



# Applying Scrum in New Product Development Process

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**Abstract.** For all organisations New Product Development (NPD) [1, 2], is a sophisticated process, necessary for introducing successfully the product on the market. Successfully means: customer satisfaction, benefits for organisation, new organisational and personal skills and experiences. The NPD process fulfils all conditions of project's definition; that's why many authors present the possibilities of applying to NPD process management instruments, specific for project management. Such attempts are limited to classical project managements methodologies and tools. Recently we observe growing interest in Scrum methodology, [3, 4]. Introduced for IT project management, nowadays is transferring completely or partially to manage the projects in other than IT fields of activities - healthcare, finance, consulting, education, and others, giving good results. This paper is a conceptual one, presenting an attempt made to show the possibility, utility and manner of transferring principal elements of Scrum toward NPD process. The objective of the paper is turn spotlight of New Product Development specialists on such possibility and encourage them to apply Scrum in this process management. The objective is achieved mainly in Sect. 5, where for all steps and activities in NPD process, their classification has been done, dividing them on unique or cyclical. The last ones (they are in the majority) can be managed according to Scrum methodology. It has been shown, for respective Scrum elements: roles, events and artefacts, how they can work in NPD process management. This study needs further research and empirical verification.

**Keywords:** New product development · Agile · Scrum methodology

## 1 Introduction

Nowadays we are witnesses of the still rising quantity of new products. The drive wheel of this phenomenon are still varying costumers' needs, encouraging the producers to put on the market almost constantly new products. New product development process is commonly recognized as a project, what gives the possibility to use project management instruments for this process. For example, such classical tools like Work Breakdown Structure, Scheduling, resources and cost planning or risk management are commonly used, [5]. From about twenty years classical methodologies of project management like PMI, IPMA or Prince2 turned out to be insufficient for more and more sophisticated projects, mainly in IT. As a response, Agile approach appeared; it

the frame of it there are several methodologies. Mostly used in IT projects is Scrum methodology. From 3–4 years Scrum has been transferred completely or partially to manage the projects different from IT, giving satisfying results [6–12]. In this paper the authors present justification, possibility and advantages of using the basic elements of Scrum to manage the New Product Development process. The main objective of the paper is to turn spotlight of New Product Development specialists on such possibility and encourage them to apply Scrum in this process. In consecutive Sects. 2, 3 and 4 the lectures will find: description of NPD process, agile approach to project management, Scrum methodology brief presentation and, finally, in the central Sect. 5 – the proposal of Scrum elements transfer toward NPD. Finally, Sect. 6 deals with summarising of the contain and suggestions of main directions to develop the subject. The paper is a proposal for NPD specialists to try apply the presented approach in real cases.

## 2 New Product Development Process

One of the key processes Innovation is the New Product Development Process – NPD [1] which is present below. The New Product Development process is often referred to the Stage-Gate innovation one, developed as a result of comprehensive research on reasons why products succeed and why they fail. When the teams collaborate in developing new innovations, proceeding according to the following eight steps, the product is marketable, relatively quickly achieved and accurately made.

### *Step 1: Generating*

During the NPD process, keep the system nimble and use flexible discretion over which activities are executed. One may want to develop multiple versions of your road map scaled to suit different types and risk levels of projects.

### *Step 2: Go or no go?*

Specific criteria for ideas that should be continued or dropped. Stick to the agreed upon criteria so poor projects can be sent back to the idea-hopper early on. Because product development costs are important, it means taking the top 3 competitors' innovations into account.

### *Step 3: Testing the Concept*

It is important to note, it is different from test marketing. Apart from patent research, design due diligence, and other legalities involved with new product development. Knowing where the marketing messages will work best is often the biggest part of testing the concept. Does the consumer understand, need, and want the product or service?

### *Step 4: Business Analysis*

The activity in this step consist in building a system of metrics to monitor progress. It is important for an organization to observe the criteria and metrics.

### *Step 5: Marketing Tests*

Arranging tests groups, launching versions, and then forming test panels after the product or products have been tested ere the activities included in this step.

*Step 6: Technicalities & Product Development*

In this step, the production department will make plans to produce the product. The marketing department will make plans to distribute the product. The finance department will provide the finance for introducing the new product.

*Step 7: Commercialize*

At this stage, consumers are purchasing the good or service, and technical support is monitoring progress. Keeping the distribution pipelines loaded with products is an integral part of this process. Keeping the product's name firmly supplanted into the minds is the second one.

*Step 8: Post Launch Review and Perfect Pricing*

In this final stage, overall value relevant to cost of goods sold is evaluated, making sure internal costs aren't overshadowing new product profits. You continuously differentiate consumer needs as your products age, forecast profits and improve delivery process.

The entire new product development process is an ever evolving system with possible errors, designs trashed, and loss. Productivity during product development can be achieved if, and only if, goals are clearly defined along the way and each process has the possibilities clearly defined.

There is relatively little in the literature on the important NPD question: how an organisation can define and implement behaviour, structures and processes necessary to make good practices of NPD working. Six key design elements which define behavioural conditions necessary for a successful NPD process are proposed [2]. As we will see in the Sects. 3 and 4, they are encouraging to use Scrum methodology elements [3]. Combining the NPD process with Scrum main elements is the first important and helpful step to introduce good practices into NPD working. The process of implementing a New Product Development is sophisticated, takes some defined time and is divided into several phases. Depending on kind and complexity of products, magnitude of production and organisational as well as technical preparation, different methodologies of project management are applied [5].

### **3 The Agile Approach to Project Management**

The description of an agile approach to project management is essentially based on [3] and the earlier authors' paper [6]. Classical methods of project management are based on a stage-based approach to product development (especially software development). Classical methods assume that the transition to each succeeding stage becomes possible following completion of work at the previous stage. In this approach, product requirements are defined at the planning stage and are not subsequently modified. It is assumed that the conditions governing project team operations are stable. As a result, there is a strong focus on documenting actions, which becomes the main aspect of control of project execution [3, 6]. One of the most popular examples of classical methods of project management is the waterfall model, which consists of seven stages of software development for the delivery of a software product to the customer [3].

The agile approach to project management, also called the adaptive approach, was created in 2001 by a group of developers who prepared Manifesto for Agile Software Development, a credo of agile software development. The Manifesto consists of four demands [4]:

- ‘individuals and interactions over processes and tools,
- working software (product) over extensive documentation,
- customer collaboration over contract negotiation,
- responding to change over following a plan’.

The word ‘over’, as used in the Manifesto, does not mean that the concepts regarded as classical have been given up completely. The authors of the Manifesto emphasise that ‘while there is value in the items on the right, more valuable are the items on the left one’ [3].

The agile method (approach) focuses on being open and reactive to changes in order to ensure for the client a product that complies with expectations. This approach is based on iterative development and delivery of the product to the customer. One of its most important aspects is that the client is a part of the project team and co-operates with this team throughout project operations. The centre of attention is the execution of work, whereas documentation is limited to the minimum and replaced with frequent project meetings, with special emphasis on direct meetings. Frequently these meetings have an influence on limited control, thanks to the relationships between members of the project team based on engagement, co-operation, a sense of responsibility for the work to be performed, and the product, as well as on mutual trust. The core element is a self-organising team which independently makes all decisions regarding the method of operation, taking into account necessary adaptations for changing conditions of functioning [6].

The agile approach to project management is currently being implemented in an increasing number of activities, such as information technology, healthcare, finance, consulting, education, and others [6–9]. The most popular agile method is Scrum. Over 58% of agile practitioners report that they use this approach in project execution [3]. The research shows also that 54% of respondents use Scrum in combination with other practices, while 42% emphasise exclusive use of Scrum.

## 4 Scrum Methodology

The Scrum methodology was formulated in 1995 by Schwaber and Sutherland [3]. Scrum is a framework designed to overcome complex adaptive problems and to deliver a product with the greatest possible value for the customer. Scrum is based on empiricism, which builds:

- clarity within each process,
- inspection to detect problems in the project,
- adaptation to changes.

Scrum consists of four main elements: Roles, Events, Artefacts and Rules.

#### 4.1 Roles [3]

There are four main roles in Scrum. *Scrum Master* is the person responsible for the understanding and use of the values and rules of Scrum by the Development Team and Product Owner. The main duties of the Scrum Master are to serve the Scrum Team in order to achieve project aims and to ensure that the values of Scrum are applied properly by the Scrum Team.

*The Product Owner* is the person who is familiar with the business associated with the project and responsible for maximising the value of the product. The main duties of the Product Owner are to control and manage the Product Backlog [Elements in Scrum, The Artefacts].

*The Development Team* is the team responsible for developing the product according to requirements. The Development Team is ‘self-organising’, which means that it has a high degree of autonomy.

The *Scrum Team* comprises the Scrum Master, Product Owner, and Development Team.

#### 4.2 Events [3]

Events in Scrum are important in order to provide regularity in Scrum. Events in Scrum are Sprint, Sprint Planning, Daily Scrum, Sprint Review and Sprint Retrospective.

*The Sprint* is a limited time interval oriented towards an increment in functionality of the project product. The Sprint usually lasts about 30 days or less and consists of the following events: Sprint Planning, Daily Scrum, Sprint Review, and Sprint Retrospective.

*The Sprint Planning* - the main goal of this event is to establish the scope of work to be done during the iteration. During Sprint Planning, items from the Product Backlog are selected; these items will be implemented to ensure the creation of product increment.

*The Daily Scrum* is a daily 15-min meetings of Scrum Master and the Development Team. The Daily Scrum is vital for monitoring progress in Sprint and for detecting problems that may threaten achievement of the goal of the Sprint.

*The Sprint Review* is an event at the end of every Sprint to inspect the delivered functionality (Increment) and implement the Product Backlog.

The *Sprint Retrospective* consists of reflections on the completed Sprint with some projection for the next one.

#### 4.3 Artefacts [3]

Artefacts the material or immaterial results of the work, which enable inspection and adaptation in Scrum methodology.

*The Product Backlog* determines the scope and sequence of a list of features which should be implemented during the project. The document is open and changes can be introduced at any stage of the project.

*The Sprint Backlog* is a part of the Product Backlog. It is created from Product Backlog items selected for the Sprint; the Sprint Backlog is created and managed by the Development Team.

*The Increment* defines the complete components of the Product Backlog completed during the Sprint and other previous Sprints.

*The Definition of Done* focuses on clearly understanding when the element from Product Backlog can be accepted as finished.

#### 4.4 Rules [3]

Rules are defined as being linked with the method; they define relationships between Roles, Events and Artefacts.

Figure 1 presents iteration in Scrum methodology. Scrum is characterised by a specific development process based on incremental growth of the product and iterations that are fixed in time [3, 6]. The first step is to create a Product Backlog, where all requirements for the project are kept. During every Sprint, elements from the Product Backlog which are compatible with the aim of the Sprint are selected for the creation of the Sprint Backlog. The Sprint is a fixed period of time during which the Development Team works to provide new functionality for the customer. The Sprint begins with Sprint Planning. In this Event, the Development Team selects tasks for the Sprint Backlog and evaluates them. During the Sprint, the Daily Scrum, or daily meeting of the Scrum Master and Development Team, is held. The total number of finished tasks from the Product Backlog make up the Increment, which should be usable by the customer. The Sprint Review and Sprint Retrospective are conducted by the Scrum Team at the end of each Sprint [3].

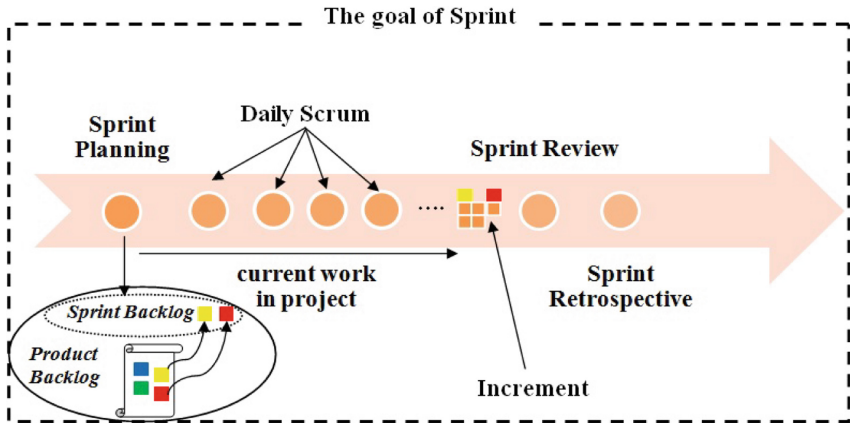


Fig. 1. The Sprint [8].

## 5 Transfer of Scrum Elements Toward NPD

As it was shown in the Sect. 3, we observe the increasing number of fields of human activities and situations where the applications of selected elements of Scrum is possible and useful. In this section – central in the whole paper, the authors show why and how the Scrum methodology can be helpful in NPD process.

In the context of NPD project should be understood as a set of ordered activities planned at lead to obtain the new product, ready to be manufactured and purchased, accomplishing all requirements and constraints (delay, cost, technical, quality and others).

Basing on earlier studies [7–9], the authors propose three main roles based on the Scrum methodology:

- NPD Scrum Master - a “servant-leader”; he or she eliminates impediments on the way to the goal. He or she coordinates the activities of members of the NPD Team and:
  - support the NPD Team in the realization of activities;
  - support meetings;
  - support in the understanding of the principles of planning activities in an empirical environment;
  - ensuring free communication between the NPD Team and the NPD Product Owner.
- NPD Product Owner - a representative of the enterprise Top Management, having decision-making power in the scope of undertaken actions during the NPD.
- NPD Team - team consisting of specialists responsible for the implementation of all activities needed in NPD Process. In its composition, there should be people from all of Enterprise units, involved in the NPD.

In addition, two Artefacts are pointed out [7–9]:

- NPD Product Backlog - includes all activities defined in the NPD Process that are necessary to be carried out. It includes two types of activities:
  - Cyclic activities - activities in the project/NPD Process that are realized continuously, at specific intervals;
  - Unique activities - activities undertaken once during the project.

It is also recommended to assess the labour intensity of tasks and include them in the NPD Product Backlog.

- NPD Sprint Backlog - activities (cyclic and/or unique) selected from the Product Backlog to be implemented during the one iteration.

The classification of actions of eight steps described in Sect. 2. for cyclic and unique activities is proposed below.

### *Step 1: Generating*

This step needs a lot creativity of people working on it, their continuous cooperation and information exchanges which should lead to the continuous improvement. Therefore it is recommended that the activity of this step should be a cyclical one (NPD

Sprint, Fig. 1). Intervals between activities should be adapted to the needs of the NPD Team, NPD Product Owner and the dynamics of changes in the environment. The most important here is a human factor, which is a part of the postulates of agile management. Building a team based on mutual trust, cooperation and commitment will enable quick decision making and adaptation to unusual conditions.

*Step 2: Go or no go?*

The nature of the activities in this step is mixed. Developing ideas and criteria are cyclical activities, that takes place at time-box intervals (NPD Sprint); drop criteria is a unique activity, take 3 competitors – a unique activity, too. Like in previous step, communication and current information about the status of activities are important.

*Step 3: Testing the Concept*

For all administrative activities and checking the marketing efficiency the suggested type is a unique activities. Identification of consumer's stage of knowledge of product is recommended as a cyclical activity (NPD Sprint).

*Step 4: Business Analysis*

All activities contained in this step are cyclical (NPD Sprint). Step by step the NPD Team goes toward the full knowledge concerning the new product from business point of view.

*Step 5: Marketing Tests*

The activities in the frame of this step consist in elaboration different versions and testing them. Recommended is their cyclical character (NPD Sprint).

*Step 6: Technicalities + Product Development*

There are three principal stakeholders in this step: production, marketing and finance department. Two first activities are prepare respective plans (production and marketing); suggested classification of them - cyclical activities (NPD Sprint), because each plan's elaboration is cyclical. The third activity - provide the finance - is typically a unique one.

*Step 7: Commercialize*

At this stage, there are two activities: keeping the distribution pipelines loaded with products and maintain the product's name in the mind of customers. Both are continuous, in which new facts appear, which is why it is recommended as a cyclical activities, carried out in time-box iterations (NPD Sprint).

*Step 8: Post Launch Review and Perfect Pricing*

Reviewing process and perfecting pricing are both continuous activities. So, in this proposal, they should be organised as cyclical (NPD Sprint).

The analysis of activities showed that in the project a significant part of the activities are cyclical activities, repeated at certain intervals of time. This is due to NPD steps character (innovating, planning, improving and so on). Unique activities appear as a result of respective cyclical actions. Most of the actions described in this study should be carried out continuously, at the agreed time intervals (NPD Sprints), until the project's goal is achieved. The result of the analysis is presented in the table below.



**Table 1.** Activities in NPD process

Cyclic activities	Unique activities
Step 1., Continuous improvement	Any
Step2., Developing ideas and criteria	Drop criteria Take 3 competitors
Step 3., Identification of consumer’s knowledge	Administrative activities Checking the marketing efficiency
Step 4., Developing knowledge about new product	Any
Step 5., Elaboration different, versions and testing them	Any
Step 6., Prepare respective plans	Provide the finance
Step 7., Keeping the distribution, maintain the product’s name	Any
Step 8., Reviewing process, perfecting pricing	Any

Development and management of the NPD Product Backlog should remain within the competence of the NPD Product Owner. In the case of the NPD Sprint Backlog, its development and management is entrusted to the NPD Team.

During the project realization, it is proposed to adopt an iterative approach (NPD Sprint). The duration of the iteration should be constant, adapted to the speed of changing operating conditions. In the course of a single iteration, actions from the NPD Sprint Backlog are carried out. The NPD Sprint Backlog includes cyclical and/or unique activities selected by NPD Team. Due to the specificity of the situation, it is recommended that the workload in the NPD Sprint Backlog is <60–80% of the planned time. This is due to the fact that in emergency situations (e.g. a sudden new version appears) it may be necessary to add new tests to be made. It is worth having a “time buffer” that will be a response to sudden events. In the absence of unforeseen actions, the NPD Sprint will be closed earlier.

It is proposed to use some meetings that will allow inspection and adaptation to changing conditions. These are meetings defined on the basis of the Scrum method, [7, 8]:

- Planning NPD Sprint - meeting aimed at analysing the situation, determining the purpose of iteration and creating the NPD Sprint Backlog. The meeting recommends taking part in NPD Scrum Master, NPD Product Owner, NPD Team and key project stakeholders (e.g. representatives of potential customers). The main product of the meeting will be the NPD Sprint Backlog, which will define the work necessary for the implementation of a NPD Sprint.
- Daily NPD Meeting – daily, brief meeting for the assessment of what has been done during last 24 h, what will be done in the next 24 h and the current assessment of the situation. Meeting is intended for members of the NPD Team to ensure inspection of undertaken activities and adaptation to changing conditions.
- NPD Sprint Review - a meeting at the end of iteration for the assessment of the implemented activities and the assessment of the degree of implementation of the project’s objective. The meeting recommends taking part in NPD Scrum Master,

NPD Product Owner, NPD Team and key project stakeholders (e.g. representatives of potential customers). During the meeting, it is recommended to:

- discuss the current situation and how it will change;
  - present of what went well, what problems were encountered and how these problems were solved;
  - present of the work done;
  - if the need arises, a probable deadline for completing activities (project completion) is expected;
  - a joint discussion of the next steps;
  - revising time, budget.
- NPB Sprint Retrospective - meeting for planning improvements for the next iteration, intended for the NPB Scrum Master and the NPB Team.

The above transfer of Scrum elements to NPD have been proposed for ten cyclical activities in the process (Table 1). For five other activities, which are unique, Scrum is not applicable. In such case, these activities will be performed once in the project. These activities will occur in the event of certain circumstances (detected during the monitoring of the situation). The decisions will be often take ‘ad hoc’. Kanban might be used here, but this would require further research.

## 6 Conclusions, Recommendations

In Sects. 3 and 4 the basic principles of agile approach to project management have been presented, as well as, particularly, of the Scrum methodology. The most important of these two section is the universality of Scrum, confirmed by increasing number or its successful applications in management of different kinds of project, [10–12]. That’s why the authors see a strongly justified possibility to apply Scrum in NPD Process management, which should improve its management and its final result, too. Further research as well as experimental implementations are necessary.

This matter – introducing the principal elements of Scrum into NPG – was analysed in the Sect. 5. The double nature of the NPD process activities has been shown. Most of them have a cyclical character, such as it practiced in Scrum. The Scrum elements in the studied process: Roles, Events and Artefacts have been presented in details.

The main recommendation is directed toward the specialists of the NPD process. From several years, Scrum is applied successfully in other domains, like Construction Industry, [13]. Another possibility of using Scrum in NPD process is offered by hybrid methodology, [14]. Hybrid is not a new methodology, but a fusion of two old methodologies – traditional and agile. It has been practiced by experienced project managers for many years under different names. Recently the name “Hybrid Project Management” has gained acceptance.

The authors encourage them to implement Scrum in their work. The results will come quickly. Note that it is possible to apply Scrum little by little.

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