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Feature based process framework to manage scope in dynamic NPD portfolios

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Abstract

The need to develop new products in increasingly frequent cycles of innovation drives organizations to form new product development (NPD) portfolios. In such dynamic environments, organizations need to reinforce their capabilities to deal with the simultaneity of multiple NPD projects, as well as with the frequent changes of the product scope. Many organizations, that have adopted the typical NPD process enforcing a streamlined product development process, are challenged beyond strict planning and rigorous control of their NPD projects.

This paper identifies the challenges to manage the scope of a complete portfolio of NPD projects within the dynamic context that organizations face today, and using existing scope management practices. This paper suggests a novel approach to structuring the scope in dynamic NPD portfolios using feature modeling, and illustrates its use in an action-research case.

Keywords: Project portfolio management; Scope management; New product development; Feature modeling; Process framework; Action research

1. Introduction

In order to sustain competiveness, companies need to create a continuous flow of products that generate new revenue streams, and also need to address the evolving customer needs. For that purpose companies often need to adopt a multi-product strategy and define a roadmap for innovative products and extensions (Tabrizi and Walleigh, 1997) to cover existing market opportunities that needs to be continuously adapted to the turbulences affecting the company's product portfolio scope (Suomalainen et al., 2011).

In more dynamic environments, such as high technology products, the impact of scope change is so high that scope definition becomes a continuous evolution. While a single product development can in certain turbulent environments be by itself already quite challenging, companies very often embark on the development of multiple products that are started one after another, with a high degree of parallelism. Furthermore, in a multi-product company product features and architecture components are interdependent causing scope changes in a specific product to be propagated to other on-going developments, triggering change events throughout several other projects. In this context the complexity in managing the scope of a NPD portfolio grows exponentially, which makes it critical for managers to have the tools to quickly gain visibility of the change effects across the multiple development projects such that wrong development paths can be avoided, minimizing the costs of rework.

Some companies adopt multi-project based processes such as the project portfolio management standard (PMI, 2008a) defined by PMI, to gain oversight of the execution of the NPD projects. However, these processes mostly focus on project prioritization and resource allocation, and do not provide the overview of project scope and dependencies among NPD projects.

The importance of managing multiple NPD project scopes has been highlighted in some top management and business

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journals on project management (Kwak and Anbari, 2009), and where a predominant occurrence of articles in related topics such as portfolio management, marketing and R&D of new products is noticeably traceable.

The objectives of this paper are to summarize the challenges that companies still face to manage the scope of an NPD portfolio and to propose a new scope management process framework based on feature oriented domain analysis (Kang et al., 1990). The paper uses a real case of a semiconductor company to illustrate the challenges and the suggested scope management practices.

The remainder of the paper is structured as follows: Section 2 reviews the literature on NPD portfolio management and methods to manage its scope; Section 3 describes the research methodology adopted in this paper; Section 4 analyzes a company case to identify the challenges of managing the scope of a new product line; Section 5 describes the identified challenges of managing the NPD portfolio scope; Section 6 integrates the new scope management processes in the NDP portfolio management context; Section 7 discusses the resulting propositions and reflects on limitations and advances some clues on future research; Section 8 provides the conclusions of this research.

2. Literature review

2.1. NPD portfolio management

To be able to deliver multiple products in an effective way companies need to manage their NPD project portfolio. This management process entails to select and manage several projects and programs that deliver new products and that in the end meet organization's objectives optimally or near optimally (Archer and Ghasemzadeh, 1999). The project portfolio management (PPM) process is a sequence of steps executed at regular time intervals previously defined in several process frameworks (Archer and Ghasemzadeh, 1999; Blichfeldt and Eskerod, 2008; PMI, 2008a). From a macro perspective the PPM process is quite consensual and can be summarized as: (1) the initial screening, selection and prioritization of project proposals, (2) the concurrent reprioritization of projects in the portfolio, and (3) the allocation and reallocation of resources to projects according to priority. Effectively managing the portfolio requires making decisions that are based on collected information generated at project and program levels and independently from each other, hopefully leading to a strategic alignment (Thiry and Deguire, 2007). However, reality is more complex and very often the products being developed are interrelated and require a deeper understanding of scope related aspects, such as checking for interdependencies, maximizing the value of project results and measuring the project and program feasibility. Although none of the PPM process frameworks in the reviewed literature have attempted to make proposals on how to manage scope from a global portfolio perspective, some literature (Jonas, 2010) introduced portfolio management process with additional tasks regarding scope, such as identifying synergies between projects and accumulating relevant knowledge on project results.

Typically, product development portfolio decisions are defined at two levels, strategic and tactical, whereas the first is related to marketing product management decisions such as market targeting and product roadmap and the second level involves selection of projects, and prioritizing and allocating resources (Edgett and Cooper, 2010) at different moments such as at portfolio periodic reviews, at NPD project gates or at development phase reviews (Steffens et al., 2007).

When product innovation and creativity is important, such as in high technology product development, management should encourage operational level decisions that result from the interaction between individuals or groups of individuals. These practices allow self-organization to adapt to new circumstances but these decisions can be unceremonious, dynamic and disordered, a reason as to why they need to be balanced with the strategic and tactical decisions (McCarthy et al., 2006; Steffens et al., 2007).

2.2. NPD project scope

The early front-end phases of NPD, preceding product development, generate two main scope related artefacts, the product concept and the project plan (Nobelius, 2002; Oliveira and Rozenfeld, 2010). Driven by a cross-functional team, also called innovation group, multiple concepts are suggested before selecting a product concept to start development (Ulrich and Eppinger, 2004). The process to achieve a consensual product concept is iterative, and some ambiguity is expected to allow the concept to be progressively elaborated and to eventually shift throughout the development execution (Seidel, 2007). Additional dynamics is introduced to reach a product definition by ever-changing factors such as customer needs, technology availability, competition offerings and regulatory standards (Bacon et al., 1994; Oliveira and Rozenfeld, 2010; Seidel, 2007). The product concept represents the set of scoped product features and specifications and is molded as development progresses.

Once the product's concept becomes narrowed to the expected goal, the engineering teams become more involved by defining the system architecture and deriving the system level and component level requirements from the product features. The development of product components usually follows a specific development process that depends on the type of component (i.e. software, hardware, etc…), the industry and the maturity of the technological domain (Unger and Eppinger, 2009). These engineering development processes progressively decompose the component structure, reducing the complexity of each element and further detailing the scope to allow its correct implementation and testing (Gumus et al., 2008).

Planning the product development requires similar flexibility every time technical solutions are adjusted and new insights are brought into consideration. Traditional project management as represented by PMI is mostly mechanical, monocausal, and nondynamic, with a linear structure and is not suitable to solve these widespread profound challenges (Saynisch, 2010) caused by the unpredictability and complexity of new product development common to high technology sectors.

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