

Success factors of agile programming – example of HaMIS

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Abstract:

The article raises the issue of the information system implementation using agile programming in the public sector. This subject is one of the emerging trends today on the basis of management science. It turns out that it is new on account of the fragmentary knowledge in literature on this subject. It is difficult to find examples of the implementation of this method in the Polish public sector. This article aims at identifying the factors that are necessary for effective implementation of public projects with the use of Scrum. Additionally, it also focuses on identifying evidence tending to apply Agile methods. The article is based on literature on the subject as well as reports on the HaMIS implementation. The literature review showed that the effectiveness of the projects by Scrum is affected among others by time, coordinating a team and the resignation of excessive documentation. The analysis shows two main conclusions. Agile methods enabled to achieve better benefits and their effectiveness suggest creating more legal possibilities for complex IT projects in an environment with a high degree of uncertainty.

Keywords: agile, Scrum, public sector, HaMIS

JEL Codes: M15

1. Introduction

Changes in the world today increase the expectations of taxpayers in relation to the public sector. Their growing public expectations, technological progress and the development of digitization have put pressure on increasing government effectiveness. More and more customers are looking for better services through the Internet. They are looking for faster and more effective methods of project implementation and procurement.

Public administration is one of the largest (if not the largest) clients in each country in terms of the quantity and value of information projects. (Dałkowski, 2000, p. 1). The leading country (according to the United Nations Public Administration Network) is the United States, which spend an average of about 100 billion USD on projects.

One of the potential directions for research is the ICT industry because of its interdisciplinary nature resulting from the desire for automation and digitization in particular areas of human activity, leading to continuous measurement of a wide

spectrum of problems. (Konieczny, 2014, p. 369). The implementation of public projects using traditional methods has repeatedly focused on accurate documentation, forgetting about constant technical progress at the same time. Their many failures force them to look for improvements and new ways of implementing projects that will improve the effectiveness of government operations and meet the needs of the people. Due to some barriers, other ways of awarding public contracts are sought in order to gain more freedom in the surrounding reality. An example of how to ensure greater efficiency is agile methodology, commonly used in business.

Same principles that work in business will work in government making them faster, more flexible, and more responsive (in short, more agile) in achieving better outcomes for their citizens (*Agile government* 2016).

The unique nature and absence of a clear action plan prevent it from being used for public projects. The ability to use the agile methodology for realized public IT projects is controversial. Increasingly, large projects use it achieve big successes.

Researchers are increasingly examining IT projects for the public sector.

The purpose of this article is to identify the key factors that have contributed to the success of the HaMIS IT project. This action was considered important for the implementation of future projects. Identifying the problems encountered and key decisions will improve the implementation of other public sector projects across the world. This article is based on literature and reports from HaMIS project.

2. Agile methodology in IT Projects

Information technology managers are looking for modern, alternative project management methods and guidance on how to achieve the greatest results in greater uncertainty. J. Highsmith states that (2004): if your goal is to deliver a product that meets a known and unchanging specification, then try a repeatable process. However, if your goal is to deliver a valuable product to a customer within some targeted boundaries, when change and deadlines are significant factors, then reliable Agile processes work better. We know when we should use agile methodology but what constitutes its basis?

In 2001, a group of software developers published the Manifesto for Agile Software Development to define the values of the Agile movement (Bird, Bird, 2016). New methodology has become an alternative to the traditional waterfall approach.

Agile is a time boxed, iterative approach to software delivery that builds software incrementally from the start of the project, instead of trying to deliver it all at once near the end. It works by breaking projects down into little bits of user functionality called user stories, prioritizing them, and then continuously delivering them in short two week cycles called iterations (www.agilenutshell.com).

Agile method builds four universal rules, generalized demands being overvaluation of existing components of the project (agilemanifesto.org):

- individuals and interactions over processes and tools,
- working software over comprehensive documentation,
- customer collaboration over contract negotiation,
- responding to change over following a plan.

The use of rules in a project is not an aim, but only a means to achieve it. Their wider analysis was contained in the book by K. Kaczor (2014, pp. 40-47) on the basis of which these 12 principles can be presented in six categories. The whole activity is directed towards the customer. His satisfaction is an important priority accompanying the project. The software provided systematically - every few weeks, gives the customer a sense of physical progress. His instructions, requests and corrections are taken into consideration which compound the final satisfaction. The key determinant of success is the project team.

Agile Project Management focuses on selecting the right skills for project team members and molding them into productive teams (Highsmith, 2004, p. 8).

It is known that the best architectures, requirements, and designs are the result of workers organizing by themselves. The creation of favorable conditions for work and the opportunity to develop have a significant impact on the quality of the supplied software. Self-organizing team has a sense of creating something important, as a result there is a 100% involvement into the implemented contract. Thanks to daily cooperation identifying the defective factors is simpler, and their exclusion is beneficial for increasing productivity. Daily meetings not only give a clear picture of the situation "done, in progress, to do", but also become a place for exchange of problems and obstacles encountered in the implementation of the project.

You can only be better if you learn from mistakes. And then failing is something that prompts you to move ahead (Zhu, 2016). The experience of people working in a team has a vital role at the stage of initial discussions with a client and planning tasks. The real scope of the planned responsibilities becomes the key of success on the road to introduce the software running on time because we know that. In fact, in an agile project, technical excellence is measured by both capacity to deliver customer value today and create an adaptable product for tomorrow (Highsmith, 2004, p. 8).

With the demands outlined above there emerges Team orientation to implementation of the project expected by the client. Cooperation of this type results in achieving the desired purpose and at the same time makes the method effective. QSM Associates research shows that projects agile method produced a 37% faster than other methodologies

projects (*The Agile Impact Report*, 2008). Moreover, only 9% of the projects were carried out in accordance with Agile fails, and waterfall methodologies are up to 30% (*The Chaos Manifesto*, 2013).

3. Scrum framework

The word scrum is taken from rugby and indicates a method of team play that allows you to take possession of the ball and lead it further along the field, and for this you need coherence, unity of intent and a clear understanding of the goal (Sutherland, 2014). The scrum is not considered a type of method or process, but the determinant of a specific framework and guidelines that complement Agile Manifesto.

According to the J. Sutherland (2014) Agile Manifest it declared the following values: people over processes; products that actually work over documenting what that product is supposed to do; collaborating with customers over negotiating with them; and responding to change over following a plan. Scrum is the framework built to put those values into practice. There is no methodology.

Scrum is a framework for project management that emphasizes teamwork, accountability and iterative progress toward a well-defined goal. The framework begins with a simple premise: Start with what can be seen or known. After that, track the progress and tweak as necessary. The three pillars of Scrum are transparency, inspection and adaptation (searchsoftwarequality.techtarget.com).

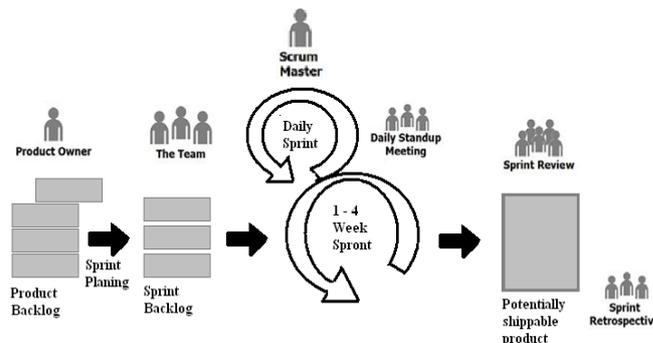
A key principle of Scrum is its recognition that during product development, the customers can change their minds about what they want and need, often called requirements volatility (Henry, Henry, 1993). In the everyday life of the project the design team is made up of 3 to 9 members. It includes individuals involved in the project i.e. programmers, testers, analysts.

A very important person in the project is the Scrum Master, the person in charge of running the process, asks each team member three questions (Sutherland, 2014):

1. What did you do yesterday to help the team finish the Sprint?
2. What will you do today to help the team finish the Sprint?
3. What obstacles are getting in the team's way?

Clearly defined activities relate to each stage of the production, which has been illustrated in figure 1.

Fig. 1. Scrum project life cycle



Source: own elaboration.

Beginning the phase of the process is the Product Backlog, which comprises an ordered list of requirements that a Scrum Team maintains for a product (Martinelli, Milosevic, 2016, p. 304). So the list containing all the steps that should be performed under the project. The customer is considered a priority value and has an impact on the decisions made. Backing product must bring real change, favorable to customers. Initial findings allow the introduction of adjustments and changes in the Thracian implementation. Particular attention is given to operations whose realization time is scheduled for the next sprint.

A Sprint (or iteration) is the basic unit of development in Scrum. The Sprint is a time boxed effort; that is, it is restricted to a specific duration (Gandji, Hartman, 2015). The duration is fixed in advance for each Sprint and is normally between one week and one month, with two weeks being the most common (Schwaber, 2004). The Scrum Product Owner is responsible for the correctness of the Product Backlog.

A client is required to actively participate in the implementation process in order to improve communication with the team, making key decisions, providing feedback (Konieczny, 2014). The next step is Sprint Planning. The Goal of this session is to define a realistic Sprint Backlog containing all items that could accommodate be fully implemented until the end of the Sprint. Therefore, sprint backlog is understood as a list of tasks to be performed in a specific sprint. It is important to the team that chooses the size and scope of the tasks for the next four weeks, pledging thereby to execute

them. Turning to the software development the team performs its tasks in the course of one month. A private employee participates every day in the Daily Scrum. The duty of each member is giving a report of what they managed to do the day before and what goals have been set today. It is also important to remember and mention about all the encountered obstacles. Sprint is finished with Sprint Review. In this part the Product Owner is acquainted with the final product. During the Retrospective there is a discussion about successes, failures and future plans to improve the product obtained. If the purpose of Product Owner is a software update, the whole process starts from the beginning. Agile methods require an absolute knowledge of the rules and the full involvement of anyone who might have an impact on the success of the product. In return, they allow you to get the most satisfactory results.

4. Barriers and constraints the HaMIS project¹

Located on the North Sea The Sea Port of Rotterdam from the XIV is the centre of maritime worldwide transport. The Port of Rotterdam Authority has a turnover of approximately €600 million and a staff of 1,100 employees with widely varying commercial, nautical, and infrastructure-related responsibilities. The foremost customer for the feature teams is the Harbour Master division. This business unit ensures the smooth, clean, and secure handling of shipping traffic (annually, approximately 33,000 ocean-going and 110,000 inland vessels) (Grgić, 2014). The success resulted in implementation of a new system in 2009 The system HaMIS. Harbour Master Information Management System has become the answer to the outdated, introduced in 1995 Pontis System. The technical barriers of Pontis prevented the further development of business processes, attracting new customers and efficient monitoring of ships. The introduction of the new system was necessary although it was associated with high risk. Changes could not adversely affect the work of the port and the fear of losing public trust as well as citizens' money was an additional hurdle. The aim of the

project was to introduce a new information system that will provide administration, management and inspection of vessels visiting Rotterdam at any time. The resulting plans, budget, expectations of suppliers and integrators of software made investors realize the demanding requirements and the accompanying risks. There was too much uncertainty about the project done with the use of waterfall method. The complexity of the project, unspecified objectives and implementation of the uncertain environment prompted investors to use Scrum.

5. The Product Owner

Formally, the order has been placed by the Sea Port of Rotterdam. In defense of the interests two project managers were recruited. The first official acted as the project manager HaMIS. The other was responsible for external communications and coordination of the projects partly dependent on other companies or departments.

Both of them came directly from business, and have always been dedicated full-time to HaMIS. The product owners were supported by a number of domain experts who would gather and provide information to product owners and teams (Grgić, 2014). The scope of their responsibilities associated with the determination of the project included: planning activities, making the most important decisions, responding to questions. The distribution of tasks between two people received a detailed development of each element of the project. Due to the public nature of the project, the analysis has been subjected to every potential user input system and its expectations. Systematically shared elements of the new system were subjected to the public. Based on the feedback they made adjustments and amendments.

6. HaMIS team and working conditions

Understanding the nature and the scope of the operation scrum method was laborious. All the relevant issues of the project were discussed in the presence of all participants in the project. V. Grgić (2014), a project participant, published the following comment about project teams: We do have a number of very experienced craftsmen, but we also have many developers who only learned to write proper software in the past four years. The HaMIS team is a mix of Port of Rotterdam employees and

¹ All information about the project has been taken from the websites: <https://www.infoq.com/articles/hamis-four-teams-four-years> and <https://less.works/case-studies/port-of-rotterdam.html#PortofRotterdam>.

contractors, with contractors making up about three-quarters of the workers. The contractors are a combination of freelancers and employees from several service integrators. It was interesting to observe that contractors, after four years and in some cases for much longer, felt more connected to HaMIS than their official employer.

We can see that the confrontation of people with varying degrees of experience led to the exchange of information and the development of individual units. Project teams consisted of 3 to 7 people. The Management of the project did not interfere in the selection of new members of the teams. Confidence from the owner favored self-organizing teams. A 15 minute meeting (stand up) every morning became very common. It was an oral report of the achievements and obstacles encountered on the previous day. Each team had one Scrum Master, whose gesture was to raise awareness of essence and principles of the scrum in the various activities. The people who have influence on the finished software include:

- Product Owner (two people)
- Project & Program management (three people)
- Domain Experts / Analysts (three people)
- Scrum Master, developers, testers, Geo (three people)
- Scrum Master, Developers, testers, DBA (three people)
- Scrum Master, developers / testers, UX (seven people)
- Scrum Master, developers, testers, DBA (five people)
- Infrastructure specialist (one person)

Employing people with various professional qualifications and creating favorable working conditions led to better experience of individual employees. It finally brought more effective work. It is recognized that a good relations between team members is the key. Phone calls and video conferences using Skype overcame the barrier of space. Each success was celebrated.

7. Life cycle of HaMIS

HaMIS is not an updating of existing software, but a completely new product created from scratch. The first elements were created with the use of waterfall method. The method involved restrictions which have changed the way of implementation of

the software. The used life cycle of the project included product backing. Specific requirements of a customer and potential users became the basis of specific expectations of the implemented system. Plans included a range of activities for the next three months. Selection of acceptable agents were contained in the Sprint Planning. Their disposal between the various task groups formed Sprint Backlog. The Specifically developed range of activities of project teams concerned 4 weeks. A 15-minute daily report on the previous day (Daily Scrum) gave the actual picture of completed tasks. After the end of a one- month action plan, each team presented the final product to the Product Owners in Sprint Review. The meetings lasted an average of 1h. Thanks to the analysis of the previous month in Sprint Retrospective the team shared the obstacles which they came across taking into consideration suggested updates.

8. Features of HaMIS project

The Analysis of Project HaMIS raises suspicion concerning the use of agile project to completion of the public project. The purpose of information contained in Table 1 is to compare and identify features combining the method of management in the discussed project with the scrum method.

Tab. 1. SCRUM Components in HaMIS project

Scrum components	Components of the HaMIS project
People involved in the project: The Product Owner, Scrum Master, Testers, Analysts, Programmer etc.	Product Owner (2 people) Project & Program management (3 people) Domain Experts / Analysts (3 people) Scrum Master, developers, testers, Geo (3 people) Scrum Master, Developers, testers, DBA (3 people) Scrum Master, developers / testers, UX (7 people) Scrum Master, developers, testers, DBA (5 people) Infrastructure specialist (1 person)
Recognition of customers' needs as a priority.	Product Owner was present at every stage of the project in order to improve communication with the team, make key decisions, give feedback.
Working software delivered to a customer regularly every 3-4 weeks.	Working software delivered after each Scrum within 4 weeks.
The project team consists of 3 to 9 people.	Individual task teams ranged from 3 to 7 people
The product was created	The right conditions for

by fully engaged people who were provided with the appropriate working conditions.	individual and group work were provided. Phone calls and video conferences through Skype helped to avoid misunderstandings. They celebrated every positively ended scrum.
Development opportunities for individuals participating in the project.	People with a lot of experience were able to demonstrate it. Responding to questions they educated inexperienced workers.
Product Owners' trust in employees.	Management did not interfere in the selection of new employees by individual project teams.
The life cycle of the project: 1. Product Backlog, 2. Sprint Planning, 3. Sprint Backlog, 4. Daily Scrum, 5. Sprint Review 6. Sprint Retrospective	The life cycle of the project: 1. Product Backlog, - defining an action plan for the next three months. 2. Sprint Planning – a one-month implementation plan. 3. Sprint Backlog- assigning specific tasks for teams. 4. Daily Scrum - realization of the plan. 5. Sprint Review - Review of successes, barriers encountered and future plans connected with the improvement of the resulting product. The average duration of the meeting is 1h.
Team meetings last for 10 - 15 min. The previous day is analysed as "done, in progress, to do".	Daily meetings lasted for 15 minutes. The members exchanged their experience in the field of the problems encountered and the successes of the previous day.

Source: own elaboration.

Presented in the table above components of the project HaMIS imply the use of the method as a dominant scrum. The reason for the start of the project was to replace the system Points with the new system, HaMIS, within two years. The main target has been achieved. The use of agile programming has allowed for the implementation of the new opportunities that were previously considered impossible. Without a doubt, the elements indicated in Table 1 had a decisive influence on the successful completion of the project, and thus its effectiveness. More than this, the attention was focused on the needs of specific visitors. Interviews, tests and observations of users during their work proved to be helpful. Not less

important was the involvement of the project team members.

9. Summary

Implementation of Agile methods is neither easy nor quick. It requires a thorough analysis of the current state of the organization and constructing the most optimal processes and their implementation. To exploit the benefits of Agile methodologies as fully as possible, it is essential to open yourself to the cultural and mental change in the organization (Stocki, Prokopowicz, Żmuda, 2008, p. 376). As shown in the example discussed, agile is possible to use in the project public after appropriate adaptation. Evidence of this effectively implemented method shows benefits of the system HaMIS. Its success consists of many factors. It is considered that the main element is a proper selection of duties and trainings in the methodology of scrum for teams. Giving the roles and responsibilities is clearly defined. A valuable ally to the project HaMIS was time, which mobilized to work at every stage of the project. The pressure of time increased effectiveness of the team and focused team's attention on what's important. Updates appearing every 4 weeks gave the image of physical progress. Another motivator was adequate working conditions, development opportunities and mutual trust. However, the key element in the project proved to be a customer orientation. Specific purpose, testing and constant conversation with the customer allowed us to create a system with more opportunities than expected in the beginning. Without a doubt, the project HaMIS broke the barrier of the use of agile method in the public sector and has become an example worth following. Despite the huge success, many countries still have concerns about using agile in public sector. Using the method of waterfall in IT projects not only does not produce the desired results but more often fails. Bad management of public money has a negative impact on relations with citizens. The public sector needs improvement so it is important to promote and seek effective agile factors in order to use it in the public sector.

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Czynniki sukcesu zwinnego zarządzania projektami – przykład HaMIS

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Streszczenie:

W artykule poruszono kwestię wdrożenia systemu informatycznego w sektorze publicznym przy użyciu zwinnego zarządzania. Artykuł ten ma na celu identyfikację czynników niezbędnych do skutecznego wdrażania projektów publicznych z wykorzystaniem Scrum. Ponadto koncentruje się również na identyfikowaniu czynników wpływających na tendencję do stosowania metod zwinnych. Przegląd literatury wykazał, że na skuteczność projektów Scrum wpływa między innymi czas, koordynacja zespołu i rezygnacja z nadmiernej dokumentacji. Przeprowadzona analiza pozwoliła na sformułowanie wniosków, że zwinność umożliwiła osiągnięcie większych korzyści, a zwiększenie skuteczności tych metodyk w sektorze publicznym wymaga stworzenia lepszych rozwiązań prawnych ułatwiających realizację złożonych projektów IT w środowisku o wysokim stopniu niepewności.

Słowa kluczowe: agile, Scrum, sektor publiczny, HaMIS.

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