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**The critical factors of Scrum implementation in IT project  
– the case study**

DOI: 10.22367/jem.2016.25.06

**Abstract**

The paper first presents basic information about the Scrum method. Then it summarizes the state of art in the domain of Scrum implementation, especially as far as the critical factors of its success are concerned. On the basis of literature survey a new model classifying Scrum implementation critical factors is proposed. The model divides Scrum implementation critical factors into five categories: Project Team factors, Psychological and cultural factors, Process and Method, Environment and Technology. The model is then developed and verified using the case study method. The research was carried out in a French IT company by means of a participating observation. The company was implementing Scrum, which ended up as a success. A journal of the Scrum implementation was conducted, presenting the experiences of the Scrum Team, their opinions and changes in the Scrum method which were introduced. On its basis critical factors, crucial for the success of Scrum implementation, classified according to the above mentioned model, were identified, completing those which had been found in the literature.

**Keywords:** agile management, Scrum, project, critical factors.

**JEL Classification:** M14, M15.

## **Introduction**

The aim of the paper is to present critical factors of a successful implementation of the Scrum method, based on an example of one of IT companies. The Scrum method is the most popular and the most rapidly growing method among the agile methodologies: 56% of agile practitioners use Scrum in their projects [VersionOne 2015, p. 9]. Agile approach means, generally, more flexible project planning and execution, with more emphasis on the constant contact with the customer, which in most cases leads to a higher customer satisfaction [PMBok 2013; Goldman, Nagel & Preiss 1995; Highsmith 2002; MacCormack 2001, pp. 75-84; Manifesto for Agile Software Development 2001]. In traditional way of project management, the process of product development was divided into some sequential phases. In this model, the customer defined all requirements at the beginning of development process. Agile methods (for e.g. Scrum) are excluded sequential of phases in project and focus on relationship with customer [Takeuchi, Nonaka 1986; Schwaber & Sutherland 2013].

Using literature review and the case study method, the authors of this paper attempted to analyze the factors which may help or disturb in the introduction of the Scrum in an organization and propose a model of their classification.

The paper consists of five sections. The first one is the introduction. The second one presents a review of the current knowledge about Scrum and classification of critical factors of agile methodologies implementation. The third and the fourth sections show our research method and findings. The identified critical factors are described, basing on the proposed model. The last section is composed of conclusions.

## **1. Theoretical background**

This section present review of the literature, to present current knowledge of researched field of study. The Scrum method and models of classification of critical factors for implementation of agile methodologies are described. Finally, the proposed by authors model of classification is presented.

### **1.1. Scrum method**

The Scrum was presented in 1995 by Ken Schwaber at OOPSLA conference in Austin [Rubin 2013], but foundations of Scrum were appearing in the eighties [Pham & Pham 2012; Rubin 2013]. Schwaber & Sutherland [2013]

suggested that a key to success in Scrum is descended from experiences and create vital part of know how in company.

The Scrum is based on the empiricism, which is achieving by some qualities. Surveyed the literature on, the qualities, which build empiricism in Scrum are a clarity in each process, an inspection to detect problems in project and an adaptation to change [Schwaber & Sutherland 2013].

Scrum consists of three main elements, which are presenting below [Schwaber & Sutherland 2013, pp. 4-15]:

1. Roles – there are four main roles: (1) The Scrum Team – consist of Scrum Master, Development Team and Product Owner. (2) The Scrum Master – the person, who is responsible for understanding and using the values and rules of Scrum by Development Team and Product Owner. The main duties of Scrum Master is to serve for Scrum Team to achieve project aims. Scrum Master is not traditional manager, she/he is more like a counselor, who build the relationship with team members based on trust and cooperation [Schwaber 2004]. (3) The Product Owner – the person who knows the business case associated with the project. The main duties of Product Owner is to control the Product Backlog. Schwaber, Sutherland [2013] emphasize that Product Owner should have a decision-making power to make decisions on behalf of company. (4) The Development Team – developed the product according to requirements. Development Team is ‘self-organizing’, which means that it has a high degree of autonomy.
2. Artifacts – are the material or immaterial results of the work. In the literature, the authors refers to: (1) Product Backlog – determines scope and list of features which should be implemented during the project. Elements in the Product Backlog are arranged hierarchically and each task has a description, serial number and the estimated value (the complexity of the task) and priority. Product Backlog can be modified during the project. (2) Sprint Backlog – a part of the Product Backlog, which is selected during the planning Sprint. Designates all actions to be done to achieve the Sprint. (3) The goal of Sprint – vital element to pave the way for Development Team and Scrum Master. (4) Increment – determines the total components of the Product Registry completed during the Sprint and Sprints on the past. (5) Definition of done – focus on clarity of understanding when the element from Product Backlog can be accepted as finished. The definition should be recognized and understand by all team members.
3. Events – are important to provide regularity in Scrum. Scrum events are: (1) Sprint – ”a time-box of one month or less during which a ‘Done’, useable, and potentially releasable product Increment is created” [Schwaber, Suther-

land 2013, p. 7]. Sprint consists of Sprint Planning, Sprint Review and Sprint Retrospective. (2) Sprint Planning – the main goal of this event is setting up the scope of work to be done during the iteration. During Sprint Planning, items from the Product Backlog are selected, to be implemented and ensure the creation of product increment. (3) Sprint Review – the event at the end of every Sprint, which is used to inspect the delivered functionality. The meeting is oriented on inspection and refinements Product Backlog. (4) Sprint Retrospective – concentrate on reflection of ended Sprint. Development Team and Scrum Master focus on inspection of completed tasks and improvement plan for the next sprint.

Scrum has specific development process, which base on incremental growth product and the fix time iterations. The first step is to create a Product Backlog, where are keeping all requirements for project. Some of elements are chosen to Sprint Backlog, which is compatible with the aim of Sprint. The Sprint is constant period of time, in which Development Team is working to provide a new functionality for customer. Every Sprint is beginning with Sprint Planning, in which Development Team, are choosing tasks to Sprint Backlog and estimating them. The Sprint is connected with a Daily Scrum – daily meeting for Scrum Master and Development Team. The amount of finished tasks from Sprint Backlog create an increment. At the end of each Sprint, Scrum Team should conduct Sprint Review and Sprint Retrospective [Schwaber, Sutherland 2013].

## **1.2. Classification of critical factors for implementation of agile methodologies**

In the literature, there are many models of classification of factors of success and failure of agile management methodologies implementation. Chow and Cao [2008, pp. 961-971] identify five major groups of the critical factors affecting the success or failure of an agile project. They point to factors relating to the organizational structure, process, people, technology and design. Nerur et al. [Nerur, Mahapatra, Mangalaraj 2005, pp. 72-78] propose a classification consisting of four categories of success factors of migrating agile methodologies: management and organizational structure, people, process, and technology. Boehm and Turner [Boehm, Turner 2005, pp. 30-39] identify three groups of barriers to a successful introduction of agile methodologies: conflict of agile values with the software production process managed linearly, conflict of agile values with business processes and problems related to the human factor. McHugh et al. [McHugh, McCaffery 2012, pp. 141-147] identify five main categories of barriers for adopting agile practices on the example of companies implementing projects creating software for medical devices.

On the basis of the literature review, where no specific model of factors of a successful introduction of the Scrum method was found, we propose a model classifying such factors, which will be verified and developed by means of a case study.

## **2. Research method**

Review of the literature in the field of project management, especially of agile project management and critical factors of implementation agile methodologies allowed to develop new model of factors, influence on Scrum implementation. The model is based on experience one of companies with Scrum method.

The presented study was carried out in a French enterprise from the IT industry, belonging to the SME<sup>1</sup> sector. The single case study method [Rola, Kuchta, Kopczyk 2016, pp. 49-63] was used, by means of a direct participation of one of the authors in the a project. On this basis, the daily report of Scrum implementations was developed, showing the changes related to the acquisition of experience by the Scrum Team in four consecutive sprints and factors affecting the implementation of Scrum identified at various stages. The factors were described basing on observation and interviews with the Scrum Team, during four Sprints of the project. Then, factors were classified by means of the above model. It has to be pointed out that the factors are formulated below in a non-uniform way: sometimes they are given as positive factors (their occurrence contributes to the success of the Scrum implementation) and sometimes as negative ones (their occurrence is an obstacle in a successful Scrum implementation) [Ozierańska 2015].

## **3. Research findings on critical factors of Scrum implementation**

This section presents proposed model of critical factors of Scrum implementation and all of critical factors of Scrum implementation, identified in examined company.

### **3.1. The proposed model for classification of critical factors of the Scrum implementation**

The proposed model consists of five categories and twenty-three sub-categories of factors. These are [Ozierańska 2015]:

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<sup>1</sup> SEM – Small and medium-sized enterprises.

1. The Project Team – factors, tangible and intangible, associated with the project team (for example the team size, objectives, responsibilities of team members etc.). The category includes three subcategories: spatial factors, the composition of the team and team goals.
2. The Psychological and Cultural Aspects – intangible factors linked to people in the project, for example, motivation, charisma, and others. The proposed subcategories are: teamwork, relationships in the team, discipline, team-members profile, relations with the environment, attitude and individual characteristics.
3. The Process and Method – factors related to the technology, techniques and tools affecting Scrum implementations. Here we have the following subcategories: role in the team, training, techniques, events, tools and team work.
4. The Environment – factors related to the environment of the project and the project team, e.g. the location of the project in the organizational structure, relations with the customer, organization influence on the project. It includes five subcategories: the conflict of business processes, synchronization between teams, contact with the customer, the influence of people outside the team and external dependencies.
5. The Technology – factors related to the technology and tools used by the project team. The category is associated with factors such as the required technical skills, the average time of task implementation by the project team, waiting time for deliveries and others. It includes two subcategories of factors: the continuity of team work and the technology of producing functionalities.

## **3.2. Critical factors of Scrum implementation**

### **3.2.1. Factors in the category Project Team**

Spatial factors relate to the work space of team members. The following two factors were pointed out: the localization of team members and the possibility to work remotely.

Localization of team members is directly related to the organization of jobs in the studied company. The literature points to the importance of the work space for the effective management by the agile principles [Rola, Kuchta, Kopczyk 2016, pp. 49-63]. Direct observation in the studied company revealed a scattering of the project team, i.e. some team members had their workplaces in the immediate vicinity, others in a significant distance from each other. This fact had a direct impact on the work of individual team members. Team members located within a short distance from each other naturally worked together and communicated without difficulty. This promoted teamwork, created synergies. The distance between the team members can restricted the freedom and frequen-

cy of communication, resulting in the emergence of individualism, which would be a threat to the successful implementation of agile methodologies and project management concepts.

The second factor – the possibility to work remotely, is linked to the organization of work in the company that allows its employees once a week to work outside the headquarter, using computer technologies. The physical absence from the workplace might negatively affected the implementation of Scrum by the lack of participation of all team members in Scrum events, such as the Daily Scrum. In studied project, this translated into difficulties related to teamwork, as well as the decline in the level of integration with the team and the responsibility for the team work.

These factors have a significant effect on the establishment of an involved Scrum project team, which should be focused on creativity, productivity and flexibility [Schwaber, Sutherland 2013].

Subcategory Composition of the team includes three factors:

1. A small number of team members.
2. Separate areas of competence of the team members.
3. Part-time availability of some members of the team.

Factor Small number of the team members refers to the number of Scrum Team members. In the analyzed project, the Scrum Team consisted of 5-6 permanent members in one project cycle (approx. three months). This fact was important for building relations between team members based on trust. It promoted communication within the team, the information flow, and identification with the team, which allowed the creation of the self-organizing team, which is an important part of Scrum.

Separate areas of competence of the team members is a factor associated with the specific competences of team members. In the studied company it was noted that the technical skills of individuals in the team were disjoint, i.e. everyone had the skills in a relatively narrow technical fields, different than the other team members. It was observed that only two team members had similar competences in 20%. This aspect negatively affected the creation of the Development Team. The literature highlights the fact that the individual members of the Development Team may have specialized technical skills, but responsibility for the work shall be borne by the whole team [Schwaber, Sutherland 2013]. Too much concentration on own work, resulting from too narrow and disjoint competencies, may result in a decrease of responsibility for the whole project and make the project team members focus only on own individual contributions.

The factor Part-time availability of some team members refers to fact that some team members had to do a work unrelated to any element of the Product Backlog of the project. This was directly related to the organizational structure

of the company and the fact that one person belonged sometimes to various project teams. In studied project, some of the team members were amenable in project 50%, 25% or only 10% of their working time. This approach resulted in a decrease of identification of team members with the project, and this adversely influenced the ability to the establishment of a harmonious Scrum Team.

Team goals include one critical factor, i.e. the divergence in the responsibility of the team in practice and theory. It was noted that the team had to do a work unrelated to the goals set earlier, and this resulted in the decrease in commitment and created frustration. The source of this situation can be seen in the high degree of uncertainty associated with the applied technology and the managerial decisions taken. Low motivation and a sense of ‘meaninglessness’ of the work was a big danger for the successful implementation of Scrum in studied project, and more exactly for the creation of the self-organizing team, focused on value creation.

The summary of factors analysis in the category of Project Team was presented in Table 1.

**Table 1.** Critical factors of Scrum implementation in the category Project Team

Category	Subcategory	Factor	Impact on Scrum implementation in studied project (+ positive; – negative)
Project Team	Spatial factors	short distance from team members	+
		the possibility to work remotely	–
	Composition of the team	a small number of team members	+
		separate areas of competence of the team members	–
		part-time availability of some members of the team	–
	Team goals	the divergence in the responsibility of the team in practice and theory	–

Source: Based on: [Ozierańska 2015].

### 3.2.2. Factors in the category Psychological and Cultural Aspects

The factors identified in the category of Psychological and Cultural Aspects was shown in Table 2. In the first subcategory here, i.e. teamwork, was identified one factor: Individualism of team members, associated with low skills in team working and the unwillingness to share problems. This factor negatively affected the creation of a harmonious, cooperation-oriented team, and encouraged individualism, which is opposite to the idea of Scrum.

**Table 2.** Critical factors of Scrum implementation in the category Psychological and Cultural Aspects

Category	Subcategory	Factor	Impact on Scrum implementation in studied project (+ positive; – negative)
Psychological and cultural aspects	Teamwork	individualism of team members	–
	Relationships in the team	friendly relations beyond work	+
	Discipline	being late for meetings	–
		absenteeism at meetings and the lack of information about having to be absent at meetings	–
	Team-members profile	a high level of competence of the individual team members	+
		high motivation to work	+
		the openness of the team members	+
	Relations with the environment	communication of the team with the environment (assistance for people outside the project)	–
		fear of being evaluated by persons from outside the team	
	Attitude	the reluctance of team members to use the adopted tool for project management support	–
		existing habits of team members (ready to change their work mode)	+
		the emotional intelligence and sense of humor of the team members	+
	Individual characteristics of team members	an unrealistic assessment of the possibilities of work execution	–

Source: Based on: [Ozierańska 2015].

In the subcategory Relationships in the team, one factor was pointed out: Friendly relations beyond work, which increased the involvement of team members. In examined project, the emergence of informal relations made people not want to disappoint each other, what motivated them to act and invest effort in the work they had to do.

Discipline involved two critical factors:

1. Being late for meetings.
2. Absenteeism at meetings and the lack of information about having to be absent at meetings.

In studied project, the presence of team members on Daily Scrum exceed 80% only in 4. Sprint. These factors resulted from the earlier habits of team members, as well as from a personal lack of discipline, or a low involvement in

the life of Scrum Team. They had a very negative influence on the Scrum Meetings which are important artifact of the Scrum method. Delays caused a decline in the value of the meetings. This also resulted in negative attitudes of team members, due to a sense of lack of respect of each other's time.

Within the subcategory Team-members profile we distinguished the following factors:

1. A high level of competence of the individual team members.
2. High motivation to work.
3. The openness of the team members.

In the project which was examined in the case study, the team members were characterized by high technical competencies, enabling the execution of project tasks. Moreover, there was among them a high level of motivation to work, which positively affected the identification with the team. The openness to cooperation was also important. Team communication or openness to changes (also in the way of working) were an important value in the construction of the Scrum Team. These aspects favored the formation of inter-functional and self-organizing Development Team, which is the basis of Scrum.

Subcategory Relations with the environment comprises the cultural and psychological factors which relate to the direct environment of the project. In the case study project these were:

1. Communication of the team with the environment – relating in the examined case to an excessive work load of the person in the team seen an authority in the field, who was continuously asked for assistance by people from outside the project, which reduced his productivity in the project.
2. Fear of being evaluated by persons from outside the team – which caused a decrease of productivity of the project team and reduced the transparency of the project progress (which is an important feature of Scrum).

In the subcategory Attitude we found factors related to the attitude to work of the Scrum Team members. An important aspect was the reluctance of team members to use the adopted tool for project management support. Lack of enthusiasm of the team members for the daily use of the computer tools selected by the organization for project management support resulted in them not being used, which made it difficult to achieve the transparency of project progress. It was also important to change the existing habits of team members, in particular with respect to meetings and their formula. Scrum requires the implementation of certain events (Sprint Planning, Daily Scrum, Sprint Review, Sprint Retrospective [Schwaber, Sutherland 2013]), with a specific meeting scheme. This requires that the members of the Scrum Team are self-disciplined and ready to

change their work mode. At the beginning of the examined project of Scrum implementation this was hard to achieve.

Within this subcategory, another important factor was noticed: the emotional intelligence and sense of humor of the team members. It affected the atmosphere in the team, helped to build relations between team members, but also enabled effective assimilation of information by its recipients.

The last subcategory in the considered category of success and failure factors of Scrum implementation is Individual characteristics of team members. Here one problem was observed: an unrealistic assessment of the possibilities of work execution, expressed by taking on excess duties. This resulted in overload and a general fatigue, which in turn translated into lack of involvement and a lower effectiveness of the work.

### **3.2.3. Factors in the category Process and Method**

The category of Process and Method consists of 6 subcategories presented in Table 3. The first subcategory is Role in the team. We noticed factors that determined a proper understanding of individual roles in the Scrum Team. Significant was the commitment of the Scrum Master in the team life, as well as the fact that the role of the Product Owner was held by a competent person, who had a detailed knowledge of the Product Backlog Items and business needs. The absence of Scrum Master during the Scrum meetings or his limited efforts in helping the Development Team were major problems that contributed to problems in the Scrum implementation. In project, Scrum Master was available for Development Team only 50% of working time. It was not enough. The role of Scrum Master consists primarily in a “serving leadership” [Schwaber, Sutherland 2013]. His low commitment affects the work of the entire team. So is in the case of Product Owner. Lack of understanding of the importance of these roles can prevent a proper implementation of Scrum.

For the success of the implementation it was also important that principles and values of Scrum were understood by all members of the Scrum Team in examined project. Training in Scrum, which is another subcategory of the considered category factors, turned out to be indispensable.

Another subcategory is here Techniques. We noticed the impact of following factors from this subcategory:

1. Task estimation methods selection – required the development of specifications as recommended by the Scrum, so that it would have been possible to select appropriate estimation methods. A wrong specification resulted in a poor estimation quality, and was reflected in the low quality of the Sprint tasks execution (lowering quality in order not to exceed the time), overload of team members or moving tasks to the next Sprint.

2. The inadequacy of the project specification to Scrum requirements – a proper specification of the project was crucial to the success of the implementation of Scrum. It was necessary for the development of the Product Backlog, including all the necessary functionalities of the product.

Within this category, there are also factors associated with Scrum events. The events in Scrum are there to ensure inspection and adaptation capability [Schwaber & Sutherland 2013]. They allow the determination of the degree of goals achievement and of problems standing in the way. Violations of meeting rules interfered with the implementation of the fundamental principles of Scrum. Consequently, this affected negatively the motivation of team members and the coordination of their work (unexpected meetings). This caused the decrease in productivity of the Development Team and did not allow for efficient self-organization of the Scrum Team.

The last two subcategories in the analyzed category of factors relate to the Tools and the Team work. In the case of the Tools, an appropriate adaptation of productivity indicators was important for the successful implementation of Scrum in studied project. In the analyzed project, there was a mismatch between the needs of the team and the indicators and tools selected for measuring the project progress. The factors mentioned previously in the paper were found to be the source of the problem, i.e. the non-compliance between the project specification and the Scrum requirements and the failure to respect the guidelines how to carry out the events in Scrum. Implementation and application of performance measurement tools, such as burn down chart, were not possible because the tasks were not defined in accordance with the Scrum recommendations. The role of Scrum Master appeared here to be truly important, especially his expertise and knowledge of Scrum, affecting the choice of indicators and tools for measuring progress in the project.

In the case of the Team work, we observed the simultaneous start of several tasks by in the project. This factor caused the occurrence of multi-tasking, ultimately resulting in many tasks initiated at the beginning of the Sprint and a small amount of them completed at the end of it. This might had a negative impact on the realization of the Sprint goal.

**Table 3.** Critical factors of Scrum implementation in the category Process and Method

Category	Subcategory	Factor	Impact on Scrum implementation in studied project (+ positive; – negative)
Process and Method	Role in the team	the commitment of the Scrum Master in the team life	+
		the fact that the role of the Product Owner is held by a competent person	+
		the absence of Scrum Master during the Scrum meetings	–
		limited efforts of Scrum Master in helping the Development Team	–
	Training in Scrum	understanding principles and values of Scrum by all members of the Scrum Team	+
	Techniques	task estimation methods selection (select appropriate estimation methods)	+
		the inadequacy of the project specification to Scrum requirements	–
	Scrum events	violations of meeting rules	–
	Tools	an appropriate adaptation of productivity indicators	+
	Team work	the simultaneous start of several tasks	–

Source: Based on: [Ozierańska 2015].

### 3.2.4. Factors in the category Environment

This category refers to factors concerning project environment in its broad understanding and the organization of Scrum Team work. The first subcategory here relates to the Conflict of business processes. As already mentioned, for the success of Scrum it was important to keep the regularity of meetings which enabled inspections, transparency and adaptation in the project. When appointments not related to the project, but important to the entire organization overlapped with project meetings, there were problems with the indicated regularity of events in Scrum. This had a negative impact on the project. It is important for the company to accept the agile way of teamwork and take into account its needs when planning organization-wide meetings so that the Scrum Team members are not forced to resign from the Scrum events.

Another important factor was a rigid adherence in the organization to the adopted plans and schedules. Its source was the project management approach adopted at the level of the company as a whole. In the analyzed project, the tasks assigned to the team were part of an overall project, implemented at the level of the entire company. This required adherence to the company level schedule.

Such an approach is close to the classic project management methods, focused on planning. It was imperative that the company understood that Scrum was a concept based on flexibility. Focusing on sticking to plans was interfering with one of the main principles of agile management.

The second subcategory of the category Environment was synchronization between the teams. Here we identified factors associated with:

1. Communication of the necessity to execute additional tasks in the project – in the project examined by the authors of the paper there was a problem with a lack of formal methods to communicate with the team in case it was necessary to execute urgent and unexpected additional tasks not related to the project. As a result, the Scrum Team was now and then forced all of the sudden to interrupt work on the project and focus on urgent additional tasks, which caused delays and loss of productivity of the Development Team.
2. Dependencies between the teams – each project carried out by more than one team requires a procedure to synchronize timing between them. It was the case in the examined project. There was no such procedure, which meant that the delay of work in one team translated into another team. This fact caused many difficulties. The negative effects of this factor were reduced by a proper and frequent communication between the teams.
3. Contact between the mutually dependent project teams – communication is the basis of cooperation. It allows adaptation to the changing conditions thanks to the feedback from other teams.

One of the keys to the success of the implementation of Scrum is also a frequent contact with the customer. In the analyzed project, there was limited communication with the customer, which was the result of a complicated organizational structure of the company. This phenomenon violated the basic principle of agile management – the continuous cooperation with the customer [Schwaber, Sutherland 2013].

During the study we noted a significant influence of people from outside the team, showing the importance of the experiences of other teams. In the project, the team witnessed a botched implementation of Scrum in another team in its immediate vicinity. This fact led to the drop in motivation and trust in the success of the implementation. It was an important factor that hindered the implementation of Scrum. Observing the failure of another team intensified the pessimistic attitude. This factor was in correlation with the relations of the project team members with the persons from the other team – the closer they were, the stronger the impact of the factor.

The last factors subcategory identified within this category refers to the dependencies, for example those with external suppliers. Using the services of

external suppliers created a relation between the punctuality of the work in the team and the punctuality of suppliers. This eventually influenced negatively both Sprint planning and its implementation. Delivery delays could result in a decrease in productivity of the Development Team. The solution, in this case, was to use exclusively the services of solid and reliable suppliers, with whom the relations have a long and positive history. This is the basis of the just-in-time concept [Greene 1993]. The summary of research in this category is presented in Table 4.

**Table 4.** Critical factors of Scrum implementation in the category Environment

Category	Subcategory	Factor	Impact on Scrum implementation in studied project (+ positive; – negative)
Environment	Conflict of business processes	overlapped important to the entire organization appointments with project meetings	–
		rigid adherence in the organization to the adopted plans and schedules	–
	Synchronization between the teams	problem with a lack of formal methods to communicate with the team	–
		dependencies between the teams	–
		frequent contact between the mutually dependent project teams	+
	A frequent contact with the customer	limited communication with the customer	–
	Influence of people from outside the team	the team witnessed a botched implementation of Scrum in another team in its immediate vicinity	–
	Dependencies	dependences with e.g. external suppliers (delivery delays)	–

Source: Based on: [Ozierańska 2015].

### 3.2.5. Factors in the category Technology

Factors in this category relate to technology used by the project team. Two subcategories of factors were identified and presented in Table 5:

1. Continuity of team work – it refers to ensuring the continuity of the team work on the project. The frequency of appearance and the time it takes to solve technical problems had an impact on this aspect in studied project. Technical problems stem from the fact of using new technologies or the lack of competence of team members. The consequence was a decrease in performance of team members and delays.

2. Technology of producing functionalities – the use of innovative technologies which the Scrum Team did not know and had to learn, may create an uncertainty and risk which adversely affected the success of the Scrum implementation. Ignorance concerning the applied technology increased the time-consumption of the tasks and caused the tasks not to be finished within a single sprint. It forced the move of tasks between sprints and led to delays in the project.

**Table 5.** Critical factors of Scrum implementation in the category Technology

Category	Subcategory	Factor	Impact on Scrum implementation in studied project (+ positive; – negative)
Technology	Continuity of team work	technical problems	–
	Technology of producing functionalities	use of innovative technologies which the Scrum Team did not know	–

Source: Based on: [Ozierańska 2015].

## Conclusions

A successful implementation of Scrum is conditioned by many factors. Each organization which is planning to introduce Scrum has to be aware of what may help them in this endeavor and what may prevent it from being successful. A failure of Scrum implementation or serious problems encountered in its execution may cost a lot, both in financial terms and as far as motivation of the organization members is concerned.

This article provides a proposal of a classification model of Scrum implementation success and failure factors, based on the knowledge gained through the literature survey and a case study. The model should be treated as a check list useful during the implementation of the Scrum method in any organization. The critical factors identified in this paper can be used as a preventive measure that reduces the probability of a botched implementation of Scrum. The authors of the paper present both factors that support and factors that interfere with the implementation of Scrum.

The model shows several aspects identified during a single case study which are vital for the Scrum implementation. The authors are aware that the factors list can be expanded. In subsequent research the authors plan to conduct a wider verification of the model in other organizations and projects. Determining success and failure factors of a Scrum implementation is complex problem.

As shown in the paper, a high number of different factors affect the implementation of Scrum. It seems necessary to identify a complete list of success or failure factors Scrum implementation (by extending the list of analyzed projects and organizations), taking into account organization size, skills and knowledge of project team members and their background (training, experience in Agile methods, etc.). The aspect that cannot be omitted is the multi-culture of project teams, which in the opinion of the authors also affects Scrum implementations. Further studies will help in the model calibration, understood as taking into consideration the specificity and the characteristics of project, project teams and organizations.

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