

## EXPERIENCES IN AGILE R&D PROJECT MANAGEMENT FOR NEW PRODUCT DESIGN AND DEVELOPMENT IN THE AUTOMOTIVE INDUSTRY

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### ABSTRACT

*In the past 20 years technology has advanced at incredible speed. Product life cycle has decreased tremendously. Innovation in product and process has become essential for companies' survival. Products are not longer simple, they integrate different and new technologies and therefore manufacturing process is evolving towards intelligent, virtual, sustainable and high performance factories. In spite of all these changes in manufacturing, R&D project management has not evolved at the same pace. The authors have approached a new way of conducting R&D projects that can integrate IT Agile Project Management and Innovation Management best practices. As a result the present paper formulates a methodology for agile new product and process development that can match the actual product cycle development requirements, shortening project life cycles but keeping space for innovation and creativity.*

*The methodology has been applied in R&D projects for the automotive industry to develop new automated manufacturing cells for production lines. The experience allowed to identify the key processes with more risk during the project execution and helped us to gather information to keep improving the methodology.*

**Keywords:** R&D, Project Management, Agile, Automotive

### 1. INTRODUCTION

Innovation is a word widely used in the industry nowadays. Companies have realized that innovation is necessary if they want to stay competitive in global market in where they play today [1, 2, 4, 5]. For the purposes of this paper we will define innovation in the manufacture industry as the creation of products or services that are successful in the market through technological development [2].

How do companies achieve innovation and thus new product and services that differentiate them with the competence? Several systematic approaches have been developed for Innovation Management within companies [4], but all of them involve project management to bring ideas to successful product, processes or services. Good project management is essential if good ideas are to be implemented in business. Artto et al. [5] also states that Project Management Offices (PMOs) have a key role in the management of innovation projects. Once the creative part have defined the ideas to be implemented, a good project management is essential for the innovating process.

The importance of project management is even more critical when innovation projects are carried within small and medium enterprises (SMEs), because of the scarcity of its resources. SMEs are vital for both developed and developing economies [6], so if they do not innovate and create new product and services, the economy of the countries will not grow. Many SMEs that want to start innovation projects face the lack of financial and personal resources. This a common experience in Catalonia where companies and research centers strive to develop new products with very limited budgets.

Fundació CIM recognize the importance of improving the methodologies used to manage R&D projects. Previous efforts were made at Fundació CIM taking advantage of rapid prototyping technologies in order to decrease product development project durations and thus its costs [7]. Besides rapid prototyping technologies Fundació CIM has been innovating in processes analyzing and adapting IT project management best practice into product development methodologies.

## **2. THE METHODOLOGY**

There is a wide variety of project management methodologies and a lot of literature exists about the subject [8, 9, 10, 11], especially on the last 20 years where the project life cycle of product development has been dramatically reduced and had become a critical success factor among competitors. Barba [8] mentions G. W. Connell and G. Stalk that recognize time as a competitive advantage factor and a strategic weapon as important as quality or innovation.

IT Project management methodologies have advanced in the used of informatics management, forecasting and budgeting tools, definition of requirements, design tools, testing, measurement, control and risk management. Last generation IT methodologies have evolved into agile and rapid ways of obtaining results [10, 11]. The agile methodologies claim to ensure that the final product is developed with a high probability of success, even in a constantly changing environment [10]. Fundació CIM started a project to develop a new R&D project methodology where all the latest improvements of mechanical and IT disciplines were included and so new product and process could be developed in less time, consumed less resources keeping high quality standards and also leaving room for creativity and innovation.

The methodology developed at Fundació CIM is mix of some of the previous design methodologies used, the classical project management theory and some of the best practices observed in the IT Industry including the new agile methodologies like SCRUM [10]. The key factors selected from IT methodologies studied were accurate project definition, role clarification and assignment, project planning and control using informatics collaborative tools, managing requirements and product specifications, product backlog, development sprint backlog, early unit, integration and system testing, versioning, systematic release and deploy management. From the previous design methodologies computer aided design, collaboration tools [12] and rapid prototyping technologies were included.

### **2.1. Roles**

An important part of the methodology is to have clear defined roles and responsibilities for the project team. The roles included in the methodology are:

- Project Manager; is the final responsible of the planning, execution, monitoring, control and closing of the project.
- Product Manager; is in charge of the final product in the organization, he develops the strategy according to the market, develops relationships with clients, unites all the departments that deal with the product and develops documentation relevant to the product.
- Designer Team; is responsible of creating new products conceptualizing and evaluating ideas.
- Developer Team; are in charge of bring the product to life. The team is expert in the technologies necessities to build the product.
- Testing Team; is in charge of the development and execution of the testing plan. The team is the final responsible that the product fulfills all the designed elements.
- Release Manager; is in charge that the product is delivered in the right way. Coordinates the documentation, installation or distribution.

## 2.2. Stages

The methodology includes the following stages

- Definition; in this stage the project definition document is created. It is a statement that includes the problem detected, the goals, the objectives, the scope, the team members, the success factors, the risks, the planning and the budget of the project. In this stage the product and project manager with support of the leaders of the other teams delineate the project. The risk management part is a key task in this stage since R&D projects normally involve high risks and it is better that the clients and the project team are aware of them.
- Design; in this stage is divided in three parts. An analysis task is performed to create the Functional Specification document where all the desired requirements for the project are explained in the best way possible including images, diagrams or whatever needed. A conceptual design is made with the aid of all the virtual design informatics tools, no matter if the product is mechanical, software, hardware design or a combination of them all. Any physical prototype is encouraged so all rapid prototype technologies and quick developments are very useful in this stage. The final phase of the stage is the detailed design, and is where all the details for the design are specified and all the characteristics of the final product are detailed.
- Development; in this stage the list of requirements defined in the design phase is used to create a Product Backlog, a concept defined in the SCRUM methodology, which is simply a list of all the things needed to be done to bring the product to life. Then small batches of work, called sprints [11] are organized to develop, build and assemble what is necessary to fulfill the functionalities desired. These tasks include integration of different modules of the product and the validation of the integration.
- Testing; this stage is divided in two phases, a test plan is written in the Test Specification document and then the test plan for the functionality is executed. If the objectives of test plan are not met, then a loop is started with the design and development teams to start a new design and development cycle.
- Deployment; in this stage the deployment manager does whatever is necessary to deliver the product to the client or clients. Is when the user manual and the product documentation is done. It is started as soon as design phase has ended but it can be adapted to the changes applied to the design during development and testing phases. Transportation, distribution, formation or installations are also managed in this stage. Finally a Closing Project documents and a Post Analysis documents are done to evaluate and learn from the project development.

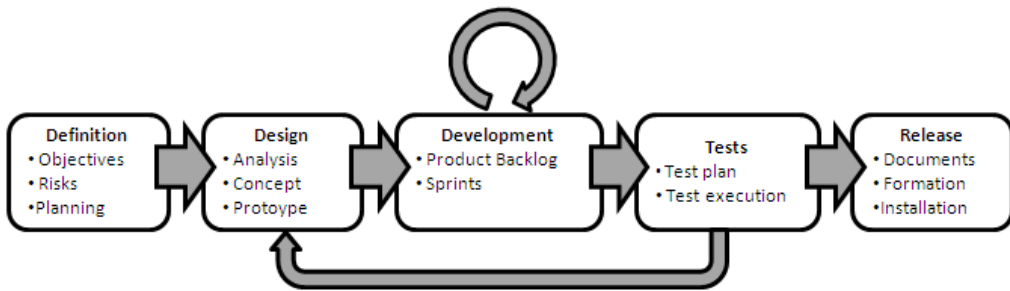


Figure 1. Simplified block diagram of the methodology

## 3. EXPERIENCES IN THE AUTOMOTIVE INDUSTRY

After defining the methodology Fundació CIM applied it in a project with a company from the automotive industry that needed to develop a new product involving a mechanical, pneumatic and software systems. The complexity and the nature of the project was a perfect opportunity to prove the methodology.

It is worth mentioning that the risk management exercise made in the definition stage helped the project team manage the problems predicted when they actually happened. The functional specification definition was the stage where more struggle occurred because designers were used to work more on physical and mechanical specifications and less with logic or functionality ones. The development phase was more fluid and the sprints and the help of rapid prototyping technologies helped the quick feedback shortening the redesign cycles. The testing phase was another phase that had good results since the test plans were defined since the design stage, their execution was done in a more automated way. Finally the release stage helped to control all the aspects of the delivery and installation of the project leaving room only for small problems without big consequences. The biggest issues during the project execution came when working with external providers that were not in the same dynamic as the project team and occasionally increased the predicted times.

The experiences have brought good results with the development of manufacturing cells that are now part of an assembly plant producing electronic auto parts. The project was executed in time and budget that were beneficial for the client as for the project team.

#### **4. CONCLUSIONS**

After having applied the methodology in a few projects we want to make a few adjustments for a second version with all the lessons learned. In the projects that we could apply the methodology we could reduce the total project execution time but the biggest benefits have been observed in the redesign cycles saving both time and money. This improvement has been achieved thanks to the time dedicated in the design phase and the functional specifications and the sprints made during the development phase where the team could quickly test the usability of the functions as recommended by the agile methodology.

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