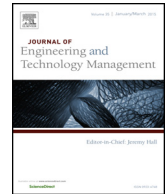




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## Agile project management and stage-gate model—A hybrid framework for technology-based companies



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### ABSTRACT

This study reports an empirical analysis of a hybrid management framework combining agile project management and stage-gate model implemented in a technology-driven project. The results indicate positive impact on the project and product development performance and suggest that combining these two approaches to balance stability with flexibility is a potential solution for managing innovation projects in high technology-based companies. The evidence indicated critical aspects to be considered, such as the proper diagnosis of organizational factors and implementation of practices, and the alignment of agile project tools (e.g., visual boards) with traditional information systems used in the stage-gate process.

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## 1. Introduction

New product development (NPD) theory has evolved considerably since 1990 (Brown and Eisenhardt, 1995; Griffin, 1997; Barczak et al., 2009) with distinct practices, tools, techniques, and management frameworks. In recent years, a new and disruptive innovation environment has challenged NPD theory and practice with the emergence of, for example, digital creative industries (Parmentier and Mangematin, 2014), co-creation (Rayna et al., 2015), 3D printing, fast prototyping (Elverum and Welo, 2015), and the demand for radical innovation-oriented capabilities (Salomo et al., 2007).

The challenges and changes in these industries require NPD strategies and frameworks that combine simplicity, velocity, and flexibility as never before. Consequently, the search for NPD models and approaches has become a new and emergent topic for both scholars and practitioners. Cooper (2008), for example, emphasized the importance of exploring different approaches, including practices from so-called “agile methods”, in order to cope with the innovation and dynamism of certain industries and project types. In addition, Cooper (2008) pointed out the need to adapt stage-gate models to achieve higher levels of flexibility and “agility”.

Agile project management (APM) methods have been disseminated widely in the software development industry. These methods gained momentum since a group of practitioners from the software development field (Beck et al., 2001) conceived a manifesto (*Manifesto for Agile Software Development*), which presents basic principles and values to assist project managers in dealing with issues related to software development projects. APM is focused primarily on managing customer needs and

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evolving requirements by using short development cycles (iterations) and continuous change and adaptation all the way through the project life cycle (Barlow et al., 2011).

Product complexity and technology innovation may affect the use of these practices for NPD environments. According to Kim and Wilemon (2003), NPD complexity can originate from several sources, for example, technology uncertainty, number of components, systems and subsystems, and number of organizations involved. These characteristics undermine the project team's ability to deal with evolving requirements. The recommended approach then is to detail the product requirements and specifications in the early stages. This results in reduced flexibility to absorb changes (Nerur et al., 2005) and to disrupt the information and communication process among teams, and, consequently, the coordination and decision-making during the NPD life cycle (Laanti, 2008 *apud* Mishra and Mishra, 2011).

These challenges make the adoption of APM as a pure approach risky when compared with traditional NPD stage-gate models, which assume a great deal of effort dedicated to the initial planning phase to identify and detail requirements and product specifications (Vinekar et al., 2006). The APM can generate rework, failures, and cost overruns in highly integrated products with interdependent components and systems (Turk et al., 2009).

Despite these considerations, other authors have argued the opposite by stating that APM is more suitable for small projects, and small and collocated teams, as opposed to traditional NPD practices, which are suited to large and complex programs (Lee et al., 2006). In this respect, the agile management approach could be a reasonable solution for small and technology-based companies.

Nonetheless, this dilemma could be resolved by properly combining both stage-gate and agile management approaches. Since the initial development of the agile approach, Boehm and Turner (2004) have argued that the challenge is to find the balance between agility and discipline. The result is a recent set of studies focused on understanding and exploring hybrid product development approaches (Fernandez and Fernandez, 2008; Port and Bui, 2009; Batra et al., 2010; Zaki and Moawad, 2010; Barlow et al., 2011; Cobb, 2011; Spundak, 2014). Despite the evolution of this literature, there is a lack of empirical studies showing if the combination of stage-gate and APM contribute to agility and better project and product development performance.

In 2010, Conforto and Amaral (2010) proposed a management framework titled Iterative and Visual Project Management Method (IVPM2), which combines APM practices and techniques with stage-gate concepts in a hybrid management model. The stage-gate model presents an overall and unified vision, which facilitates communication between team members. Combined with APM practices, it supports the use of agile principles, such as promoting a team's self-discipline and process flexibility to allow experimentation and iterative development, using multiple planning and execution levels.

This study evaluates the implementation of the IVPM2 in a single case, a project that aimed to develop a new product, conducted in a small technology-based company. Based on the project team members' perceptions, we attempted to answer three main research questions, as follows. (RQ1) Did the company use stage-gate model combined with agile practices? (RQ2) Did the framework contribute to the agility principle? (RQ3) Did the framework improve overall performance of the project and product development? To address these questions, we applied a combination of research techniques (e.g., interviews, questionnaire application, and observation) with an in-depth case study approach involving all team members that worked on the project.

## 2. APM combined with stage-gate as a solution for technology-based companies

Recent studies have shed some light on the investigation of the use of structured and flexible product development processes in different industries and project contexts (Marion et al., 2012; Högman and Johannesson, 2013). Despite the potential paradox between structured and flexible approaches and the evolving literature about NPD frameworks, there is still a lack of studies focused on understanding the benefits and limitations of combining different practices from distinct approaches to meet the current state of technology and product development in fast-changing and competitive business environments.

Small technology-based companies or high-tech firms (Olausson and Berggren, 2010) share characteristics, such as focus on R&D activities, innovation, entrepreneurial behavior, and high levels of interaction among collaborators (Grinstein and Goldman, 2006). These organizations are driven to create innovative products and services, and therefore, need to be responsive to changes and opportunities, while dealing with uncertainty, risks, and complexity of NPD projects (Olausson and Berggren, 2010).

A study of NPD practices adopted in two early-stage firms conducted by Marion et al. (2012) identified challenges for this type of company in the use of well-disseminated NPD practices, especially in detailed and well-structured processes with systematic milestones, and phase evaluation guided by a linear ("waterfall") development approach. Very often, the lack of resources (financial and human) limits the use of these practices commonly adopted by large organizations (Marion et al., 2012).

The characteristics and limitations of this type of organization represent an opportunity for developing and testing hybrid management frameworks, combining NPD practices and project management concepts, which are specifically designed for this environment, as highlighted by Olausson and Berggren (2010). Recently, other authors have debated the idea of developing hybrid approaches as a potential solution to improve the performance of innovation projects (Fernandez and Fernandez, 2008; Port and Bui, 2009; Batra et al., 2010; Zaki and Moawad, 2010; Barlow et al., 2011; Cobb, 2011; Spundak, 2014; Carvalho and Rabechini, 2015).

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