A Comparative Analysis of Agile Project Management Tools

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Finding the best agile methodology tool for a specific problem is a challenge both from developers point of view and customer vision. That happens because the foundation of this type of projects is communication. The paper provides an overview of agile project management methodology, describing the principles that are the bases of this management approach through a literature review. It covers various agile project management tools and defines the criteria that should be taken into account when a company aquires such products.
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Introduction

Today's world is rapidly changing. Information is growing exponentially at a rate never seen before. Innovation is at it is peak. This is an era of research and development. There is a constant need for adaptability and flexibility, in response to a dynamic environment.

Software companies are managing complex projects due to the increasing and compounded business requirements, finding themselfs in need of an agile project management tool that is not only intuitive, but helps them handle their projects in a timely and effective manner. Agile project management software helps users to plan and oversee a project throughout all of the development phases. This grants a semnificative advantage to managers, because it also offers the posibility of laying out the stages of a product development by estabishling deadlines and creating tasks. The resources and procedures involved in the project can be changed according to the project needs.

This study will assist software development companies to indentify suitable agile project management tools. It will guide analysts and professionals to choose an agile software product according to their needs.

Literature Review

A systematic review was conducted to demonstrate the potential of agile concepts and methodologies to project management as a response to a dynamic environment, that demands not only knowledge of the latest technologies, but also strives for performance by means of adaptability in response to change.

The ideas are reinforced by Dingsøyr, who states that "agile principles of change readiness and adaptability are expected to foster a learning environment in agile teams, organizational learning and related perspectives"[1]. He emphasizes the potential that agile methodologies have in revolutionize the way in which the information is generated and managed.

A research conducted by Dikert, Paasivaara and Lassenius identifies several success factors for large-scale agile transformations: management support, commitment to change, leadership, engaging people, communication and transparency. In the article are also presented the main challenges that are facing organization that want to implement Agile: change resistance, lack of investment, hierarchical management and organizational boundaries, coordination challenges in multi-team environment and Agile difficult to implement. To implement successfully Agile, organizations must realize the need to change and wishfully participate in this transformation. If people are resistant to change, the project will fail. Organizations need to be transparent about the changes they are making, so that they engage everyone in the organization. According to this paper, a

"strong commitment from management assures teams that is the right thing to do"[2]. In another reaserch Inayt identifies a major cause of the failure and draws attention to the importance of the induction of the project: "It is established that 70% of the projects failed at requirement definition stage" [3]. This finding emphases the necessity of a company to invest in software products that guarantee them successful outcomes and competitiveness in the market place. Project Management Agile Tools are at the heart of a project helping companies plan, organize and oversee every stage in the life cycle of a product.

In a world that is rapidly changing and information is growing exponential companies that want to keep their seat at the table of the most powerful players in the global market place must acquire and manage complex enterprise software products that demand high tech infrastructure. This infrastructure is not only expensive, but is also need to be maintained by an IT division. Also, if a company is no longer needing the entire infrastructure because is rethinking the business strategy, then the costs of maintaining that infrastructure it not provides them a return on investment, being a waste of resources. Facing this problem companies are more and more turning to cloud solutions outsourcing this aspect of their business. This fact is very well argued in a paper written by Younas: "Based on our findings, there is a need for more cloud-based agile tools which could provide end-to-end support" [4].

Software companies had faced the problem of adaptability and flexibility in development of their products, where old methodologies like the classic "waterfall" prevent them for better understand the needs of their clients and deliver products that needed multiple changes, often hard to implement. The solution came in the form of the agile methodologies. Agile promotes communication with the stakeholders throughout the entire process of development and focuses on individuals, instead of tools and processes. The methodology became a way of managing numerous factors implicated in businesses, today being applied also in various industries. The significance of collaboration in the management of a product life-cycle is highlighted by Lanubile: „A consistent PLM strategy can evolve in parallel with this process, providing mechanisms to guide and align technologies to the degree necessary. Such a strategy is valuable when working in external networks with participants from different organizations." [5].

Methodology
The exponential rate of the information technology and communications is growing and the number of tools intended for implementation of the Agile methodology is very high and can not be covered entirely in a single paper. Thus, we choose to select some tools which are frequently used by companies activating in various sectors.

In the next section is the list of the most popular project management tools that are used by companies in managing their Agile projects, followed by a description of the characteristics that we considered definitive in comparison that underlie this study. We choose five tools to compare. After reading several papers on this topic, we decide to these because they are most used in this domain.
1- Atlassian JIRA
2- Taiga
3- Version One
4- Assembla
5- Asana
We find a lot of criteria through which these tools could be compared. Most are important, but we have focused our attention on those that are relevant to the idea of Agile methodology. So, the criteria on which this research is based are:
1- Integration facilities
2- Mobile Apps
3- User stories
4- Training
5- Planning
Integration Facilities: in the context of a team for a project sized to large, where team members can be distributed in several geographical areas, also customers can be in different geographical area, and the flow of

information to be exchanged between all entities involved is large, integration becomes a fundamental element for a good collaboration. This may came in the integration with the internal communication system that company owns or another external solutions like such as Skype, Windows Live Messenger, Google Chat, etc.. We search for every tool documentation, on their sites, to see how wide is the scope of integration, and score with points from 1 to 5.

Mobile Apps: On the one hand we talk about the ability of the tool to be available on multiple platforms like desktop, web and mobile offering flexibility and on the other hand, the possibility of integration with the cloud for storing large data and even remote collaborative work. For that companies must enter a contract with a cloud services provider that can be customized exactly according to customer needs. For this criterion the unit of measure is the number of mobile platforms where the tool has developed an application. This platforms are iOS, Android and Windows. We search into the applications stores for each tool to see if exists and we looked for the reviews provided by users who downloaded them.

User stories: This particularity of tool is one of the closest principles to the Agile Manifesto published in 2001. It may seem very informal and unstructured data format but it is the element that encourages all entities participating in the development process to express themselves freely, to be transparent in recognizing the problems, the solutions and the achivments. User stories are short, simple and describe in natural language the perspective of a person (user or customer) about a subject from the project, it can be a software capability or anything else.

Training: This feature is related to the one before. Thus, for any tool to be adopted successfully in a working group members need to be involved in a training where they can learn and understand the functionality of the tools and how they can be used to improve their activity and the company productiviness. Training can be both offline (by receiving written documents or audio-video), by videoconference, or can be given by a consultant from the company that provides the software in order to present them the tool and understand what are the operations and processes that they do on a day by day basis so that will offer them custom training. The elements taken into account for this criterion are: access to documents, tutorials, webinaries and the time and cost of support when submiting cases.

Task Management It is necessary to measure and justify the level of effort required to complete the project and this information must be based on transparency, so that at any time, any participant in the development, either the developer or client has the posibility to access this information. Things are always changing on the fly and tools must provide automated schedulers that can send notifications about the progress of the project, deadliness and other factors involved in order to keep the stakeholders informed in all the stages of the product development cycle.Also this feature help the team to better organize their resources, maintain the expected cost of the project and even plan their free time depending on how the work progresses.

The criteria described before were used to analyze the most popular project management software products and the results of the investigation were synthesize in the following table. Below the table are defined the metrics for each criterion.

The values semnifications are: 0 – absent, 1 – very weak, 2 – features exists, but there are weak points or problems in utilisation, 3 – the main features respect minimum requirements, 4 – features nessesary to obtain at least an average performance, 5 – features are express very well

For first criteria, we read documentation about what can offer this tools. The main source is their websites[9],[10],[11],[12],[13]. The main types of integration we looking for are communication (chat/messaging), cloud, mail services, calendar, social media(Facebook, Instagram, Tweeter). One point for each category.

For second criteria, we search for the application on the three aplication stores:

AppStore[6], GooglePlay[7] and Microsoft Store[8]. In this way, we download the applications, in case they exist, on three mobile devices with different operating systems. Thus, from a maximum of five points, three of them are allocated for presence of mobile application on this three platforms. Another maximum two points remain are offer in relation with the rating offered by the other users who download and used the applications. All the three stores have a section with rating for all the applications, with a scoring system made from zero stars to five stars. So, if a tool was rated with five stars, we give him the maximum of two points, if he has two stars, we give 0.8 points, and so on.

For the third criteria, we analize the capabilities provided by tools companies. Like we can find in table, all received a maximum score. This happend because all of them have this feature, of course that are differences in terms of design or structuring mode, but this feature is so important for the idea of Agile development methodology.

For the training criteria, we focus on the options offered as support for users. Even if the way of training is free or only with a subscription, we look for three main features. First of them is the *direct instant support*, including phone talks, live video sessions and even direct consulting interventions with a consultant, no matter the time or the day when the team needs assistance. The second type of support is *direct lagging support*. This refers to obtain materials, training, support via e-mail, reports, request documentations, etc. The last modality of training is offering an online group/collectivity, like blogs, forums, where developers on different project can discuss similar problems. First two ways of training will be grade each with maximum two points, and the last with one point.

For the last criteria, we consider that a signifiant problem it's the capability of tool to satisfy personalized needs of developers. So we download the tools on our computers and try to test a very simple project, with just some tasks, to understand how easy is to use every software if you are not very familiar to work with this methodology. After this, we read what the companies of tool present on their websites about task management and so we formed an idea and we could give notes.

Table 1. The values of the criteria used in analysis of the software products

	T_1	T_2	T_3	T_4	T_5
(C_1)Integration	4	1	5	3	5
(C_2)Mobile Apps	5	5	0	2	4
(C_3)User stories	5	5	5	5	5
(C_4)Training	5	2	3	3	3
(C_5)Task management	5	3.5	5	3	3

The definition of the new values is required by necessity of criteria aggregation levels measured in a dimensionless value, independent of unit-specific features. The goal is to build a comparative analysis of aggregate indicator whose value synthesize all levels studied and measured characteristics representing the tools.

The values resulted from Table 1 were normalized to contain values defined on the [0,1] interval (Table 2).

Table 2. The values of the objective variables.

	T_1	T_2	T_3	T_4	T_5
Integration	0.8	0.2	1	0.6	1
Mobile	1	1	0	0.4	0.8
User stories	1	1	1	1	1
Training	1	0.4	0.6	0.6	0.6
Task management	1	0.7	1	0.6	0.6

To calculate the values we had to determine the minimal and maximal interval values, every cell being calculated with the formula below:

$F(val)_1 = (val - min) / (max - min)$, where min is the minimal value and max is the maximal value for a feature that a product could have. The values obtained by this formula are in the [0;1] range.

The reference values used for the software products are calculated using the following formula:

$$I_i = \sum_{j=1}^{5} (C_j * P_j)$$

$P_j = P(T_j)$, where P_j is the weight of criterion j.

All criteria are important but as in any other system composed of several variables, each element has a weight. We have asked some faculty colleagues who have been used an Agile software product to manage their projects, to give us the grades for the chosen criteria, according to the relevance each one considers. Thus, 38 students offered grades and we could calculate an average to become a weight.

The weight values are presented in Table 3.

Table 3. The values of weights of the criteria.

P	$P(T_1)$	$P(T_2)$	$P(T_3)$	$P(T_4)$	$P(T_5)$
Valoare	0.23	0.22	0.21	0.20	0.16

Condition to be observed: $\sum_{j=1}^{5}(P(T_j)) = 1$

The final scores for tech analysed tools are calculated and the results are shown in Table 4.

Table 4. The final score for the analysed tools.

Tool indicator	Value
I_1	0.974
I_2	0.668
I_3	0.720
I_4	0.652
I_5	0.832

Results

The final hierarchy is presented in Table 5.

Table 5. The hierachy of Agile tools.

Position	Tool
1	Atlassian JIRA
2	Asana
3	Version One
4	Taiga
5	Assembla

We now have an overview about all this tools, so we will draw some directions for each one, in the revers order of results.

The list starts with Assembla. It's a robust and intuitive tool implementing Agile methodology through user stories and a very good application for iOS, but nothing for the other two platforms. The other facilities, including training are middle scored, offering although basic functionality.

The second tool is Taiga. This open-source tool is not very popular but he has some interesting features like support Scrum, user stories and more of that, it's very simple to use. This make it so good for small teams, with not very complex projects. The fact is that is still yet lacking the integration features, but compensates with full mobile applications range, user stories and a basic training features.

On the third place is Version One, whose best pro's are a very intuitive task management, including Gantt pattern and integration with other applications is on a high level. Very poor though regarding mobile applications. This is what keeps him on this place.

Asana is one of the best tools on the market. Like Version One, it comes with a very strong integration feature and also mobile application for iOS and Android with a very large number of downloads and a 4+ rating overall. The task management covers the main needs for developers, including reports, filters and training that is realized with tutorials and documentations.

During the study, it was discovered that there isn't a complete tool, universal functional for any business's needs. It's a good thing that there are tools specialized in certain directions and thus come in aiding specific projects. However, in study we compare several solutions, so we can draw some conclusions. Thus, as a result of rough calculation of the performance indicators, the most powerful tool has been shown to be Atlassian JIRA. It obtained the best scores, almost maximum. It contains all the features necessary and this is seen through market share. The enterprise subscription is expensive but offer live direct support and interventions, all range about training. Their mobile applications are complete, with best score on iOS.

Conclusion

Nowadays, we are witnessing an exponetial growth of information technology that requires from specialists that activate in this fields the ability to adapt rapidly to the changes that occur in a dynamic environment. Agile Methodology is not a new concept and its principles are not only simple, but extremly usefull to follow in such extent that they will bring added value to any project team. Based on our findings, there is an increasingly number of agile project management software products on the market that could help users to manage their projects. The use of agile tools could help improve productivity overall software development cycle.

One idea for future studies is to create a mathematical model with multiple criteria that were not included in this paper, which contain parameter so that the process of choosing the most appropriate tool consists in the allocation of values of parameters and outcome / results favorable is automatically returned.

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