ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

Agile and Traditional Methodologies: An Investigation In The Light Of Experience Based On a Multiple Case Study

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ABSTRACT:Recently, relevant changes have made organizational boundaries more fluid and dynamic in response to the rapid pace of knowledge diffusion and innovation and international competition. This helps to reconsider how to succeed with informaiton technology (IT). The IT has moved beyond the implementation of IT applications to an age of IT-enabled change. The trend towards increasing use of IT continues and the challenge remains how to better manage IT projects in order to maximise their economic benefits. This paper presents a diagnostic use in traditional and agile software project management practices in Brazil. To be able to assess the use of such methodologies in the light of experience, multiple case studies were conducted in three Brazilian organizations, who claimed to manage their software projects adopting practices of both approaches. At the end of the survey, it was found that the project management software in Brazil is done by combining traditional and agile practices. The results were satisfactory, validating the present proposal.

KEYWORDS: Project Management, Traditional methodologies, Agile methodologies, Software Project.

I. INTRODUCTION

Historically, software development projects are marked by high rates of faulties and failures ([1]; [2]; [3]), therefore, the attempt to develop quality software products that meet customer needs is necessary to use processes, practices, actions, techniques and tools that are appropriate to the reality of the project ([4]; [5]). In that sense, there are currently on the market two approaches to project management, termed as traditional and agile ([4]; [6]; [7]; [8]; [9]).

Traditional methodologies have already been consolidated in the market, having established its principles since the 1950s ([9] ;[10]), the absence of specific associations responsible for the standardization and dissemination of their practices ([11]; [12]), which should be applied to all projects, regardless of size or complexity, in a uniform manner, to ensure that the goals initially set for time, cost, scope, quality, among others, are achieved with minimal possible changes ([7]; [9]; [10]; [13]).

In contrast, in 2001 a new ideology for managing projects called “Agile Manifesto”, which aims to manage projects in a simple, practical and iteratively, valuing the constant participation of the client during the project execution, with the objective to always deliver products with high added value ([14]). The agile management approach aims to be suitable for projects that are innovative and undergo constant changes ([4]; [9]; [14]; [15]; [16]; [21]).

DOI: 10.15680/IJIRSET.2014.0312005

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

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Nevertheless, in recent years, it was noticed an increase in the adoption of Agile methodologies in project management, especially in projects of Information Technology (IT) ([9]; [13]), which are, by nature, characterized as innovative projects. However, it is noteworthy that the agile practices have often been adopted in conjunction with the processes and practices of traditional methodologies ([4]; [6]; [7]; [9]; [13]).

From the context presented, one realizes that to manage projects currently there are two main approaches, which have conflicting ideologies, whereas traditional methodologies preach the planning and strict control targets set at the beginning of the project, and agile methodologies advocate flexibility full in the planning process, being favorable to constant change. On the face of it, the traditional methodologies have been criticized for not being possible to apply them holistically managing projects that have high levels of innovation, uncertainty and change ([9]; [13]). On the other hand, agile methodologies are criticized for obstructing estimates of cost and time for the whole project, since they allow scope changes at any stage ([9]; [13]).

Thus, shown to be important to conduct a study to identify how the practices of these two approaches to project management are being adopted. Thus, this work aims to investigate the main traditional and agile practices that are adopted in project management software in Brazil. To this end, the research methodology used to achieve this goal was the realization of a multiple case study, considering three Brazilian software development organizations, state and perform project management using traditional and / or agile practices.

II. RELATED WORK

In recent years, several studies on the use of traditional and agile methodologies have been conducted in order to better understand the implementation and each operation; it has compared them and mixed them. Some examples are the studies done by Eder [4], Fernandez and Fernandez [6] Cross [7] and Špundak [9]. Therefore, for a better understanding the current situation of research on the topic of this paper, it is shown useful to have an approach about the research objectives cited.

In his work, Eder [4] has described the existing project management practices in companies, ranking them in terms of employed project management approach (traditional and agile), to enable the identification approach used by an organization. At the end of the study, it was obtained an inventory of practices, which helped to identify the practices in real companies and their categorization on the approach used.

Besides, Fernandez and Fernandez [6] performed a historical analysis of practices and applicability of agile management in projects that have a more traditional approach. Moreover, it presented a background information on agile methodologies in order to encourage the adoption by professionals.

In his work, Cruz [7] presented an overview of the Scrum methodology and the PMBOK, however, he did not argue that one is better than the other, but showed how the two approaches (agile and traditional) can be used jointly to optimize project management. Therefore, the author presented basic concepts of the two approaches, as demonstrated it can be pushed together and made statements as in a case study.

Špundak [9] presented a questions series about the combination of traditional and agile methodologies such as: "Can you combine different approaches within a single project management methodology?"; "Is there a single methodology, which offers a better solution for all projects in a specific environment, for example, a company, or some kind of change is needed to create the best own methodology for the project?". At the end of the study, the authors have found that both traditional and agile approaches have their advantages and disadvantages. For this reason, the approach selection should be carried out carefully considering the design features and characteristics of the organizational environment. Furthermore, it is possible to combine the two approaches to a project and within a single methodology, in mind when it is best to use each approach. Finally, it was found that it is important that the methodology is adapted to the project and not vice versa.

ISSN: 2319-8753

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The body of research above is just a small sample illustrating the great interest of the scientific community to study the relationship between traditional and agile methodologies in order to reveal the importance of this research in project management practice.

III. TRADITIONAL AND AGILE PROJECT MANAGEMENT

Theoretical clippings, planning is considered a matter of singular importance in any activity developed in organizations, this is the simplest or the most complex activity ([7]; [9]; [17]). This assertion is justified, since without proper planning and management, a lot of activities and projects fail in their scope, time, cost and/or quality, which are the most affected areas when you have a correct strategic thinking had moved planning ([10]; [17]). Therefore, perform project management is of paramount importance, so that you can achieve your predetermined goals. Thus, the Project Management Institute - PMI [12] defines project management as the application of knowledge, skills, tools and techniques to project activities in order to meet their requirements. As for [18], project management is a structured set of techniques and tools that are used to solve specific problems. Supporting himself in such settings, traditional methodologies consider that the projects are structures that can be controlled, predictable, linear and limits (beginning, middle and end) clearly defined, which facilitates detailed planning, and the fulfillment of that plan until the end without many changes ([9]; [13]; [19]; [20]). To achieve this goal the traditional methodologies require a disciplined planning, with close monitoring of the various phases of the project life cycle, not being susceptible to changes in planning. Already agile methodologies have emerged from a contemporary movement that preaches the execution of a project of dynamic, flexible, simple and interactive way, valuing constant changes and active customer participation during project execution ([4] , [9]; [14]).

Provided that, the agile project management is defined as a management approach made up of a practices set, techniques and tools that are applied in conjunction with the appropriate environmental factors, it contributes to a better performance in agile project management (time, cost, quality and innovation), and adds value for customers and the market, in an innovative and dynamic business environment ([15]; [16]; [21]). Consequently, according to [19], the approaches of traditional and agile project management differ in aspects presented in Table 1.

Table 1.Differences between agile and traditional project management.

Aspect	Traditional	Agile
Project objectives	Focus on completing the project on time, cost and quality requirements.	Focus on business results, and achieve multiple goals successfully.
Project Plan	A set of activities to be performed as planned to meet the triple constraint (time, cost and quality).	An organization and a process to achieve the expected goals and outcomes for the business.
Planning	Performed once at the beginning of the project.	Performed at baseline and reassessed whenever necessary.
Managerial approach	Rigid, focusing on the initial plan.	Flexible, variable, adaptive.
Execution	Predictable, measurable, linear, simple.	Unpredictable, non-measurable, non-linear, complex.
Organization Influence	Minimum, neutral from the project launch.	Affect the project during its execution.
Project control	Identify deviations from the original plan, and correct work to follow the plan.	Identify changes in the environment and adjust the plan accordingly.
Methodology Application	General and equal application across all projects.	Process adaptation depending on the type of project.

ISSN: 2319-8753

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Management style	A model meets all kinds of projects.	Adaptation, process depending on the type of project.

Source: [19]

Another scholar who treats the differences between traditional and agile approaches is [4]. This author presents the differences by means of a practices inventory, which is being formed by a set of actions, techniques and tools. Where, according to the author, the action consists in something that generates results through the use of one or more techniques (a systematic procedure) and tools, that is something tangible, like a model or software. Therefore, based on the inventory of practices developed by [4], this researcher made an analysis considering only the actions and tools, according to (traditional and agile) approach. The 23 (twenty-three) and 21 (twenty one) tools identified and classified according to the study done by [4] are presented in Table 2.

Table 2. List of actions and tools classified according to the approach.

Action	Approach	Tool	Approach
Adding detail to user stories sooner Ask	Agile	Slideshow	Hybrid
Ask for a time commitment	Agile	Minutes of meeting	Hybrid
Collect requirements	Traditional	Data base	Traditional
Scope control	Traditional	Cards/Sticky Notes	Hybrid
Project plan control	Hybrid	Cardboard	Hybrid
Scope change control	Agile	Checklist	Hybrid
Charter project	Agile	Contract	Traditional
Identify the necessary work for the project (product, deliveries, and others.)	Hybrid	Design/Schema	Hybrid
Declare the problem/opportunity	Hybrid	Diagram/Graphical presentation/Chart	Hybrid
Define task	Traditional	Roadmaps	Hybrid
Define project scope	Hybrid	E-mail	Hybrid
Set schedule	Traditional	List	Hybrid
Define Target Velocity/Estimating Velocity/Velocity	Agile	Quality manual	Traditional
Estimate the task duration	Hybrid	Mockups	Agile
Estimate the task resources.	Hybrid	Mental models//Process Maps	Hybrid
Identify and measure gaps.	Agile	Models/Prototype/Template	Hybrid
Finalise the project plan	Traditional	Spreadsheet/Table	Hybrid
Prioritize requirements	Agile	Board/Wall	Hybrid
Prioritize the necessary work	Agile	Report	Traditional

ISSN: 2319-8753

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Task sequencing	Traditional	Questionnaire	Hybrid
Measure complexity	Agile	Project management software	Hybrid
Check scope	Traditional	-	-
Define product scope	Traditional	-	-

Source: [4]

After presenting the fundamental differences between traditional and agile management approaches, the next section shows the research methods used in this work, detailing each of the steps performed.

IV. METHODOLOGY

The research in this paper can be classified as qualitative and exploratory, because it has the main objective to conduct an investigation through interviews and analysis of the multiple environments study and at the end, it does a complete the interpretation of the information collected. For this, at first it was necessary to review the literature about the concepts related to traditional and agile project management, as well as identify the bibliography fundamental differences between them. After understanding the fundamental concepts of the research, then occurred the selection and contact with the organizations with the potential to be the object of study for this work. Soon afterward, it was held interviews with application of semi-structured questionnaire and checklist, with three (3) organizations that agreed to contribute to the research. Next, the results obtained from the analysis of multiple cases were analyzed. Figure 1 illustrates the five (5) steps that make up the research: literature search; selection of organizations; definition of evaluation criteria; application of the criteria in the selected organizations; and diagnosis.

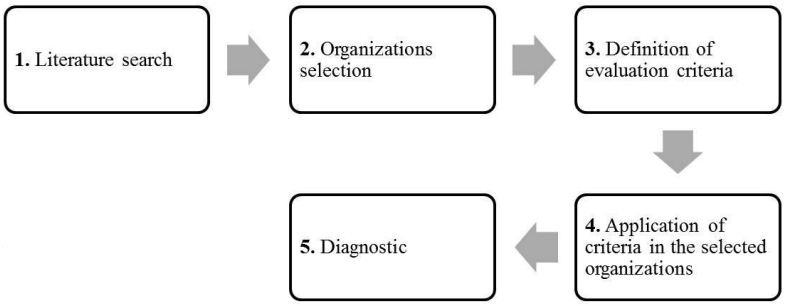

Figure 1.Steps that make up the research.

The first step consisted of simple literature search, where, at first, the main concepts related to traditional project management, and agile project management were identified. Shortly thereafter, it was taken into account the related published research, a comparison of the main aspects of each approach was performed, besides a survey and classification of the main practices adopted in each, so that it was possible to carry out the analysis of the practical use on each methodology.

In step 2 took place the organizations selection. So, for this were used the following criteria: the research organization shall have a process of project management; the studied organization must declare that uses agile and / or traditional approach to manage its projects; and the organization studied should develop software products. To identify these criteria the site of each organization was visited as well as it was sent the official standard virtual communication, an e-mail, that was stating the purpose of the study and an invitation to contribute to the research was formally done. There were selected and contacted nineteen (19) organizations located throughout the Brazilian territory, however, only three (3) answered the e-mail stating that they had interest in contributing to the research, these organizations are located in the regions, north, northeast and southeast of Brazil. During the third step of the evaluation criteria selected as the object of study the organizations were defined, a semi-structured questionnaire with questions related to the

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stages of project management and a checklist containing the actions and tools of traditional and agile approaches had been used. Its important to highlight, the objects for evaluation of the institution were built based on the work of [4].

In step 4, the evaluation criteria was applied to the selected organizations. This process happened through an interviews with an information technology manager for each organization, where the semi-structured questionnaire and checklist was applied. As previously mentioned, the organizations analyzed are spread across three different Brazilian regions, so the interview with the application of semi-structured questionnaire was conducted by web conferencing with the help of "Hangout" Google tool. For the implementation of the checklist on practices, it was performed with the aid of the "(Google Drive)Form", also from Google. Finally, in step 5 the analysis of information obtained through application of semi-structured questionnaire and checklist was done, and from these, it was possible to get a diagnostic demonstration traditional and agile practices methodologies in Brazil.

V. RESULTS AND DISCUSSION

This section aims to present and discuss the results obtained from the execution of multiple case studies. At first, the adopted organizations as the object of study will be briefly presented and its characterization will be shown. Shortly after, the results obtained with the application of semi-structured questionnaire and checklist are presented, to demonstrate which aspects of traditional and agile practices are adopted by each organization. It is worthy showing that the application of semi-structured questionnaire and checklist of practices aimed to perform a diagnostic of project management in general, not considering a specific project.

Characterization of Organizations:

Organization A: An Organization from the government sector that makes up the sphere of public institutions for monitoring and controlling, which has the task of ensuring the effective external control through surveillance systems, guidance and evaluation of the results on management and public policy in favor of the society. It is worthy saying that the organization in this case states that uses traditional and agile practices for managing software development projects.

Organization B: An organization from the service sector, which has the mission of contributing to the success of companies creating software that improve the management of their business. This organization works closely with the software development, and according to interviews with members of the organization, that was founded based on agile principles, and the management of the entire organization follows the agile ideology. Therefore the organization on focus essentially states using agile practices to manage their projects.

Organization C: An organization from the service sector, which has the mission of conducting self-sustained knowledge transfer in information technologies between society and academia. This organization is an innovation center that uses Information and Communication Technologies (ICTs) to solve complex problems for businesses and industries from various sectors. According to interviews done with one of the project managers, to do project management software they have adopted both, traditional and agile practices.

After understanding the mission of each organization, the interviews happened, adopting at that time, the semi-structured questionnaire, and this was applied to only one member of each organization. That way, it is important to emphasize once again that the analysis was not performed on a specific project, but with a macro view of the entire management process adopted for all projects on software development organizations.

Application of semi-structured questionnaire:

The semi-structured questionnaire was developed based on work by [4], the same being composed of a set of questions according to the stages of project management. Thus, the first set of questions is related to the startup phase of the project, in a second stage, questions related to the manager are presented. Soon after, questions about planning, therefore, on the implementation and control of the project are realized. Finally, questions related to the completion stage of the project are presented.

Organization A: In the initiation phase, a meeting is held to begin the project, and this time the project plan is created and published in a management system. If any change in the initial project plan occurs, this is recorded in memory of meeting. Furthermore, according to the interview, during the initiation of the project success criteria are not

DOI: 10.15680/IJIRSET.2014.0312005

ISSN: 2319-8753

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established. With respect to the manager, there is only one responsible for the whole sector, which performs monitoring of all projects.

About planning, it is held weekly or in every two weeks, through meeting between technical and business teams, and this period varies from project to project. Everything that is discussed and defined in this planning meeting is socialized through the project management system. Even during the planning is done a scope management, human resources and time is performed, in other words, it is defined the activities to be developed during the cycle (a week or in fifteen days), and those responsible for running them, and also the time so that they can be completed and delivered.

Regarding the execution and control, as well as the planning, also monitoring is performed weekly or biweekly, these may vary from project to project. In addition, periodic meetings between the project manager and the one responsible for the activities are performed in order to check the progress and to identify potential problems. In addition, all activities that must be performed during the cycle are recorded in the project management system, and this information is shared among all members of the project (team of business and technical staff). It is noteworthy saying that performance indicators are not used and neither the quality is evaluated, the customer satisfaction is verified informally, through conversations. Finally, at closure, when a module of the system is completed, it generates a term shutdown, where the business team representative certifies that the features were delivered. It is worth highlighting that at the end of a module or part of the system, the lessons learned are not discussed, nor shared.

Organization B: The project begins with conducting a meeting which involved the technical team and the client, when it is discussed and defined the important points of the project objectives, the form of communication, time, budget, among other points, all done in a simple and objective way. Then, during this meeting, according to the objectives identified, it is defined the project size (small, medium or large), and from this it is estimated time and fixed costs. Also at this meeting the scope is treated in a variable way, where a change may occur during the project.

With regard to the manager role, this position does not exist in the organization, since the entire team is responsible for managing the entire project. With respect to planning, it is held every fifteen days, following the procedures of the Scrum agile methodology, so, there is no overall planning, but a continued project watch. As mentioned previously, the only points that are planned in general are: cost and total time and overall project objectives.

Also, when the project scenario is extensive and known an analysis of agile business cards will be used to design the current and future scenario, which raises the problems and goals, which are detailed and transformed into requirements. However, when the scenario is marked by many uncertainties, such as when an analysis is not performed, because it is considered an unnecessary work, since it is subject to many changes. As there is no role of a project manager, all team members are responsible for managing the project (including the client), so all participates of the team do the planning of activities to be developed during the course of fifteen days. These activities are being recorded in online spreadsheets that are shared with all team members and client.

On the implementation and project control procedures of the Scrum methodology, as well as the Kanban are adopted. The progress of all the activities planned for the cycle fifteen days can be verified by any member of the team and the client, at any time, through shared spreadsheets and graphs that illustrates the project evolution. Additionally, daily and review meetings are held. With regard to changes during project implementation these are not controlled, although when it is found that any changes is needed, it will be verified with the customer. Yet, about the control of the project, it is important to emphasize that the organization, in every cycle of fifteen days, it is done the measurement of customer and staff satisfaction, as well as for the requirement from the project objectives. At closure, there happens no formal procedure it is only sent an email to the customer informing him about the project completion. Moreover, at the end of a cycle or the project as a whole, it is held a meeting to discuss and share lessons learned.

Organization C: To start a new project an initiation meeting is held between technical staff and client. In this, the budget is discussed and defined, when the scope and time are discussed, but it may occur appropriate changes as the project progresses. As the organization serves a diverse range of clients, methodology and their management practices adopted vary from project to project, often in innovative projects are adopted agile practices already in more

ISSN: 2319-8753

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bureaucratic projects that require more documentation and formalization, are adopted practices of traditional methodologies. Besides this, the team composition also varies according to the profile of the project. With regard to the criteria and indicators of success and monitoring, these also depends and vary according to the profile of the project, and in traditional designs monitoring, which is more rigid and bureaucratic, for agile projects such monitoring occurs in cycles and in a less formal manner. The manager's role happens in all projects, even when agile methodologies are adopted.

Therefore, the manager is chosen taking into account the harmony of his or her profile and the characteristics of the project. The planning is performed using cyclical techniques and tools, this happens weekly through the meetings between technical staff and client mode, where it is defined goals to be achieved. Consequently, the targets related to time, scope, risk and quality are defined by the technical team together with the client, since the budget is prepared by the manager. Everything is planned, documented in spreadsheets with different levels of detail, ranging from project to project. The record of planning and documentation are available to the customer via e-mail, in addition, are adopted tools such as graphs and tables for publication and socialization of planning with the entire team.

During the execution of the project team itself conducts daily meetings, with the goal of socializing the progress of activities, as well as presenting obstacles identified. Despite existing the role of the manager, all team members are "owners" and responsible for project progress. Besides the daily meetings at the end of each week meetings for the purpose of ascertaining whether the goals set at the previous meeting were reached and soon it turns out into quality indicators, risks and deadlines are performed.

It is important to mention that the client can participate and monitor the entire process of project execution as well as to evaluate it constantly. In addition, the organization constantly checks the criteria for acceptance and validation of the project, and for this encourages customer participation, it also incorporates the test team to perform a test automation, it is done an audit and a checklists of everything before delivery. When finishing a project is only performed administrative closure. In addition, it holds a meeting of general retrospective, and shared the lessons learned in the design ecosystem.

Checklist of Project Management Practices:

After applying the semi-structured questionnaire, the organizations adopted as the object of study were analyzed from a checklist, also based on the work of [4]. Through this checklist, it was determined which traditional and agile practices are adopted by the organizations, as well as trends of practices for managing software projects in Brazil. As already explained, this work considers only related practices to the actions and tools. The elements that were analyzed in the checklist can be checked in Table 2. After applying the checklist, it was found that although the Organization A take action, agile tools has increased the use of traditional practices tendency, as it can be seen in Graph 1. This finding goes against the data collected during the semi-structured questionnaire, where the project manager reported adopting traditional and agile practices. Furthermore, because it is an organization of the government sector, it is natural to need to adopt more rigid and bureaucratic procedures for management.

Analyzing the responses of Organization B is it possible to see that although it is essentially self-declare agile organization, they still adopt a high percentage of cases (50%) and tools (100%) that are fundamentally classified as traditional (Graph 1). Furthermore, it was found that among the organizations analyzed the Organization C is the one that most adopts it, in combination, the traditional and agile practices (Graph 1), such information is consistent with the survey conducted in semi-structured questionnaire, since was reported by the projects manager interviewed, the organization uses both traditional practices like agile, and this adoption varies according to the profile of the project.

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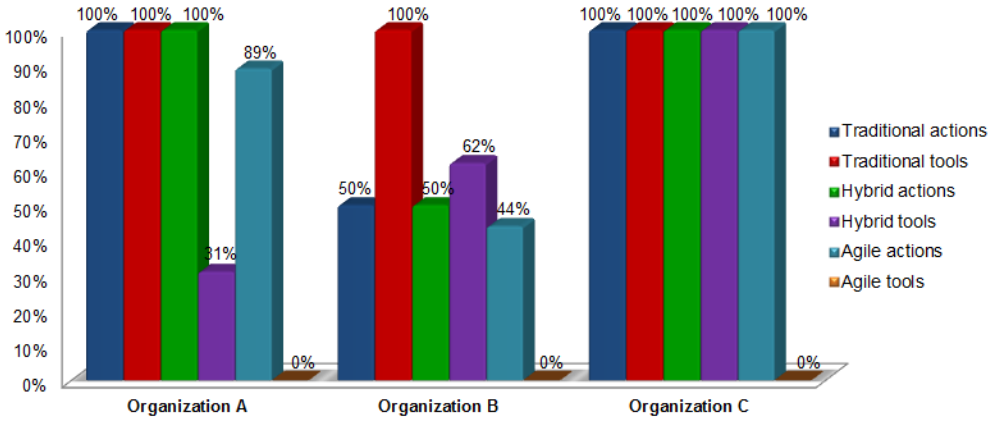
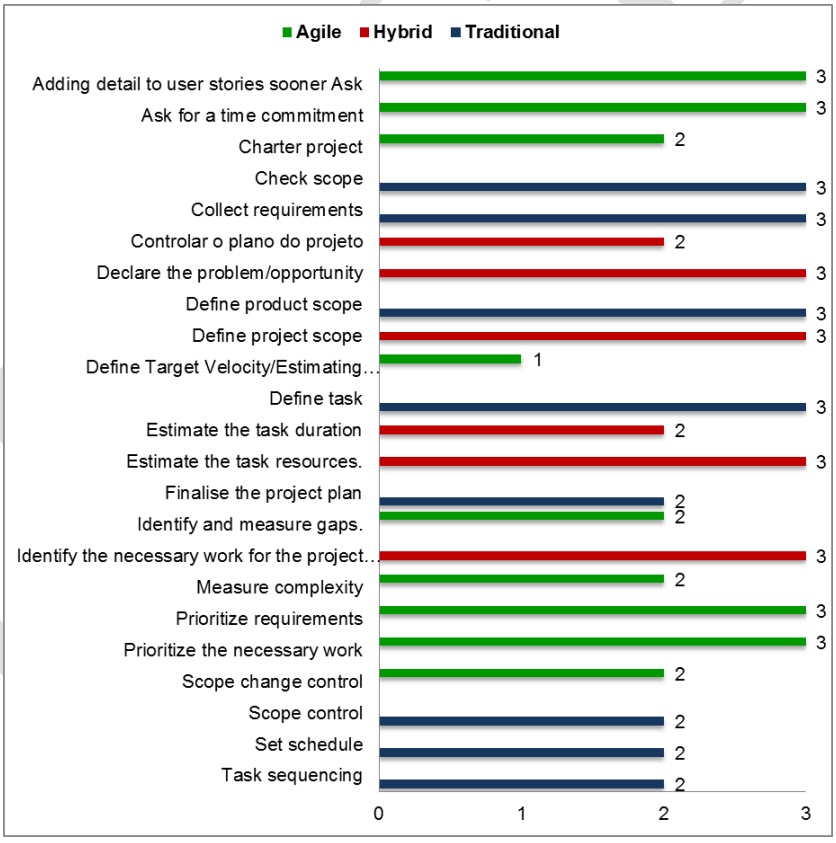


Graph 1.The adoption to take traditional action, hybrid and agile tools in the analyzed organizations.

After examining the use of tools and actions in each of the organizations studied, seems relevant also check the overall rate of use of each of the practices. Thus, when analyzing the graph you can see that 2 of 23 (twenty three) cataloged by [4] all actions are used by at least one of the organizations, and four traditional actions, and four agile, four hybrid actions are adopted by the three organizations studied. This shows that in Brazil there is a tendency to project management with the balanced adoption between traditional and agile actions.



Graph 2. Adoption rates of project management classified according to the methodology.

With regard to the adoption of tools to analyze the graph one can see that 3 of 21 (twenty one) are actions related by [4] only one (Mockups) is not adopted by any organization, this is the only one classified as agile. When analyzing the

DOI: 10.15680/IJIRSET.2014.0312005

ISSN: 2319-8753

International Journal of Innovative Research in Science, Engineering and Technology

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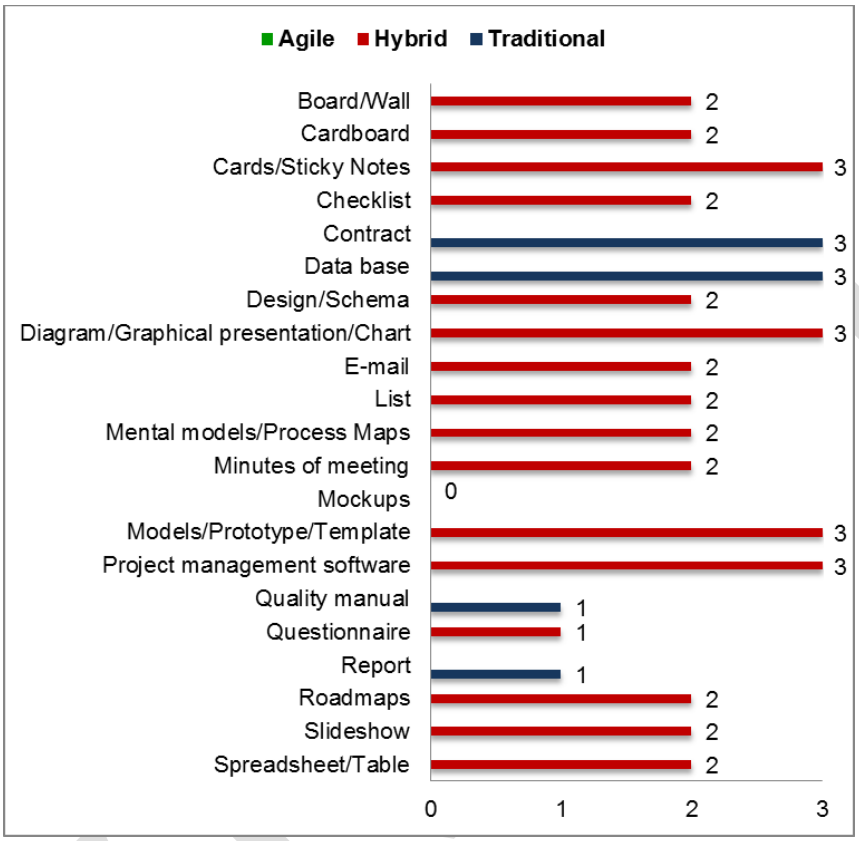
other indexes, it appears that four tools that are adherent to traditional and agile (hybrid) methodologies are adopted by the three organizations. This reinforces the tendency for management of Brazilian projects be conducted in mixed form, with traditional and agile practices.



Graph 3. Adoption rates of project management classified according to the methodology tools.

When analyzing the results obtained from the application of the semi-structured questionnaire and the checklist from the three organizations with different profiles, which are located in distant geographical regions, it is clear that, in general, in Brazil there is a tendency for project management software actions and tools that combines traditional and agile methodologies, also those adherent to both methodologies. This demonstrates the concern of Brazilian organizations in developing a planned, organized and controlled software, but at the same time be responsive and manage a high-quality results and high added valued software to the customer. After presenting the results obtained by conducting the case study, the next section presents the conclusions found with the work.

VI. CONCLUSION AND IMPLICATION

In general, the objective of this study was to conduct a research about the main traditional and agile practices in software project management in Brazil. Consequently, the study shows it is relevant because it presents a diagnosis of the Brazilian project management software, from the perspective of traditional and agile practices, based on multiple case studies, besides showing possible trends, in addition to supporting new research related to the management software projects in Brazil. To enable it to achieve this goal, initially a conceptual study was performed in order to understand the project management following the traditional and agile approaches. Therefore, to demonstrate the use of such methodological approaches in Brazil, there were selected three (3) organizations, distributed in three (3) different Brazilian regions, which declared to adopt a management process to execute software projects. From this, it was

ISSN: 2319-8753

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performed a multiple case study with selected organizations, using a semi-structured questionnaire with questions related to the management process, as well as a checklist to identify the traditional and agile practices.

From this, it was found that the management of software projects in Brazil combines the use of traditional practices methodologies to Agile practices, besides using hybrid practices, which are common to both approaches. From this, it can be said that Brazilian organizations that manage software projects, it aims to execute projects in a planned, documented, organized and controlled , therefore, adopt traditional practices, such as setting and checking project scope, which generates reporting and contract, among others. On the other hand, it aims to perform a simple and objective projects way, it achieved valid results, quickly and with high added value, immediately adopt agile practices such as prioritizing requirements and work measurement complexity, among others.

About the limitations of the study, it is evident the fact that the survey is being sustained in only three case studies, and the analysis of the environments was non-face manner, using only interviews thorough web conference, since it was not possible visits the spot, considering the geographical distance of each studied organizations. However, it is important to note that the small number of organizations considered in the study is due to the great difficulty of obtaining feedback from the organizations contacted. Finally, although the results demonstrate the effective joint use of traditional practices and agile project management software in Brazil, it is important to emphasize that it is still necessary to check the impact of this combination in the final performance of the project. Therefore, as future work is proposed conducting research that shows the performance of projects before combining traditional and agile practice.

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