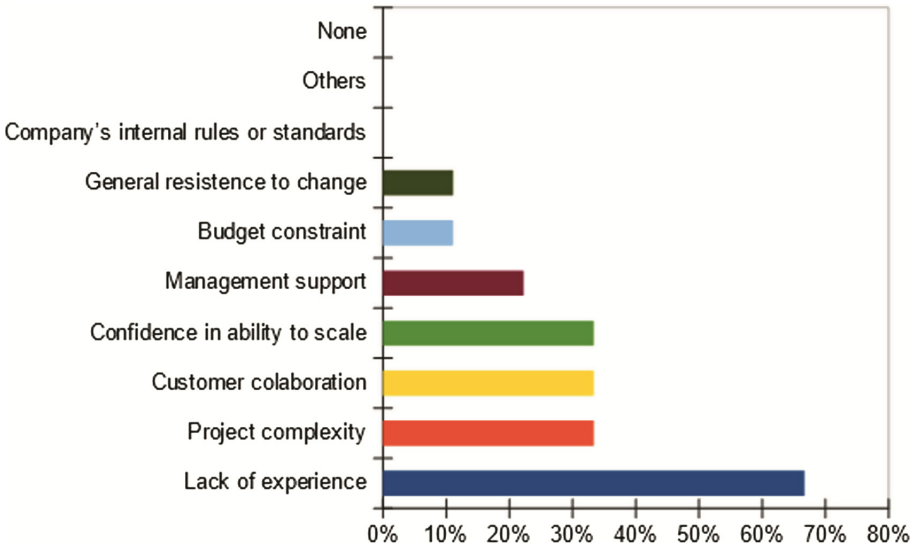

Fig. 6. Barriers to further Agile Adoption

The factors which are mainly chosen as main barriers to the adoption of agile methods (Fig. 6) are: (a) lack of experience with 66.66%, (b) project complexity, 33.33% (c) customer collaboration, with 33.33% and (d) confidence in the ability to scale with 33.33%.

Experience time is an important factor for the wide adoption of agile methods. The majority (55.56%) of the participating companies have average experience of 1 to 2 years (Fig. 7).

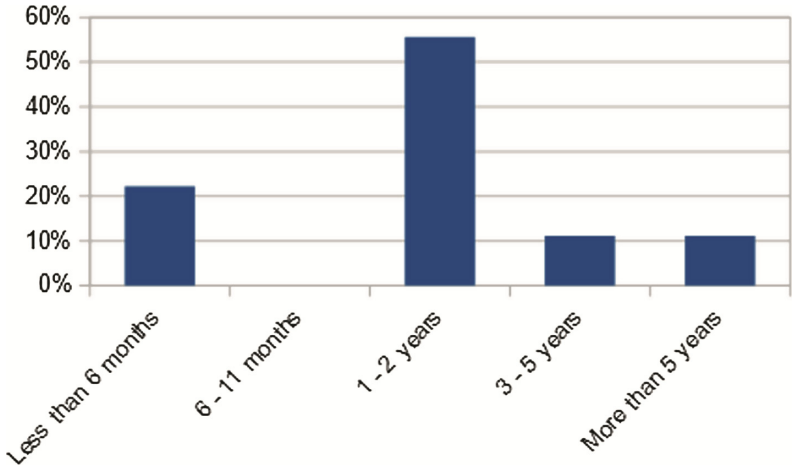

Fig. 7. Company experience with agile

The choices of methods and techniques are also fundamental according to the knowledge, the characteristics of the team and of the company (Figs. 8 and 9). Most of the companies interviewed prefer Scrum and the most used practices are: Unit tests with

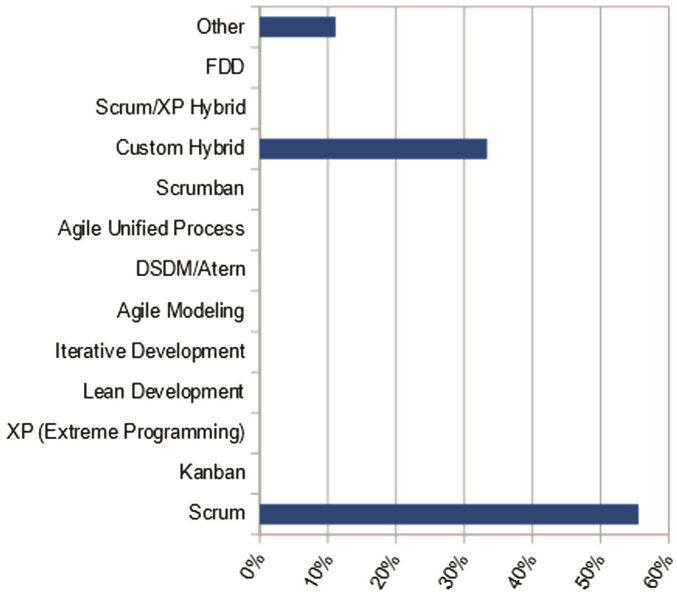

Fig. 8. Agile methodology used

55.56%, Short iterations with 44.44%, Backlogs prioritized with 33.33%, Daily meeting with 22, 22%, Retrospectives with 22,22%, Release planning with 22,22%, Continuous integration with 22,22% and Open work area with 22,22%.

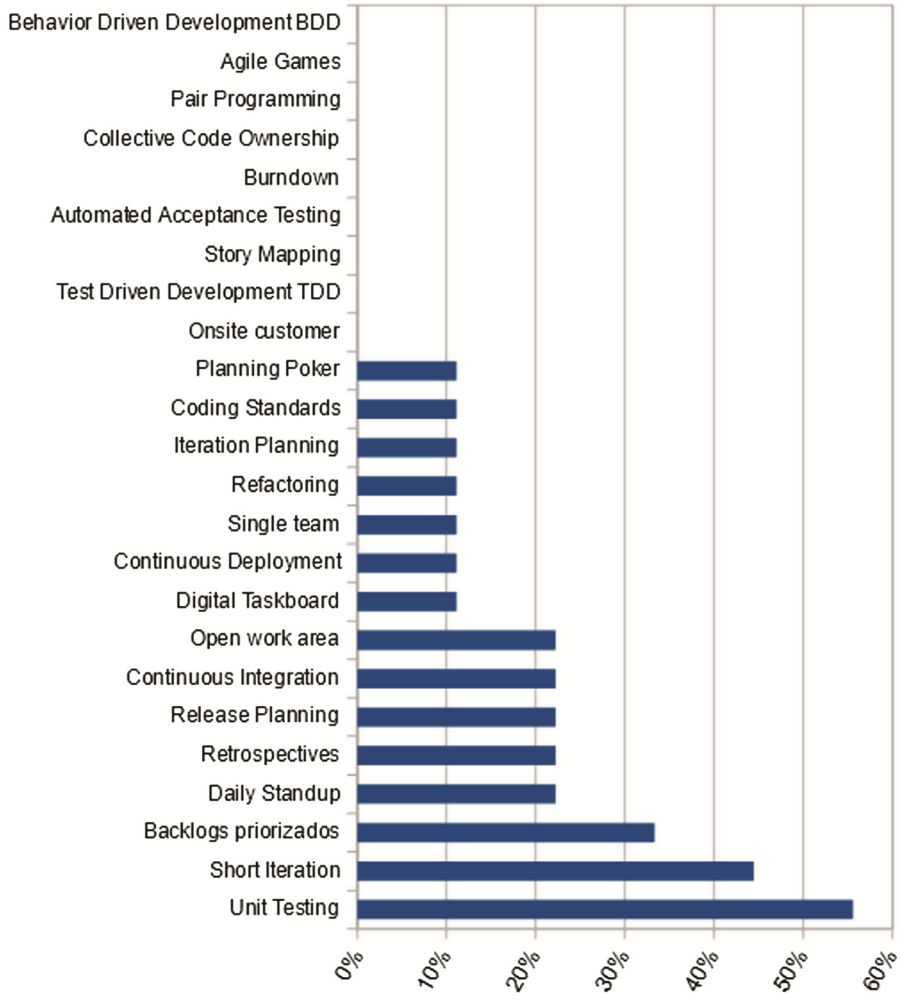

Fig. 9. Agile techniques used

Another data that allows us to visualize the adoption level is the quantity of projects developed with agile methods (Fig. 10). The majority (55.56%) of the companies used agile methods in 50% or more of their projects.

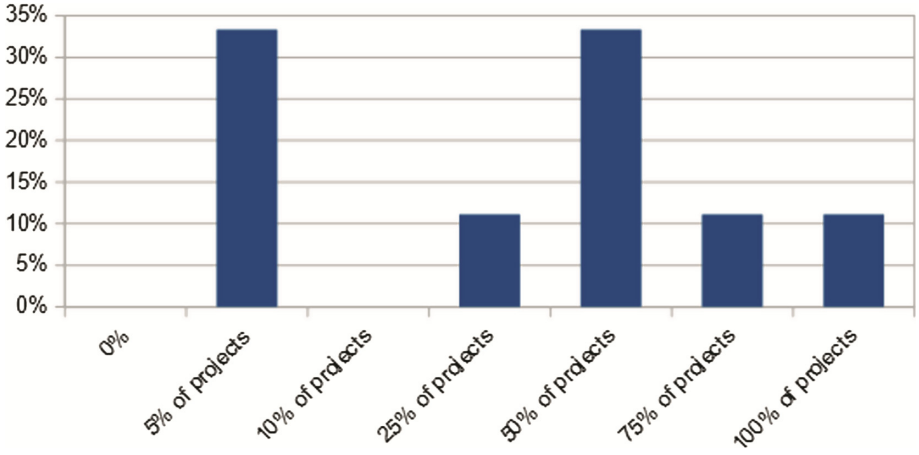

Fig. 10. Number of projects using agile methods

5 Discussion

When analyzing the results obtained, we can see that it was possible to identify similarities with the study conducted by VersionOne [2], mainly in the difficulties for the adoption of agile methods: organizational culture in disagreement with agile values (63%) and lack of skills or experience with agile methods (47%). Our study shows that the main barrier to the full adoption of agile methods in Paraguay is the lack of experience (66.66%). One of the possible causes may be the lack of training in agile methods and techniques, according to the opinions expressed by people related to the agile community in Paraguay.

In three aspects our results were very similar to those obtained in [13]: total size of the technology team, experience of the company in agile methods and most used method (Scrum). The main differences were related to:

- Percentage of projects carried out with agile methods. In [13], 30.4% of the companies developed all of their projects using agile methods. In our study, 11.11% of companies do the same;
- Profile of participants in the survey. In [13], 18.5% of respondents were developers. In our study, by the very design of the research, no developer was a respondent.

The greatest concern for the initial adoption reflects the following: 44.44% of participants had concerns about software quality at the time they adopted agile methods. The other reasons are: inability to scale, 22.22%, and development team resistant to changes, 22.22%. We believe that the concern with lack of reliability in software quality is probably the result of lack of knowledge or training on agile methods and techniques. Agile methods propose a better response to client expectations, so that more software quality is what should be expected.

It is important to note that the results cannot be generalized statistically because it corresponds to a preliminary study that aims to be complemented with more data to be significant and to allow a more concrete visualization of the mentioned scenario.

6 Conclusions

This research was carried out with the purpose of identifying the level of adoption of agile methods in software development companies in Paraguay, raising the barriers and the concerns for their implementation. The answers to the questionnaire reveal that these companies experience the use of methods and techniques, and the main concerns they reported are (a) reduced software quality, (b) change resistant development team, and (c) inability to scale.

The barriers reported are (a) little experience, (b) confidence in the ability to scale agile methods, (c) little or no customer collaboration, and (d) complexity or size of projects. Another interesting result is that more than 50% of the companies adopt the Scrum Framework.

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