The Use of Control Systems in New Product Development Innovation: Advancing the ‘Help or Hinder’ Debate

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New Product Development (NPD) innovation is a critical activity in the current economic environment. In order to manage their NPD innovation projects, firms use Management Controls Systems (MCS). However, the effect that these systems have on NPD innovation is not clear. One stream of research suggests that MCS help NPD innovation while another stream suggests MCS hinder NPD innovation. Past research has shown that the role and style of MCS used may offer explanations on why MCS can both help and hinder NPD innovation. This paper adds another explanation by examining the relationship between three models (divisional, activity/decision and conversion/response) of a commonly used MCS, known as the Stage-Gate Process1 in the NPD innovation literature, and three types of NPD innovation projects (incremental, semi-radical and radical). The insights from an ethnomet hodology informed field study are used to understand how and why the firms may use a different MCS (Stage-Gate Process models) for different NPD innovation project types.

Introduction

Introducing new products into the market is an important way for firms to enhance their competitive advantage (Kumar and Phrommathed, 2005). In particular, firms now place emphasis on the following strategies in New Product Development (NPD) innovation—first mover advantage, fast product introduction, better product functionality and shorter product life cycles (Davila, 2000).2 To implement these strategies, academics and practitioners stress the importance of Management Control Systems (MCS) within firms. We follow Bisbe and Otley (2004) to define MCS in that it refers to the processes utilized by the organizational participants to mobilize resources and action towards some individual or shared interests.

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1 Stage-Gate® is a registered trademark of the Product Development Institute Inc. We use the term only in its generally used sense of a product development process that provides alternating stages and gates.
2 NPD innovation refers to the complete process in bringing a new product to the market. A new product is one that has been in the market for less than 3-5 years (Cooper, 2001).

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According to Cooper (2001, p. 4), “NPD innovation is one of the riskiest, yet most important endeavors of the modern corporation.” An example of the risk is the uncertainty in the market acceptance of the new product. To minimize risks, managers employ MCS to keep NPD innovation projects on track (Bonner, 2005). The MCS in an NPD innovation context is thus, a “mechanism used to influence the means and achieved desired ends by specifying and monitoring the behavior and activities to be followed by the NPD innovation team” (Bonner et al., 2002, p. 234).

One common MCS in NPD innovation used by firms is the ‘Stage-Gate’ process. This process comprises groups of development activities classified as ‘stages’ which are evaluated for resource allocation decisions at specific points known as ‘gates’. Early research in this area carried out extensive studies of several projects and proposed different stage-gate process models (Cooper and Kleinschmidt, 1987; Wheelwright and Clark, 1992; and Barnett and Clark, 1998). While these process models enhance the extant NPD innovation literature, disagreement exists regarding the usefulness of these models (and generally MCS) for a firm’s NPD innovation efforts (Eisenhardt and Brown, 1995).

One stream in the NPD innovation literature (hereafter called the ‘hinder’ literature) tends to either downplay or ignore the use of MCS during NPD innovation (e.g., Tushman, 1997; and Amabile, 1998). The contention is that MCS such as the stage-gate model is designed for stable conditions and may not accommodate uncertainty inherent in some contexts. In contrast, another stream (hereafter the ‘help’ literature) of literature indicates that the use of MCS has a positive effect on NPD innovation (e.g., Bart, 1991; Chenhall and Morris, 1995; and Davila et al., 2005). This stream suggests that MCS block any innovation excesses which are not amenable to implement. These studies are consistent with Cooper’s (2001) and Bonner’s (2005) views that MCS are important for coordinating and controlling NPD innovation projects.

The purpose of our paper is to advance this help or hinder debate by examining the potential reasons as to why MCS can be thought to hinder the NPD innovation efforts. Our key argument is that the MCS design must be appropriate to the nature of NPD innovation. We identify different types of stage-gate process models which can match with different levels of NPD innovation. The appropriateness of the match determines whether MCS help or hinder NPD innovation.

Next, we review the MCS literature on the use of MCS during NPD innovation. This is then connected to the innovation literature which suggests that different NPD innovation products may need to be managed differently. Three stage-gate process models along with their relative merits and demerits are presented next. This is followed by reports on an ethnomethodology-informed field study carried out by the first author to better understand when and how different stage-gate models are used in practice to manage different NPD innovation project types, followed by conclusion.

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1 Over 70% of firms are now said to use some kind of stage-gate process model (Cooper, 2005).
Literature Review

The general literature on the use of MCS during NPD innovation is mixed. Some studies argue that MCS help NPD innovation while other studies have found that they are not relevant or may even hinder NPD innovation. We discuss below the arguments for and against the use of MCS during NPD innovation.

Why MCS May Not Be Appropriate During NPD Innovation

A stream in the innovation literature tends to downplay or ignore the use of formal MCS during NPD innovation. This literature instead stresses the importance of culture (Amabile et al., 1996; Tushman, 1997; and Brockman and Morgan, 2006), organizational integration (Song et al., 1996; Kahn et al., 2006; and Millson and Wilemon, 2006) and the composition of teams and their leadership (Clark and Fujimoto, 1991; Brown and Eisenhardt, 1995; and Aronson et al., 2006). The main focus of this literature is on how culture, organizational integration and team composition and leadership help firms to manage the uncertainties inherent in NPD innovation. Some of these authors have also argued that formal MCS are not able to deal with the uncertainties found in this context (Tushman, 1997; and Amabile, 1998).

Why MCS May Be Useful During NPD Innovation

Another stream of literature argues that the use of MCS has a positive effect on NPD innovation (Dent, 1990; Bart, 1991; Wheelwright and Clark, 1992; Chenhall and Morris, 1995; and Davila et al., 2005). These studies argue that MCS block innovation excesses, thus helping ensure that ideas are translated into new products which enhance organizational performance. Davila et al. (2005) find that in addition to controlling execution, stimulating dialogue and idea creation, MCS stabilize an environment that, by nature of the innovation process, is rich in opportunities. Davila et al. (2005) suggest management controls provide the infrastructure to anchor product innovation. These studies are consistent with the view that suggests that MCS are important for coordinating and controlling NPD innovation projects (Cooper and Kleinschmidt, 1987; and Zirger and Maidique, 1990).

Current Explanations

Two studies that have provided explanations for these contradictory results are Davila (2000), and Bisbe and Otley (2004). Davila (2000) suggests that a possible explanation for the contradiction could be due to misunderstanding the role of MCS during NPD innovation. Bisbe and Otley (2004) suggest that another possible explanation for the contradiction could be related to the style of MCS use.

Different Roles of MCS

Davila (2000) suggests that a possible explanation could be the different interpretations of the role of MCS. Davila (2000) argues that those studies that find that MCS are not relevant or may hinder NPD innovation, concentrate solely on its traditional role of promoting goal congruence. Davila (2000) shows that in addition to a control role, MCS also play an information role. This information role, he argues, is important as it helps managers to manage the uncertainty inherent in NPD innovation. Thus, during NPD innovation, MCS
may play more of an information role which is used to enhance learning and coordination to reduce uncertainty.

**Different Styles of Use of MCS**

In addition to having different roles, Bisbe and Otley (2004) suggest that the way or style in which MCS are used may explain the inconsistent results. They use Simons’ (1995) interactive control lever to argue that those studies that find formal MCS hinder NPD innovation may be partial to the extent that they focus exclusively on thermostat-like, diagnostic uses of formal MCS, and ignore the implications of interactive uses of formal MCS. Bisbe and Otley (2004) argue that those studies that find MCS facilitates successful NPD innovation are those that are more comprehensive to the extent that they capture the presence of interactive uses of MCS as well as the dynamic tension between diagnostic and interactive uses of MCS.

**NPD Innovation Project Types**

Using a matrix to illustrate the interplay between technology and business models, Davila et al. (2006) developed an NPD innovation framework (Figure 1). They argue that it is vital to understand the NPD innovation project type so that NPD innovation projects can be managed, funded and resourced appropriately. The framework is based on the analysis of two important aspects of NPD innovation, namely technology and business model. It then divides each of these aspects into two categories, new or near to the existing. This two-by-two matrix leads to four NPD innovation segments, incremental, radical, semi-radical (new technology) and semi-radical (new business model).

![Figure 1: NPD Innovation Framework](image)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Business Model</th>
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<tr>
<td>New Semi-Radical</td>
<td>Near to the Existing</td>
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<tr>
<td>Near to the Existing</td>
<td>Semi-Radical</td>
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<tr>
<td>New</td>
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</table>

Source: Davila et al. (2006, p. 36)

According to Ettlie and Subramaniam (2004, p. 97) incremental NPD innovation projects “are a result of refining prevailing knowledge” while radical NPD innovation projects...
arise because prevailing knowledge gets transformed.” Incremental NPD innovation projects thus result in small improvements to existing products and business processes while radical NPD innovation projects result in new products delivered in entirely new ways. In between the two extremes are semi-radical NPD innovation projects, which involve substantial changes to either the business model or the technology an organization has used in the past.

Incremental NPD innovation projects simply replace existing products in the product line such as new product varieties. On the other hand, radical NPD innovation projects create new categories that did not exist before. In between incremental and radical NPD innovation projects are semi-radical NPD innovation projects. These projects include either a new technology or a new business model. Thus, they would include NPD innovation projects that add to the organizations’ existing product line but require the firm to develop some new technology or current products launched in a different market which requires a different business model.

Research has suggested that it is important to understand context in any organizational setting (Burns and Stalker, 1961; Abernathy and Utterback, 1978; Galbraith, 1982; Burgelman, 1983; and Bart, 1988). From this, it can be argued that the management of incremental NPD innovation projects should be different from the management of radical NPD innovation projects. This idea is supported by Rice et al. (1998, p. 52) who observe that “what is sound management practice for incremental innovation—where speed, cycle time, and quick cash recovery are primary objectives—might actually hamper the radical innovation’s progress.” Each of these NPD innovation project types are examined below.

**Incremental NPD Innovation Projects**

Incremental NPD innovation projects aim to reinforce prevailing market structures and competitive positions to strengthen existing barriers to entry for competing firms (Abernathy and Clark, 1985; and Iansiti, 1995). Accordingly, the predominant emphasis when managing incremental NPD innovation projects is on precise planning, economically allocating resources and proficiently structuring and coordinating activities. This is because the core idea for managing incremental NPD innovation projects is to improve efficiency (Ettlie and Subramanian, 2004).

Iansiti (1995, p. 38) suggests that when managing incremental NPD innovation projects, management’s “focus is on developing a structured process with clearly defined and sequential phases, through which the future product is defined, designed, transferred to the manufacturing plant, and rolled out to the market. Performance is related to mechanisms that add clarity and stability to the project, such as a clear project definition phase as well as a stable product concept and specification. The emphasis is on a process aimed at achieving focused and efficient project execution, involving strong project leadership, integrated problem solving and team-based organizational structures.” This supports the idea that incremental NPD innovation projects require MCS that impose limits to organization members’ freedom by focusing on clear rules and procedures for organizational members to follow.
 Radical NPD Innovation Projects

Radical NPD innovation projects, on the other hand, require knowledge to be transformed (Tushman and Andersen, 1986). This is because the environment is not stable; thus the emphasis is on learning how to communicate with the other organizational members involved in the process. These projects are generally characterized as having long time horizons, starts and stops, and periods of seemingly going nowhere. Through a collaborative research project of the Rensselaer Radical Innovation Research Project Team and the Research-on-Research Committee of the Industrial Research Institute, Rice et al. (1998) come to the conclusion that conventional management techniques that are suitable for incremental NPD innovation projects are unsuitable for radical NPD innovation projects until uncertainty is sufficiently reduced.

Consequently, it appears that the primary imperative driving radical NPD innovation projects is to reduce uncertainty to the point where conventional management practices are appropriate, or where it becomes apparent that the project should be abandoned. Rice et al. (1998) suggest that MCS used during the NPD innovation process for radical NPD innovation projects can be employed to set boundaries, proactively stimulate radical innovation activities, evaluate and screen the projects, create incubating mechanisms, and support individual initiatives. Iansiti (1995) highlights that in cases where high levels of new technical and market information emerges during the timeline of the project, the emphasis should shift from the capabilities for focused and rapid project execution to the capabilities to react to newly discovered information during the course of the project itself.

The fundamental idea in the management of radical NPD innovation projects is to embrace change and not fight it. Consequently, the development process should be characterized by flexibility and responsiveness so that the people involved in the NPD innovation project have the ability to gather and respond to new knowledge about technical and market information as a project evolves. Iansiti (1995, p. 38) adds that “the flexible approach is not simply a function of hiring creative individuals or of implementing an organic organizational structure. Instead, significant systematic changes in a project’s definition and basic direction are managed proactively by creating a development process and a product architecture that increase the speed by which the organization can react to such changes.” In other words, management’s competence to respond to the elements of novelty which result from radical NPD innovation projects depends on the design of MCS (in this study, the stage-gate process).

Semi-Radical NPD Innovation Projects

As semi-radical NPD innovation projects involve the use of some of the existing competencies but at the same time require a reasonable amount of new knowledge, the MCS required to adequately manage these projects should comprise some aspects used for incremental NPD innovation projects and some aspects used for radical NPD innovation projects. That is, the MCS required for semi-radical NPD innovation projects need to include both a set of clear rules and procedures that organization members need to adhere to for the incremental side of
the project while at the same time being able to understand and respond quickly to novel conditions in the radical side.

As suggested by Davila et al. (2006), semi-radical NPD innovation projects involve either a new business model or a new technology. Consequently, semi-radical NPD innovation projects involve either high market uncertainty or high technical uncertainty, but not both. When an organization faces high market uncertainty, it needs to place greater emphasis on using scarce resources in understanding the new market. This would require a strong emphasis on pre-development work to address business issues such as sustainability, product advantage, synergy and market attractiveness. In addition, a sharp product definition is essential before the development of the products begins. This work needs the involvement of people from functions specializing in areas related to markets, e.g., sales and marketing, who need to communicate their work to functions specializing in the technical areas for them to turn the product definition into actual products. Therefore, the MCS needed for semi-radical NPD innovation projects that involve high market uncertainty need to allow for interactions between the different functions. The use of cross-functional teams then becomes necessary to facilitate pre-development activities and to reduce market uncertainty before development begins.

On the other hand, when an organization faces high technical uncertainty, it needs to place greater emphasis on using resources to understand the new technology. To do this an organization will need to use functional teams that can examine technical aspects of the project in detail. The organization can use common knowledge relating to the market to create rules and procedures for the technical functional teams to adhere to when developing the new products. Therefore, the MCS required for NPD innovation projects with high technical uncertainty and low market uncertainty is characterized by the use of pre-planned rules and procedures along with the use of functional teams specializing in the technical aspects of NPD innovation.

In summary, our review suggests that each NPD innovation project faces a different level of uncertainty. NPD innovation projects involving incremental changes face low market and technical uncertainties. On the other hand, NPD innovation projects involving radical changes face both high market and technical uncertainties. Technical semi-radical NPD innovation projects face high technical uncertainty and low market uncertainty, while market semi-radical NPD innovation projects have high market and low technical uncertainty. Because of this, each NPD innovation project type may require the use of a stage-gate process characterized by different features. Different stage-gate process models are examined below to better understand how firms can manage NPD innovation projects.

**Stage-Gate Process Models**

The Stage-Gate Process (Figure 2) is made up of stages where organization members carry out different activities and gates where project teams update management on their progress. These stages and gates assist organizations in achieving desired results in terms of reducing uncertainty and promoting goal congruence (Cardinal, 2001).
In this study we define MCS in relation to the stage-gate process which firms use to manage the flow of new products from idea generation to their launch into the market. While we recognize that the stage-gate NPD innovation process is only one possible MCS\(^4\) that a firm can use during NPD innovation, many have argued that this process has had a profound impact on the way that many organizations' development efforts are managed, controlled, and measured (Wheelwright and Clark, 1992; Cooper, 2001 and 2005; Davila et al., 2005; and Davila et al., 2006). As the needs and requirements of organizations engaging in NPD innovation have changed and different risks associated with NPD innovation identified, the stage-gate process has evolved (Cooper, 1994, 2001 and 2005). According to Saren (1984), these models fall into one of the five categories: departmental, activity, decision, conversion, and response. As many of these categories link together, we have combined these to form three stage-gate process models—departmental, activity/decision and conversion/response—which are examined below.

**Departmental Stage-Gate Process Model**

Within a departmental stage-gate process model (Figure 3) activities are carried out sequentially within individual departments during each stage of the process (Saren, 1984). The output of each departments work is reviewed and then sent to the next department to

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\(^4\) Other MCS examined in the literature in relation to NPD innovation include budgets, the balanced scorecard (Biba and Ordley, 2004), and personnel and accounting controls (Abercromby and Brownell, 1997).
carry out a set of activities. In this type of a model, innovation proceeds through each department, usually starting with R&D and ending with Sales (Saren, 1984).

One example of this model in the innovation literature is the ‘phased review process’ developed by NASA in the 1960s (Cooper, 1994). This process was developed to help manage the elaborate and detailed scheme NASA used for working with contractors and suppliers. NASA split projects into discrete stages which included a series of activities which were carried out sequentially by individual departments. In this stage-gate process, each task is carried out by a functional group. At the end of each stage, are gates or decision points at which the project team presents its findings to a group of senior managers. Continued funding is conditional on the project team meeting certain prerequisites. The approach to managing and controlling the development of new products under a departmental stage-gate process model involves extensive planning of procedures with clear goals that must be met for the project to continue.

The departmental stage-gate process model exhibits a rigid control system with an approach emphasizing extensive functional planning. Cooper (1994) argues that this rigid control system helps reduce technical risk and ensures the completion of activities and thus may be suitable for organizations that face high technical uncertainty. This is because managers can better understand and manage technical uncertainty through the use of functional teams who can examine technical aspects of the project in depth.

However, this stage-gate process model also has some limitations. First, the process is narrow as it takes idea generation as a given one, and thus starts with a narrow technical view of the idea. By having a narrow focus on the technical and engineering side of the project, this process ignores market conditions. Thus, this process model might not be suitable for organizations that face high market uncertainty. In addition, this process divides the stages into functional activities which may limit interactions between departments. This could have an adverse affect on the project as the interaction between departments could bring up critical issues. This process also involves sequential activities as well as laborious check points which could slowdown the process. This could cause a project to be held up in a queue for a management review, or worse be put on hold at a review point awaiting the completion of one activity that is behind schedule (Cooper, 1994).

**Activity/Decision Stage-Gate Process Model**

The activity/decision stage-gate process model (Figure 4) is made up of sets of activities which are bundled into stages followed by management decision points at the gates

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<th>Figure 4: An Activity/Decision Stage-Gate Process Model</th>
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<td>[Diagram showing stages and decision gates]</td>
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Source: Cooper (1994)
(Saren, 1984). The stages in this process model are identified by the types of activities that take place, such as the discovery stage where many different kinds of idea generation activities take place with the purpose of discovering new product ideas.

In the activity/decision stage-gate process innovation is viewed as a logically sequential process which can be divided into a series of separate stages (Cooper, 2001). During the stages, activities are undertaken concurrently. This speeds up the process, enabling projects to be completed in a shorter period of time. Moreover, this process has decision points with clear criteria, which can include both quantitative and qualitative measures (Cooper, 1994).

As can be seen in Figure 4, the stage-gate process model includes stages before the firm starts the development and testing of a product. These stages involve discovery, scoping and building the business case. These pre-development stages include activities which require organization members to assess the market and develop a strong product definition before development begins. As a result, there is a much stronger market orientation as the customer becomes an integral part of the NPD innovation project. With the addition of these pre-development stages, the activity/decision stage-gate process model has a sharper product definition prior to the beginning of product development and more time to adjust the product to changing market conditions (MacCormack et al., 2001).

A key feature of the activity/decision process model is the use of cross-functional teams to carry out activities during all the stages of the process. This is in contrast to the departmental process model where individual departments were expected to carry out their own project activities. Furthermore, decisions at the process gates are also said to require the use of a cross-functional executive management team (Cooper, 1994). This is because decisions at the gates require both functional specific knowledge and buy-in from the managers who have overall responsibility for the resources in their functional area.

Although this stage-gate process model has a stronger market focus in comparison to the departmental stage-gate process, it is not capable of managing all NPD innovation projects (Cooper, 1994). According to Coöper (1994), this process can still be time-consuming as projects have to wait at the decision gates until all of the activities within a stage have been completed. Thus, even when most project activities have been completed, a project has to wait for all the other project activities to be completed before going through the gate.

A Conversion/Response Stage-Gate Process Model

The conversion/response stage-gate process model (Figure 5) emphasizes flexibility and includes a more efficient way of allocating resources to increase responsiveness to change. According to Cooper (1994), this stage-gate process model represents a precarious balance between the need for thoroughness of action and complete information.

The conversion/response stage-gate process model views innovation as a conversion process where different kinds of inputs (such as knowledge and raw materials) are converted into an output (a new product). While this process model also includes activities, they are not assigned to specific stages or gates but instead are undertaken when needed. That also
means that the gates for evaluating the stage are also uncertain and take place when needed. This conversion process is driven by organization members responding to their environment. Organization members respond to stimulus to generate ideas, conceive of new possibilities, make proposals, which then results in the adoption of new innovation. Thus, innovation is understood in terms of the conversion process and how organization members respond to external or internal events.

Some of the key features of this process model include adaptable, overlapping and fluid stages (Cooper, 1994). Fuzzy gates which feature conditional go decisions (rather than absolute ones), are dependent on the situation (Cooper, 1994).

However, Cooper (1994) warns that due to greater flexibility and adaptability, this process is potentially more complex. He suggests that NPD innovation project teams are more familiar with the details and intricacies of their project than anyone else in the organization, executive managers must increasingly rely on the NPD innovation project team for reasoned arguments and recommendations, and be prepared to accept these. While executive managers would still have control over resources, and are ultimately responsible for the results achieved, there would need to be some shift in decision-making authority to the NPD innovation team (Cooper, 1994). To better understand the stage-gate process used for different NPD innovation project types, the results of an in-depth longitudinal field study are presented below.
Field Study of OpCo

This paper draws on an ethnomethodology informed longitudinal field study to better understand how a firm actually carries out NPD innovation in practice. During the field study, eight NPD innovation projects including three incremental, three semi-radical and two radical projects were observed. Access to the field study firm was used to observe project team interactions as well as middle and senior managers meetings and interactions where NPD innovation projects were discussed. Following is a brief summary of the field site, research method and examples of the stage-gate process model used for incremental, semi-radical and radical NPD innovation projects within the firm.

Field Site

The field research was carried out by the first author at an operating company (referred to as OpCo in the paper) of Fonterra, a US$12 bn New Zealand company. OpCo is a highly innovative firm with a history of developing successful new products. These products have enabled OpCo to become the market leader in every category in which it competes within the New Zealand market. It has many competitors in the New Zealand market including worldwide market leaders. OpCo is also a successful exporter and sells its products in many markets around the world. The field material reported on in this paper was collected at OpCo through direct participant observation of the activities that all organization members were involved in (Figure 6) from the selection to the launch of new products.

Figure 6: Organization Structure at OpCo

![Organization Structure Diagram]

Interactions between organization members took place during both formal meetings and informally throughout the organization. The details of the interactions that occurred were entered into field notes which contained the details of the context as well as some brief conversations between participants. The field material was collected at OpCo over a 9-month period from December 2004 to August 2005 and is presented in Table 1. Throughout the field study, a wide spectrum of materials were collected including detailed field notes of

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project selection meetings, NPD innovation project meetings, manager meetings as well as observations of the daily activities of various organization members within different functions at OpCo.

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<tr>
<td>Field Notes</td>
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<tr>
<td>Number of NPD innovation projects observed</td>
</tr>
<tr>
<td>Project team meeting observations</td>
</tr>
<tr>
<td>Functional manager meeting observations</td>
</tr>
<tr>
<td>Executive manager meeting observations</td>
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<tr>
<td>Site visits (observation days)</td>
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<tr>
<td>Informal conversation notes</td>
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**Ethnomethodology**

The field study was informed by ethnomethodology (Garfinkel, 1967 and 2002; Lynch, 1993; and Rawls, 2002). Ethnomethodology is “the study of the methods people use for producing recognizable social order” (Rawls, 2002, p. 6). The emphasis of ethnomethodology is the study of members' methods based on the theory that “a careful attention to the details of social phenomena will reveal social order” (Rawls, 2002, p. 6). For this reason, ethnomethodology is grounded in the practices of people rather than in relating social theories to these practices (Garfinkel, 2002). Ethnomethodology thus focuses on the “embodied, endogenous, witnessable practices” that are part of peoples’ everyday activities rather than on a cognitive or conceptual understanding of the individual (Rawls, 2002, p. 7).

From the perspective of ethnomethodological practice, every action proceeds in orderly and expected ways as people interact within a given scene or context. This is because it is only through this recognizable order that people can understand the meaning of each others actions (Garfinkel, 2002). According to Garfinkel (2002), this order is displayed in the contextual details of the scene because this is where action takes place. Garfinkel (2002) argues that even though the people in a particular scene may change, the scene will continue. Because of this, individual views or perspectives are not the main focus of studies of practice from an ethnomethodological perspective. Instead, the objective is to understand the actual recognized practices in a particular scene (Garfinkel, 2002). The key to understanding practice, therefore, lies in detailed studies of those shared practices that are essential to the production of order in a particular scene (Garfinkel, 2002).

**NPD Innovation Projects at OpCo**

Eight NPD innovation projects were observed over the 9-month observation period. Discussed below is a report on the stage-gate process models used by organization members at OpCo during the creation, selection and development of incremental, semi-radical and radical NPD innovation projects.
Incremental NPD Innovation Projects at OpCo

Incremental NPD innovation projects at OpCo followed a four stage version of the activity/decision stage-gate process model (Figure 7). While these projects had relatively low levels of market and technical uncertainty, both were high enough to require some pre-development activities, even though these were not as extensive as those recommended in a full five stage activity/decision stage-gate process model.

![Figure 7: Stage-Gate Process Used for Incremental Projects at OpCo](image)

The activities carried out at OpCo during the pre-development stage were used to gather potential ideas and also to limit the number of projects going through the process as the firm did not want to invest a large amount of resources into products that would not add much value. During idea generation/project planning (Stage 1), a group of functional (middle) managers from the marketing and technology departments formed a group to develop and organize new product ideas. This started with a search of products being introduced in other markets by marketing and technical personnel. There were then a series of formal cross-functional activities during this stage. Once a project brief had been signed off by the relevant departments, it was put on a project review list which was presented monthly to the firms' executive managers. At the project review (Gate 1), executive managers ranked the projects using a ranking system that involved five categories which the managers felt linked to the firms' strategic and financial goals. The managers then examined the resources they had (personnel and capital) and decided which projects would get funding. Once a project was allocated resources, it proceeded to development (Stage 2) where a cross-functional team was formed to carry out a number of activities. This cross-functional team would take the project through to launch. For incremental project, these teams usually consisted of a marketing/sales and technology member. Some testing activities (Stage 3) took place for these projects but were not usually extensive.

Thus for incremental NPD innovation projects, it can be seen that the stage-gate process enabled a high level of planning and coordination between the marketing and technology departments. This would support the use of an activity/decision stage-gate process model. This stage-gate process allows organization members to plan most NPD innovation activities based on an understanding of existing competencies which define the rules and procedures that organization members need to adhere to. This stage-gate process can also be used to monitor outcomes and correct deviations quickly which were reported to senior managers at the gate meetings. Thus, the emphasis for incremental NPD innovation projects at OpCo was on efficiency and speed to market.
In addition, the activity/decision stage-gate process model is characterized by the use of cross-functional teams which allow for a high level of interaction between departments. The activity/decision stage-gate process meets the requirements of incremental NPD innovation projects. Thus, the activity/decision stage-gate process may also be suitable for managing incremental NPD innovation projects as these projects still have both market and technical uncertainties that have to be managed.

Radical NPD Innovation Projects at OpCo

The radical NPD innovation projects at OpCo did not really follow a well-defined process but instead carried out activities when needed. This fits with a more flexible conversion/response stage-gate process model (Figure 8). These projects had both high levels of market and technical uncertainty but they did not come about through rigorous pre-development activities. Instead, they came about through lab activities carried out by technology and sales personnel. These laboratory activities led to the initial project idea which was then examined through further development and business planning activities (Stage 1). Because of this, the business planning activities which took place for other projects before development were both influencing and were being influenced by the development activities. This meant that the development activities could be adjusted by the findings of the business planning activities and the business planning activities could be adjusted by the findings of the development activities.

![Figure 8: Stage-Gate Process Used for Radical Projects at OpCo](image)

Once the ideas had been presented to senior management at an idea screening session (Gate 1), cross-functional teams were formed to take the products to launch. These projects did not go through the stages and gates like incremental projects, but were evaluated when needed. This usually occurred when either capital equipment or marketing support was necessary for the project. The first significant investment decision took place at the project review (Gate 2). This was required to develop a production plan and to carry out a market trial (Stage 3). Once this had been seen to be successful, a launch proposal activity was arranged (Gate 3) where the project team presented their launch plan and the goals they had set for the product. The products were then launched (Stage 4) and reviewed (Stage 4).
This stage-gate process model was useful for the development of radical NPD innovation projects at OpCo because ideas necessary for radical NPD innovation projects did not come from a well-planned pre-development stage. Instead, the two radical projects observed at OpCo came from laboratory activities where they were developed as much as possible before being presented to the firm. In other words, development work started early during the process. This contrasts with the incremental projects which proceeded through a well-planned activity/decision process model. If that type of process model had been used for radical NPD innovation projects, the process could have overly constrained the project team which might have been detrimental to performance. Thus, the use of an activity/decision stage-gate process model could hinder a radical NPD innovation project as it is not flexible enough to deal with the level of new knowledge required to make informed decisions. The wrong stage-gate process may result in organization members making uninformed decisions that could result in potentially successful radical NPD innovation projects being stopped. Therefore, as the number of novel elements increases, the emphasis changes from one of processing more information to being able to respond and adapt to change as well as dealing with a higher number of strategic uncertainties. Consequently, a flexible process is needed to enhance learning and the construction of a joint understanding of the novel conditions.

**Semi-Radical NPD Innovation Projects at OpCo**

The semi-radical NPD innovation projects at OpCo followed a combination of the departmental and the activity/decision stage-gate process models (Figure 9). This could be due to the fact that semi-radical projects are split between projects that have either higher technical uncertainty or high market uncertainty but not both.

![Figure 9: Stage-Gate Process Used for Semi-Radical Projects at OpCo](image)

Even though all these projects came through a series of idea generation activities (Stage 1), they started to differ. Following the idea generation activities, the NPD innovation projects that were focused on new technology then, became very departmental focused with most of the activities in project planning, development and testing carried out in the functional departments (Stages 1A, 2A, 3A, 4A). The same trend though was not seen for the semi-radical projects which had high market uncertainty. These projects were managed using the

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5 NPD innovation projects that involve new technology need to have patent applications in process before the idea is presented to the rest of the firm.
standard five stage activity/decision stage-gate process model. During development (Stage 3), these projects were given to cross-functional teams who took the project through to launch stage (Stage 5).

Thus for semi-radical NPD innovation projects, there was a balance between using the stage-gate process for planning and coordination as well as allowing the functional departments to solve important issues in a sequential manner. While the activity/decision stage-gate process model allowed organization members to plan the idea generation and launch activities based on an understanding of existing competencies, it also had to revert to a different type of process to solve important functional issues. Thus, for semi-radical NPD innovation projects, the stage-gate process was used to monitor outcomes and correct deviations quickly at the gate meetings while at the same time allowing some functional specialization. Thus, the emphasis of semi-radical NPD innovation projects at OpCo was on both efficiency and effectiveness.

Conclusion

As shown by the above examples, the features of each stage-gate process model are important for managing different types of NPD innovation projects in practice. Therefore, extending Davila’s (2000) and Bisbe and Otley’s (2004) views, it can be argued that the stage-gate process model a firm uses in relation to the types of NPD innovation projects it carries out, adds to our understanding as to why previous studies may have found contradictory results.

From the evidence presented above and summarized in Table 2, it can be argued that a departmental stage-gate process model may be most suitable for semi-radical NPD innovation

| Table 2: Summary of NPD Innovation Project Types and Stage-Gate Processes |
|-----------------------------|-----------------------------|-----------------------------|
| **NPD Innovation Project Type** | **Emphasis On** | **Most Suitable Stage-Gate Process Model** |
| Incremental | Efficiency, planning and coordination | Activity/Decision |
| Semi-Radical | Efficiency, planning and coordination for incremental activities | Departmental for high technical uncertainty |
| | Flexibility and responsiveness for radical activities | Activity/Decision for high market uncertainty |
| Radical | Flexibility and responsiveness | Conversion/Response |

projects with high technical uncertainty, an activity/decision stage-gate process model may be more suitable for semi-radical NPD innovation projects with high market uncertainty and incremental NPD innovation projects with some market and technical uncertainty, while the conversion/response stage-gate process model may be best suited for radical NPD innovation projects.
References


