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List of Abbreviations

AusFood - The Australasian multinational food company which provided access and sponsored the study

CEO - Chief Executive Officer

CFO - Chief Financial Officer

CoP_{EM} - Executive Manager Community of Practice

CoP_{FM} - Functional Manager Community of Practice

CoP_{FMPD} - Functional Manager Product Development Community of Practice

CoP_{FS} - Functional Specialist Community of Practice

CoP_{F} - Finance Community of Practice

CoP_{M} - Marketing Community of Practice

CoP_{O} - Operations Community of Practice

CoP_{PT} - Project Team Community of Practice

CoP_{S} - Sales Community of Practice

CoP_{T} - Technology Community of Practice

DC - Diagnostic Control

GM - General Manager

HR - Human Resource

IB - Influence Beliefs

IC - Interactive Control

IP - Intellectual Property

Lab – Laboratory

OpCo - The operating company within AusFood where the field work reported in this thesis was carried out

PGC - Promote Goal Congruence

PMO - Project Management Office

RU - Reduce Uncertainty

R&D - Research and Development

SB - Set Boundaries

List of Key Terminology

Boundary objects (Carlile, 2002; Star, 1989; Star & Griesemer, 1989)

- Star (1989) states that boundary objects are one way for communities of practice to solve the heterogeneity problem which is produced by local issues and divergent viewpoints. Boundary objects are artefacts that take on different meanings in different parts of the organisation (functions or levels in the hierarchy) and yet are stable enough to allow organisation action.
- In this thesis I follow communities of practice to see how they use three boundary objects to accomplish management control during product development. These consist of numbers, documents and models.
    - Numbers - include both financial numbers gathered and reported by the firm's accounting system as well as non-financial operational numbers gathered and reported by the marketing, sales, technology and operations departments.
    - Documents - include process documents, marketing and sales reports, project reviews and presentations, as well as strategy and brand plans.
    - Models - include product and packaging samples as well as manufacturing and market trials.

Communities of practice (Wenger, 1998, 2004)

- Groups of people who share an interest and who interact regularly in order to learn how to do it better. Key aspects include;
    - An exposure to common issues or problems (Lesser & Storck, 2001)

    - Sharing a common domain and sense of identity (Wenger, McDermott, & Snyder, 2002)
    - Having a common sense of purpose (Brown & Duguid, 2001)
    - The ability to collaborate directly and learn together (Lave & Wenger, 1991)
- In this thesis communities of practice consist of formal hierarchal communities including; executive managers, functional managers and functional specialists and formal functional communities including; marketing, technology, sales, operations and finance.

Ethnomethodology (Garfinkel, 1967, 2002; Lynch, 1993; Rawls, 2002)

- Ethnomethodology literally means the study of people's methods. It is a sociological discipline which focuses on the ways in which people go about their everyday activities and produce social order in a given context.
- Ethnomethodology is a distinct discipline and is grounded in Durkheim's (1966) fundamental principle of sociology which states that the aim of sociology is to find "the objective reality of social facts." While functional sociology attempts to achieve this through theoretical abstractions and formal quantitative analysis, ethnomethodology is based on the view that social order can only be displayed and recognised by people as they go about their every-day activities.

Management control (Bisbe & Otley, 2004)

- Management control refers to the processes used by organisation members to mobilise resources and action towards some individual or shared interest(s).

- In this thesis management controls are viewed in relation to the activities in which communities of practice take part in during the product development process and the objects they create and re-create to mobilise resources and interact in relation to their individual and shared interests.

The product development process (Crawford & Di Benedetto, 2006)

- The activities undertaken within an organisation from the generation of new product ideas to the launch of these products onto the market.

The role of management control (Davila, 1997, 2000)

- To promote congruence with the firm's strategic and financial goals.
- To reduce uncertainty about technology, the market and project scope.

The style of management control use (Bisbe & Otley, 2004)

- Interactive control systems (Simons, 1995a) are defined in terms of the extent to which managers regularly and personally involve themselves in the decisions and problem solving activities of subordinates. Interactive controls are characterised by;
    - Face-to-face meetings where managers and employees debate information, and challenge assumptions and action plans about the way forward.
    - Interactions that generate organisation learning and shape emerging strategy.

- Diagnostic control systems (Simons, 1995a) are defined in terms of critical performance variables and feedback systems used to monitor outcomes and correct deviations from preset performance standards. Diagnostic control are characterised by;
    - The measurement and monitoring of critical performance variables associated with the organisation's strategy.
    - The way in which they provide motivation, and establish guidelines for corrective action.
    - Project monitoring systems that allow *ex post* evaluation such as
        - Time to market
        - Project cost
        - Product cost
        - Product profitability or gross margin
- Boundary systems (Simons, 1995a) are defined in terms of risks to be avoided and formally stated limits and rules that must be respected. They are characterised by;
    - Management actions which limit the territory in which organisation members can operate.
    - Systems which allow individual creativity within defined limits.
    - Rules and proscriptions in codes of conduct, strategic planning systems, and asset acquisition systems.
    - Emphasis on risks to be avoided.

- Belief systems (Simons, 1995a) - are defined in terms of an explicit set of shared beliefs that define basic values and are used to;
    - Provide guidance to opportunity-seeking behaviour, for example
        - Statement of core values
        - Vision statement
    - Manage purpose, direction and commitment within the organisation.

Chapter 1: Introduction

1.1 Introduction

The objective of this thesis is to provide empirical insight into management control practices in product development with particular reference to the interface between communities of organisation members across different functions and hierarchal levels within the organisation. The specific research questions are:

1) How do communities of practice use management controls during product development?

2) How do communities of practice members accomplish management control during product development?

These questions are examined through an intensive longitudinal field study during which I observe and participate in the daily activities of executive managers, functional managers and product development project team members from marketing, technology, sales, operations and finance departments during the product development process.

I motivate the first research question in Chapter 2, through a review of the literature on product development and management control. The second research question is motivated in Chapter 3, by the literature on practice theory, ethnomethodology, communities of practice and interest, organisation boundaries and boundary objects.

This thesis aims to contribute to the management control literature by extending past research showing how organisation members use management controls during product development. This is done through a detailed examination of the activities which communities of practice at different levels within a firm's hierarchy and across different functions carry out to see how they accomplish management control in this context.

The following sections examine the importance of product development in organisations (Section 1.2), explain what is meant by the term management control (Section 1.3), discuss functional and social management control perspectives (Section 1.4) examine product development (Section 1.5) present three product development types (Section 1.6) outline the product development process (Section 1.7), present the research approach (Section 1.8) and conclude with a review of the thesis (Section 1.9).

1.2 The importance of product development

Success at product development is a critical issue. Research has shown that product introductions are vital to most firms' growth and prosperity (Booz, Allen, & Hamilton, 1982; Cooper, 2001; Kumar & Phrommathed, 2005). The advent of global competition and faster technological development has shortened product life cycles substantially in the past decade (Cooper, 1995). Thus, product development and the successful introduction of products into the market are significant tools used by many firms to enhance their competitive advantage (Kumar & Phrommathed, 2005). As a consequence, pre-manufacturing activities have become more important for management accounting (Dolinsky & Vollmann, 1991). In response to increased competition, firms now place a strong emphasis on first mover advantage, fast product introductions, better product functionality and shorter product life cycles (Davila, 2000). Product development has

become the "*new currency of competition … the key to organic growth, the lever to widen profit margins, the Holy Grail of 21st century business*" (Conlin, 2006:19).

With the increasing importance of product development in many firms there has been a view that this process needs to be coordinated and controlled (see for example, Cooper, 2005; Cooper & Kleinschmidt, 1987; Wheelwright & Clark, 1992; Zirger & Maidique, 1990). This view conflicts with the commonly-held view that control is a constraint to creativity and innovation (see for example, Amabile, 1998; McNair & Leibfried, 1992; Nemeth, 1997; Tushman, 1997). A stream of research in the management control literature has argued that a tight view of management controls is one of the limiting factors in understanding product development activities (Bisbe & Otley, 2004; Davila, 2000). The next section examines management controls and defines how they are viewed in this thesis.

1.3 Defining management controls

It has often been argued in the innovation literature that management controls are needed to keep product development projects on track (see for example, Bonner, 2005; Cooper, 2005; Wheelwright & Clark, 1992). The aim of this section is to examine management control definitions and to describe their use in this thesis.

Anthony (1965:17) develops an early definition of management control;[1] "*the process by which managers ensure that resources are obtained and used effectively and efficiently in the accomplishment of the organisation's objectives*". Langfield-Smith (1997) argues that this definition limited subsequent researchers to envisage management controls as

[1] Also known in the literature as management control systems or MCS (Anthony, 1965), performance management systems (Otley, 1999), organisation control (Ouchi, 1979), and management accounting systems (Davila, 2000).

encompassing the largely accounting-based controls used to plan and monitor activities. Later, researchers describe management controls as processes for influencing behaviour (see for example, Flamholtz, 1983; Flamholtz, Das, & Tsui, 1985; Ouchi, 1979). They suggest that management controls provide a means for gaining cooperation among collectives of individuals or organisation units who may share only partially congruent objectives, and channelling those efforts toward a set of organisation goals. Building on this definition, Otley (1999) suggests that management controls provide information that is intended to be useful to managers in performing their jobs and to assist organisations in developing and maintaining viable patterns of behaviour. More recently Bisbe and Otley (2004) argue that management controls refer to the processes used by organisation members to mobilise resources and action towards some individual or shared interest.

This thesis is based on the definition of Bisbe and Otley (2004) and examines one such process, the product development process, which is argued to have a major influence on the development of products (see for example, Cooper, 2005; Davila, 2000; Wheelwright & Clark, 1992). The focus of this thesis is on the every-day activities of communities of practice and how they mobilise resources and interact during the product development process.

1.4 Management control perspectives

Within the management control literature there is a significant distinction between functional[2] and social[3] based research perspectives (see for example, Nørreklit, Nørreklit, & Israelsen, 2006). The functional view of management control is about technical efficiency and effective organisation performance (Otley, 1994). This view is based on the

[2] Also called the mainstream or positivist perspectives.
[3] Also called the social constructivist perspective.

assumption that information can be transferred without losing its meaning (Galbraith, 1973). In terms of this view information is based on a set of processes, tools, and techniques that make it easily transferable (Marr, 2003). The main limitations of this view are the constructs used to examine the concept of control and the assumption that information can be processed and transformed within an organisation (Carlile, 2004).

The social based research perspective of management control focuses on the way in which people make sense of their experiences at work, based on the assumption that management control emerges from social interactions (see for example, Chua, Lowe, & Puxty, 1989). It acknowledges the implicit nature of much of the knowledge that resides within organisations (see for example, Nørreklit et al., 2006). Its limitation is that it undervalues the role of management control structures in social interactions. However, these structures can shape social interactions. This can be seen in the rules of a game which give a game structure and influence the social interactions that take place. To play a game people have to play by a set of rules which need to be in a form the participants understand. The rules help to set the scene where the action takes place. The rules set out a certain taken-for-granted order which allows the actions which take place to be understood by people as they play the game (Rawls, 2002). This does not mean that the rules exist in a vacuum, only that the rules and the playing of the game cannot be separated. The rules of the game may even change but this change must be recognised and understood by those who play the game. Taylor (1993:57-58) has explained this relationship by stating that;

> *in its operation, the rules exist in the practice it 'guides'…. The practice not only fulfils the rules, but also gives it concrete shape in particular situations….In fact, what this reciprocity shows is that the 'rule' lies essentially in the practice. The rule is what is animating the practice at any given time, not some formulation behind it, inscribed in our thoughts or our brains or our genes or whatever. That is why the rule is, at any given time, what the practice has made it.*

This thesis builds on this idea by examining management controls in a way that includes both the functional and social perspectives. This is done by using practice theory. Practice theory pays particular attention to both the organisation settings and the actions of organisation members by examining the context in which practice takes place (Bourdieu, 1977; Garfinkel, 2002; Latour, 1999b; Law, 1992). In recent years research has assimilated and used the work of two practice theories, Bourdieu's (1977) structural constructivism (see for example, Carlile, 2002, 2004; Goddard, 2004; Neu, 2006) and Latour and Callon's (Callon, 1987; Latour, 1999b) actor-network theory (see for example, Briers & Chua, 2001; Cuganesan & Lee, 2006; McLean & Hassard, 2004; Mouritsen, Larsen, & Bukh, 2001). This thesis is informed by a third practice theory, Garfinkel's ethnomethodology, which is the study of the methods that people use to create order in a given context (see for example, Garfinkel, 1967, 2002; Lynch, 1993; Rawls, 2002).

I use ethnomethodology instead of structural constructivism or actor-network theory as ethnomethodology informs an understanding of the methods organisation members use to create order during their every-day practice. As this study seeks to explain the methods communities of practice use in their every-day practice to accomplish management control ethnomethodology seemed to be the most suitable approach. In particular this thesis seeks to understand the methods communities of practice use to mobilise resources and interact during the activities they carry out during the product development process.

While my research revealed no field studies in the management accounting literature that are explicitly based on ethnomethodology, Jönsson and Macintosh (1997:367) argue that ethnomethodology could be a "*valuable way to understand the way accounting works in actual organizational settings*" but that it also needs to be "*induced to work more closely to*

current theoretical discourses." This thesis uses an ethnomethodology informed field study to connect the use of management control and the ways in which it is accomplished by communities of organisation members in a product development setting to the theoretical categorisations of control proposed by Davila (2000) in relation to goal congruence and uncertainty reduction, and Bisbe and Otley (2004) in relation to the style of management control, which is based on Simons' (1995a; 1995b) levers of control. These theoretical categories are examined in Chapter 2 while an overview of ethnomethodology is presented in Chapter 3.

1.5 Product development

Product development is a broad field of endeavour dealing with the generation, design, creation, marketing and launch of products (Crawford & Di Benedetto, 2006). It involves the "*transformation of a market opportunity and a set of assumptions about product technology into a product available for sale*" (Krishnan & Ulrich, 2001:1).

The focus of this thesis is on individual projects within a single firm and not the wider area of innovation which addresses issues at a firm or industry level. It includes the generation of new product ideas as well as the screening, development and launch of new products, processes and business models.

For some products, such as chemicals and glass, the product and process are inseparable. However, for most manufactured goods the product and the process by which it is manufactured, even though easy to separate, are both crucial technical parts of product development. From a business model perspective the concept of a new product includes a change in the target product market. This is because when a firm sells an existing product

into a new market changes to the packaging and sometimes even the ingredients are necessary.

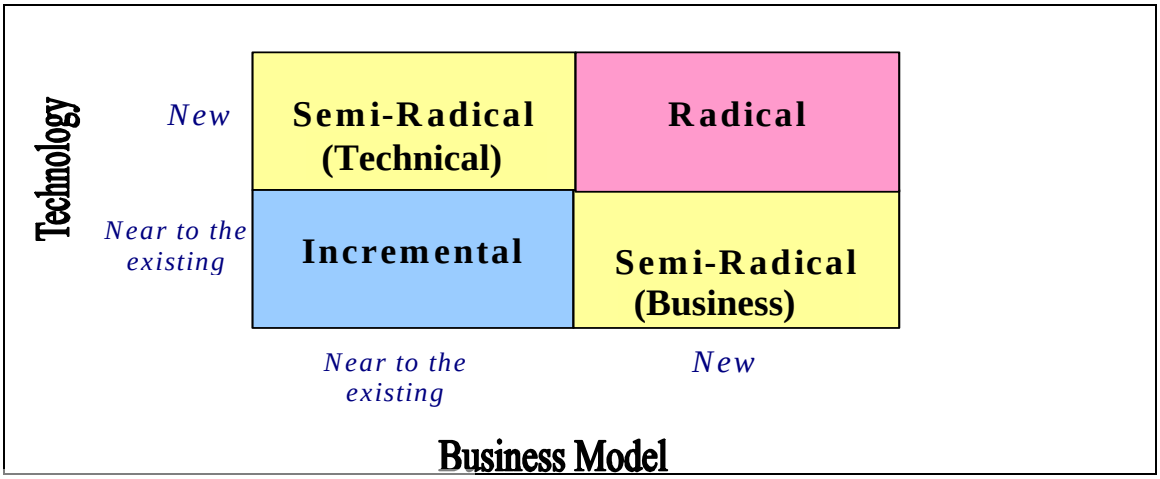
Research suggests contextual variables affect organisations (Abernathy & Utterback, 1978; Bart, 1988; Burgelman, 1983; Burns & Stalker, 1961; Galbraith, 1982). A key contextual variable in product development is the types of product development projects a firm carries out. This is highlighted by Rice et al (1998:52) who state 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*." The following section examines three different product development project types.

1.6 Product development project types

In the product development literature, projects are often classified on a scale from incremental to radical. According to Ettlie and Subramaniam (2004:97) incremental innovations "*are a result of refining prevailing knowledge*" whereas radical innovations "*arise because prevailing knowledge gets transformed*."

Davila, Epstein and Shelton (2006) use a matrix to illustrate the interplay between technology and business models and to develop a framework of different product development project types (see Figure 1). This framework provides a way of understanding why different product development project types may need to be managed in different ways. Davila et al (2006:39) argue that it is vital to understand the type of product innovation so that the innovation can be "*managed, funded and resourced appropriately*."

Figure 1: Framework of Product Development Project Types



Source: based on Davila et al (2006:39)

The categorisation scheme of Crawford and Di Benedetto (2006) provides examples of these three product development project types (see Figure 2).

Figure 2: Examples of Product Development Project Types

Incremental product innovations
- New product variety - additions to an existing product line or line extensions in the firm's current market

Semi-radical (business) product innovations
- Current products in new markets

Semi-radical (technical) product innovations
- New product lines - products that take a firm into a new segment of a market in which they already operate

Radical product innovations
- New product category - inventions that are based on a new technology and create a whole new category that did not exist before

Source: based on Crawford and Di Benedetto (2006)

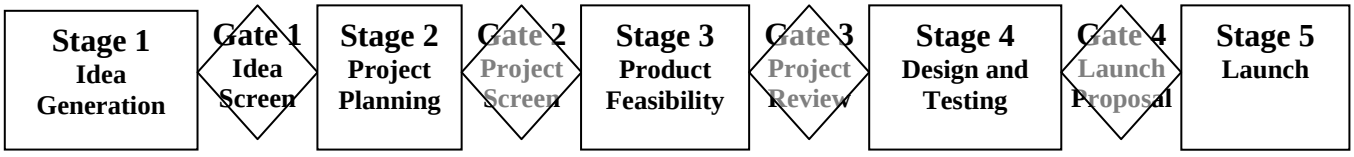
Incremental innovations include products that add to a group of existing products such as a new product variety. Radical innovations, on the other hand, are products that are based on a new technology and create a new category that did not previously exist. In other words,

incremental innovations lead to small improvements in existing products and business processes while radical innovations result in products delivered in entirely new ways. Between incremental and radical innovations are semi-radical innovations. These innovations include either a new technology or a new business model. Thus, they include products that add a new product line which requires the firm to develop some new technology or current products launched in a new market which requires a different business model**.** Semi-radical innovations involve substantial changes to either an organisations business model or its technology and they occupy the space between these two extremes.

1.7 The product development process

Organisations manage the development of new products by mapping the product development process from idea generation through to product launch (see for example, Barnett & Clark, 1998; Cooper & Kleinschmidt, 1993; Wheelwright & Clark, 1992). Cooper (2005) suggests that this helps to reduce risk and ensures completion of activities, thus bringing discipline to an otherwise chaotic, ad hoc activity. The product development process is made up of stages (sometimes called phases) and gates (also known as decision points) though which projects pass (see Figure 3).

Figure 3: The Product Development Process



The product development process starts by generating ideas (Stage 1) from both internal and external sources. This is followed by an idea screen (Gate 1) at which managers decide which projects have the most potential. These projects then proceed to project planning (Stage 2) where product concepts are generated. Following this is a project screen (Gate 2) where managers decide which projects have the best chance of success. This is necessary as most firms have limited resources to carry out the more detailed product feasibility, design and testing work. At product feasibility renew (Stage 3) technical, marketing and financial information is collected and a preliminary product design plan, budget and project team is put in place. These are then reviewed (Gate 3) by management. The best projects proceed to design and testing (Stage 4) where technical specifications and deliverables are examined, tested and validated along with marketing strategies and launch plans. The project is then presented to the managers who evaluate the launch proposal (Gate 4). The final stage is the product launch (Stage 5) where the product is manufactured and delivered to customers.

1.8 Research approach

This thesis reports on an intensive longitudinal field-based study conducted at an operating company (called *OpCo* in the thesis) of a leading Australasian multinational food company (AusFood). I chose a field-based study as it enables a close-up view of both the product development process and the way in which interactions between communities of practice takes place. It also informs an understanding of management control through an appreciation of meaning in context. This is supported by Otley (2001:256) who argues that "*intensive, field-based methods are much more likely to pick up on the wide variety of control mechanisms deployed by organizations in practice*."

I saw the food industry as appropriate to examine the use of management controls during the product development process. Many food products have short life cycles, which means that product innovation is an ongoing activity in these companies (Brody & Lord, 2000). New products are important in this industry as growth and survival depends on the introduction of new products (Earle & Earle, 2001). This high level of innovation activity enabled me to follow a number of product development projects in a relatively short period of time.

The field study was conducted over a nine-month period using participant observation (see Chapter 4.4 for more details) of product development activities within the firm, from the generation of ideas through to the launch of new products. To answer the research questions I followed the activities which communities of practice carried out during the product development process. This included observations of eight product development projects during the nine months including three incremental, three semi-radical and two radical projects. During the product development process I observed members of different functional communities (technology, marketing, sales and operations) as well as different hierarchal levels (executive managers, functional managers and functional specialists) within the organisation during both formal and informal activities.

1.9 Outline of the thesis

The rest of the thesis is set out as follows. Chapter 2 presents a review of the literature on management control and product development to motivate the first research question. It starts with a review of the product development literature and the methods used to understand the activities that take place during the development of new products. It then reviews the management control literature which focuses on product development and the

more general research and development context. The chapter then summarises this literature and presents the first research question.

Chapter 3 motivates the second research question by building a practice theory perspective, which is informed by ethnomethodology (Garfinkel, 1967, 2002; Lynch, 1993; Rawls, 2002). Ethnomethodology is used to gain a view of the organisation structure and the context in which communities of practice interact. This chapter links ethnomethodology to the use of knowledge in practice which is understood through communities of practice (Wenger, 1998) and community of interest (Fischer, 2001a) concepts. The chapter shows that the existence of communities of practice creates knowledge gaps or boundaries within an organisation (Carlile, 2004) which communities of practice overcome through the use of boundary objects (Star, 1989). The final sections summarise the chapter, present the second research question and draw some conclusions about how this helps form an holistic understanding of management controls in practice.

Chapter 4 outlines the field site and the empirical material collected. It then presents the ethnomethodology-informed participant observation research method used to examine the activities that take place during product development. The chapter then presents an overview of the field study site including the operations, the organisation structure, the communities of practice, the boundary objects used and the product development process. This chapter also discusses issues such as site access, confidentiality and ethics and ends with a summary.

Chapters 5 and 6 report on the activities communities of practice carried out during the field study. They examine the role of management controls and the style in which they are

used and set out the ways in which communities of practice use boundary objects to accomplish management control in practice. Chapter 5 focuses on the first half of the product development process which includes activities related to the generation of new ideas and project selection, while Chapter 6 focuses on the second half of the product development process which includes activities related to product feasibility, design and launch of new products.

Finally, Chapter 7 concludes by showing how communities of practice accomplish management control through the use of boundary objects during product development. It analyses the use of numbers, documents, and models for each product development project type. It them examines the role of control and the differences between each of the hierarchal communities of practice as well as the style in which communities of practice use management controls. It concludes by outlining the contributions the thesis makes to management control research, indicates the limitations of the study and offers suggestions for future research.

Chapter 2: Literature Review: Product Development and Management Control

2.1 Introduction

As mentioned in Chapter 1 the first research question is;

> 1) How do communities of practice use management controls during product development?

This chapter motivates this question through a review of the literature on product development and the use of management controls in this context. Section 2.2 presents an overview of the product development literature to set the context for the study. The next section (2.3) examines an important aspect of product development, namely the types of product development projects and how they can be managed. This is followed by an analysis of the literature dealing with the use of management controls in product development, and a general research and development context (Section 2.4). The chapter concludes with a summary (Section 2.5) and a restatement of the first research question (Section 2.6).

2.2 The product development literature

This section presents an overview of the product development literature, as informed by the literature review of Brown and Eisenhardt (1995) with a view to better understanding the product development context. To gain an understanding of the extensive literature on

product development this thesis examines three streams of research that they review. The first stream of literature views product development as a rational plan and examines how various elements within an organisation are related to product success. A second stream of literature concentrates on the ways in which organisation members communicate during the product development process. This includes both product development team communications and the way in which product development teams communicate with those outside the team like managers, suppliers and customers. A third stream of literature presents product development from a problem-solving perspective.

The different perspectives of product development in these three streams contribute to an holistic view of product development. The following sections review each of these streams; examine methodological issues raised by the studies, and assess the implications for this thesis.

2.2.1 Rational plan stream

The rational plan stream of research takes the view that successful products come from a rational organisation process (see Brown & Eisenhardt, 1995). These studies show that if "*a product is well planned, implemented, and appropriately supported it will be a success*" (Brown & Eisenhardt, 1995:348).

This perspective is based on the work of Myers and Marquis (1969), and Rothwell et al (1972; 1974). It has been promoted by Cooper (1979), Cooper and Kleinschmidt (1987; 1990; 1993), and more recently by Song and Perry (1996; 1997a; 1997b), Cooper, Edgett and Kleinschmidt (2004a; 2004b; 2004c), Cooper (2005), Millson and Wilemon (2006) and Swink and Song (2007).

These studies typically examine the success of new products in relation to the market, product features, communication, the role of top management and the role of project teams. The aim of these studies is to come up with a list of factors shown to be related to some measure of success. [4] This research shows that successful products are more likely when;

- A product has market-place advantages (see for example, Im & Workman Jr, 2004; Li & Calantone, 1998; Song & Parry, 1997a)
- There is a product development process which involves a well-thought-out set of activities (see for example, Cooper & Kleinschmidt, 1987, 1990).
- The firm uses well-coordinated cross-functional teams (see for example, Millson & Wilemon, 2006; Myers & Marquis, 1969; Song & Parry, 1996).
- Product attributes are aligned with market needs in relation to quality, cost, and product features (see for example, Cooper et al., 2004a; Cooper et al., 2004b; Cooper et al., 2004c; Cooper & Kleinschmidt, 1987).
- Marketing and manufacturing are integrated (see for example, Swink & Song, 2007)
- Marketing and R&D are integrated (see for example, Song, Thieme, & Xie, 1998)
- Top management is involved in executing the product development plan and evaluating projects (see for example, Cooper, 2005).

This stream of research suffers from several problems. The first is their use of large-scale questionnaire surveys or structured interviews with single informants. These informants, usually managers, are asked to quantify judgments about a product development project from a long list of internal and external factors, often long after the product has been launched. The reason for the time lag is the need to see how these factors affect financial success or market share so as to measure product success. Secondly, these surveys and

[4] Most studies use financial or market data to measure success although Song and Perry (1996; 1997a; 1997b) are exceptions as they use manager ratings of overall success.

interviews are not driven by hypotheses (a recent exception to this is Swink & Song, 2007) but test for many factors to see which ones correlate with product success. While these studies can say that their findings are related to product success they cannot say why or how these factors help product development.

2.2.2 Communication web stream

The communication web research centres on the communication practices of project teams during the product development process (see Brown & Eisenhardt, 1995). According to Brown and Eisenhardt (1995:354) "*the underlying premise is that communication among project team members and with outsiders stimulates the performance of development teams*." Instead of examining a wide range of issues during product development, as in the rational plan stream, this research is focused solely on communication.

This stream of research is based on the work of Allen (1971; 1977) and Katz and Tushman (1981) and has since been promoted by Von Hipple (1986), Ancona and Caldwell (Ancona & Caldwell, 1992a, 1992b), Dougherty (1990; 1992) and more recently by Dougherty (2001), Hoegl and Wagner (2005) and Bonner (2005).

These studies typically examine how communication takes place within a project team and between the project team and managers, customers and suppliers. They measure success in terms of manager perceptions. The aim of these studies is to better understand how project team members communicate both within the team and with outsiders. This research shows that successful products are more likely when;

- Project team members communicate with people from outside the firm (Allen, 1971, 1977).

- Project teams have “gatekeepers” who are organisation members which bring information from outside sources into the organisation and disperse it to fellow project team members (Katz & Tushman, 1981).
- Project teams communicate with key customers (Bonner, 2005; von Hipple, 1986) and suppliers (Hoegl & Wagner, 2005) regarding better product design.
- Project team members communicate more with outsiders who have similar functional backgrounds (Ancona & Caldwell, 1992a, 1992b).
- Project teams combine their perspectives in highly interactive ways, thus increasing information content (Dougherty, 1990, 1992).
- Work is organised through communities of practice who concentrate on problems associated with that group (Dougherty, 2001).

This focus on communication results in a good understanding of a small part of product development. This stream of research, though, suffers from several problems. The first is that because it is so narrowly focused on communication it ignores important factors such as market-place advantage, the product development process and product attributes which are shown to be important in the rational plan studies. Thus, this stream may not capture how different types of communication may be needed for different types of product development projects. A second problem is that the research is based on an information processing (Galbraith, 1973; Lawrence & Lorsch, 1967) view of communication (an exception to this is Dougherty, 2001). Carlile (2002; 2004) has shown that this view of communication is limited in explaining how organisation members communicate across organisation boundaries (see Chapter 3.5).

2.2.3 Disciplined problem solving stream

The third and final stream is known as the disciplined problem solving approach (see Brown & Eisenhardt, 1995). This stream views product development as a "*balancing act between relatively autonomous problem solving by the project team and the discipline of a heavyweight leader, strong top management, and an overarching product vision*" (Brown & Eisenhardt, 1995:359). These studies measure product success in relation to time-to-market, productivity and quality.

This stream of research is based on the field-based study of Imai, Ikujiro and Takenuchi (1985) and has since been promoted by Clark, Chew and Fujimoto (1987), Clark and Fujimoto (1991), Womack, Jones and Roos (1990), Iansiti (1993) and more recently by Eisenhardt and Tabrizi (1995), Kusunoki, Nonaka and Nagata (1998) and Yasumoto and Fujimoto (2005).

These studies carry out field research in successful organisations and report on the practices they use for developing successful new products. They follow a wide range of organisation activities related to cross-functional project teams, external supplier and customer networks, and the activities of top managers. These early studies find that successful products come about through the use of;

- Extensive supplier networks (see for example, Clark et al., 1987; Imai et al., 1985).
- Cross-functional teams for problem solving (see for example, Clark & Fujimoto, 1991; Imai et al., 1985).
- Subtle control[5] by top management - which acts as a balance between ambiguity and control (Imai et al., 1985).

[5] Defined as a balance between an emphasis on the firms' vision and objectives and autonomy for project teams

- Heavy-weight project managers who are both part of development teams and work with top managers (see for example, Clark et al., 1987; Clark & Fujimoto, 1991).
- Overlapping product development phases (see for example, Clark & Fujimoto, 1991; Imai et al., 1985).

The more recent studies by Eisenhardt and Tabrizi (1995) Kusunoki, Nonaka and Nagata (1998) and Yasumoto and Fujimoto (2005) suggest that some of the organisation activities presented in the earlier studies do not always lead to successful products. Instead these studies find that;

- Overlapping product development phases for radical product development projects have a negative effect on performance (Eisenhardt & Tabrizi, 1995).
- The use of cross-functional teams can inhibit organisation learning if there are no mechanisms for this knowledge to be shared with other organisation members (Kusunoki et al., 1998; Yasumoto & Fujimoto, 2005).

These findings show that the context in which product development takes place influences organisation activities. Thus, the organisation activities used to develop incremental products in mature market segments may differ from the organisation activities needed to develop radical products in new market segments.

A problem with the early studies in this area was that they did not explain how cross-functional project teams worked together and how these teams communicated with top managers (see for example, Clark & Fujimoto, 1991; Imai et al., 1985). These issues are addressed by more recent research which shows how cross-functional teams learn (see for example, Kusunoki et al., 1998; Yasumoto & Fujimoto, 2005). Another potential

weakness of this research stream is its use of constructs such as subtle control, product vision, and system focus. The use of these constructs may reflect the complexity of the issues firms face during product development. However, as this stream is based on field research it can examine organisation issues in more depth than the rational plan stream, and has a broader scope than the communication web stream.

2.2.4 Conclusion

From this review of the product development literature the following issues stand out. The rational plan research stream shows the importance of examining the activities which project teams and top management take part in during the product development process. While this literature presents an holistic approach to this area it has be criticised for its lack of theoretical rigour (see Brown & Eisenhardt, 1995; Davila, 1997).

The communication web research stream shows the importance of communication both between members within the project team but also between the project team and managers, suppliers and customers. The examination of this area has helped set the scene where management controls take place as these can only take place within the functions and between the hierarchies within the firm.

Finally the disciplined problem solving literature stream of research shows that it is important to understand the balance between control and creative problem solving. It argues that successful product development involves cross-functional teams who are connected to supplier networks so that the firm can respond to customer needs quickly. The recent conflicting findings within this area show that the type of product development

project may influence the types of activities and the way in which they are carried out during the product development process.

2.3 Product development project types and management controls

Different types of product development projects, which are outlined in Chapter 1 (see Figure 2, on page 9), come about because projects face different environmental factors. Hence, the way in which management controls are used for different types of projects may differ. The following sections examine this in relation to three project types; increment, semi-radical and radical.

2.3.1 Incremental projects

Incremental projects are close to the firm's current product range and thus reinforce prevailing market structures and competitive positions and strengthen existing barriers to entry (see for example, Abernathy & Clark, 1985; Iansiti, 1995a; Iansiti, 1995b). According to Ettlie and Subramaniam (2004) the predominant emphasis when managing these projects is on precise planning, economically allocating resources and proficiently structuring and coordinating activities. Iansiti (1995a:38) suggests that when managing incremental projects, firms need to make sure that the

> *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 organisational structures.*

2.3.2 Radical projects

Radical projects, on the other hand, are far from a firm's current products as they include both new technology and a new business model. Thus, the environments these types of projects have to deal with is not stable (Tushman & Andersen, 1986). Rice et al (1998:54) use the analogy of a river winding its way to the ocean to describe the highly unpredictable and uncertain nature of radical projects.

> *Like a river, they have a general direction but don't get there directly. Sometimes they dry up to only a trickle, sometimes they go underground, and at times they spill over and flood. They not only make twists and turns but also sometimes give rise to new streams. However, like a river, they are generally constrained by their environment.*

Radical projects are generally characterised 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 projects may not be suitable for radical projects until uncertainty is sufficiently reduced.

Iansiti (1995a) highlights that in cases where much new technical and market information will emerge during the typical 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. Consequently, the development process should be characterised by flexibility and responsiveness so that the people involved in the project have the ability to gather and respond to new knowledge about technical and market information as a project evolves. Iansiti (1995a:38) adds that

> *the flexible approach is not simply a function of hiring creative individuals or of implementing an organic organisational 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 organisation can react to such changes.*

2.3.3 Semi-radical projects

Semi-radical projects involve an incremental aspect based on the firms existing competencies and a radical aspect which involves a reasonable amount of new knowledge (Davila et al., 2006). Thus, these projects require a mix of management styles that are both rule based and restrictive as well as flexible and responsive to new knowledge.

2.3.4 Conclusion

The research reviewed in this section suggests that incremental projects require management controls that impose limits to organisation members' freedom. Thus management controls may need to be clearly planned, outlining the rules and procedures for organisation members to follow. For radical projects management controls may need to be more flexible, allowing organisation members to understand and respond to the novel conditions. Finally, the management controls required to manage semi-radical projects may need to include some clear rules and procedures while at the same time being able to respond quickly to novel conditions in relation to either the business model or technology as these projects contain aspects of both incremental and radical innovation.

2.4 Management control in product development

This section reviews the research on management controls in an innovation context. This literature can be split into two streams. The first stream focuses on management control in R&D departments while the second stream examines management control in relation to the product development process.

2.4.1 Literature on management control in research and development (R&D)

The first stream of research in this area concentrates on the use of financial controls in R&D departments (Rockness & Shields, 1984, 1988) and generally finds that they do not play a significant role in this context. Rockness and Shields (1984) do include some non-financial controls and state that these control mechanisms might be more appropriate in this context.

Abernethy and Brownell (1997) extend this research stream by dividing management controls into three groups; financial, behavioural and personnel. They survey the use of these controls in an R&D setting and find that financial control only has a significant effect when uncertainty is low. Their study also finds that personnel control, which includes the use of selection and training procedures, has the largest effect while behaviour control, which includes procedure guides, operating manuals and job codification, has little or no effect.

A limitation of this stream of research is that it examines only a few possible control devices. Since these studies are based on survey data the management controls examined are chosen by the researchers while the firms may use management controls for which the researchers could not test. Finally, they could not examine interdependencies between the

different types of controls as survey research examines the use of controls at only a single point in time.

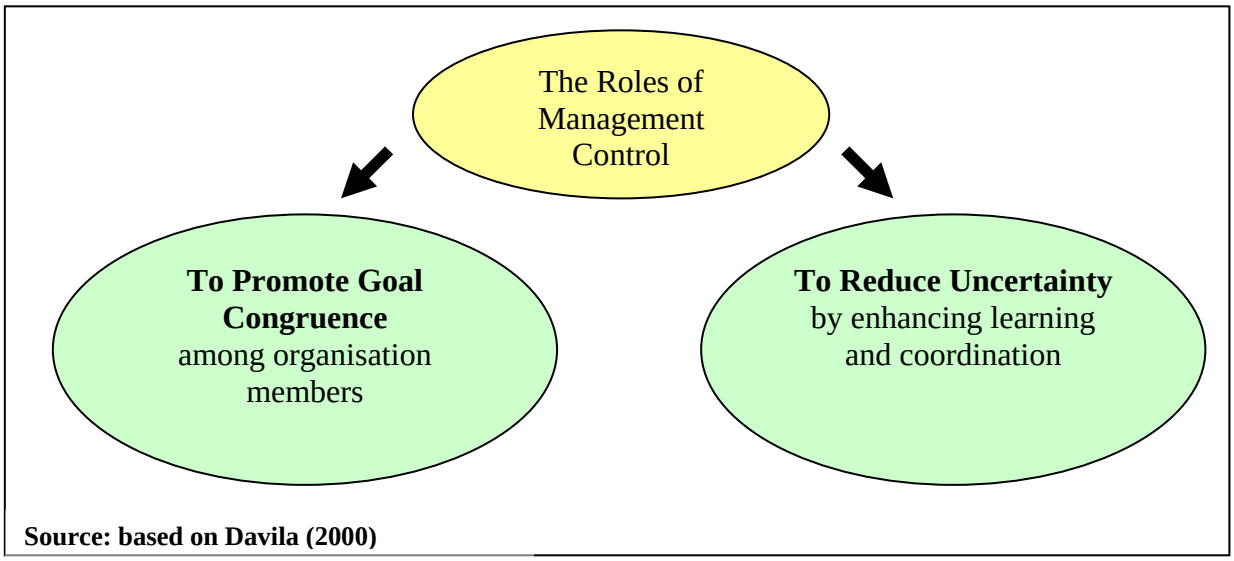
2.4.2 Literature on management control in product development

More recently a second stream of research has taken a wider view of product development and concentrated on processes used during product development such as budgeting and the balanced scorecard (Bisbe & Otley, 2004) and the product development process (Bisbe & Otley, 2004; Bonner, Ruekert, & Walker Jr, 2002; Davila, 2000; Hertenstein & Platt, 2000). This mirrors the product development literature where the focus has changed from a narrow departmental focus to a wider organisation view of product development (see for example Cooper et al., 2004a; 2004b; 2004c; Ernst, 2002; Krishnan & Ulrich, 2001).

Hertenstein and Platt (2000) carry out an exploratory study of management controls in product development. They focus on three management control mechanisms; the position of product development in the organisation structure, the product development process and product development performance measures. They find that the product development function reports to a senior executive in most firms and can influence and be influenced by the firms' strategy. They also find that while most firms have a well-articulated product development process, it is not often linked to strategy. Finally they find that most firms do not have any performance measures for product development and those that do have some measures do not think they were linked very well to strategic goals. While this study is a good overview of current practice in the product development area it does not contribute to a theory of management control.

Davila (2000) examines the relationship between uncertainty, product strategy and management controls. He shows that management controls can have two roles (see Figure 4); the first is the traditional role of promoting goal congruence among organisation members while the second is to reduce uncertainty by enhancing learning and coordination (Davila, 2000).

Figure 4: The Roles of Management Controls



Source: based on Davila (2000)

Davila's (2000) motivation is to show why the innovation literature has generally disregarded the use of management control in product development and to show how management controls may add value in practice. He proposes that the reason that they disregard the use of management controls is that they assume that the role of management control is to promote goal congruence among organisation members in relation to the firm's strategic and financial goals. Davila (2000) argues that in addition to the promotion of goal congruence organisations also need an "information infrastructure." This, he argues, is needed to help project managers obtain the information they need reduce uncertainty. As these managers do not possess all the knowledge in the firm, they need to

collect information both from inside and outside the firm and to communicate with other organisation members who have knowledge of specific product development projects.

Davila (2000) develops a theoretical framework based on Galbraith's (1973) concept of uncertainty and proposes that as uncertainty increases project managers collect information from a wider range of sources instead of trying to promote goal congruence.

He examines this role through the use of field-based interviews with project managers, marketing managers, R&D managers and general managers in twelve business units, which he follows up with a survey of fifty six project managers in the medical instruments industry. The focus of both the survey and the interviews with managers was on the design stage of the product development process. Davila (2000) argues that this is the most likely time for project managers to use management controls to reduce uncertainty. Davila (2000) finds that management controls take on an uncertainty reducing role during the design stage as organisation members gather and communicate information.

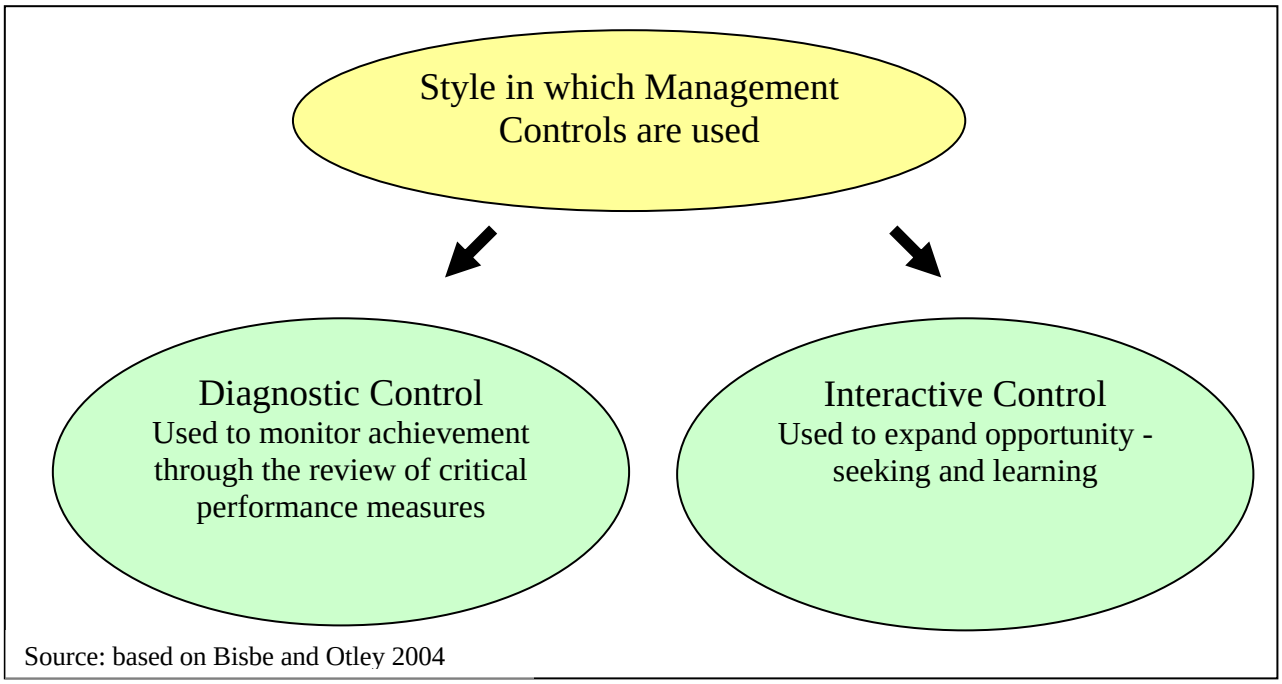
Davila's (2000) study contributes to our understanding of management control in product development by showing that management control can take on an uncertainty reducing role. This study, though, is partial in that it examines only this role of management control. It also examines only one part of the product development process, the design stage, and does not differentiate between different types of product development projects which have different product attributes. An understanding of product attributes has been shown to be important in the rational play stream of the product development literature.

In this thesis the role of management control to promote goal congruence in a product development context is defined in terms of overall firm strategic goals and financial goals. Thus, when the focus of communities of practice is on these goals the role of management control is argued to be concerned with promoting goal congruence. Conversely the role of management control to reduce uncertainty is defined in terms of the information communities of practice collect and analyse to determine how better to understand a product development project. Thus, when the focus of communities of practice is on collecting and analysing information they are argued to be concerned with reducing uncertainty.

Bisbe and Otley (2004) examine a wide range of controls including budgets, the product development process and the balanced scorecard. This paper is also motivated by the inconsistent findings in the innovation literature which the authors argue views management controls mainly in relation to diagnostic control. Bisbe and Otley (2004) suggest that the style in which management controls are used may explain the divergent views of management control in the innovation literature. Bisbe and Otley (2004) use Simons' (1995b) interactive and diagnostic levers of control (see Figure 5) to study the effect that management controls have on innovation and organisation performance. According to Simons (1995b:95)

> *Diagnostic control systems are the formal information systems that managers use to monitor organisational outcomes and correct deviations from present standards of performance while interactive control systems are formal information systems managers use to involve themselves regularly and personally in the decision activities of subordinates.*

Figure 5: Styles of Management Control Use



Source: based on Bisbe and Otley 2004

Bisbe and Otley (2004) argue that those studies that find management controls are not important during product development may be partial to the extent that they focus on management controls used in a diagnostic style. Their study finds that management controls have a positive effect on a firm's performance when management controls are used in an interactive style (Bisbe & Otley, 2004). They argue that this is because interactive controls can be used to expand opportunity-seeking and learning which helps managers in making informed decisions.

Although these styles of control are informed by a top management perspective they are used in this thesis to inform an understanding of the interactions that take place between different levels within a firm's hierarchy. As stated in Chapter 1 the focus of this thesis is on the interactions that take place between communities of practice in relation to individual

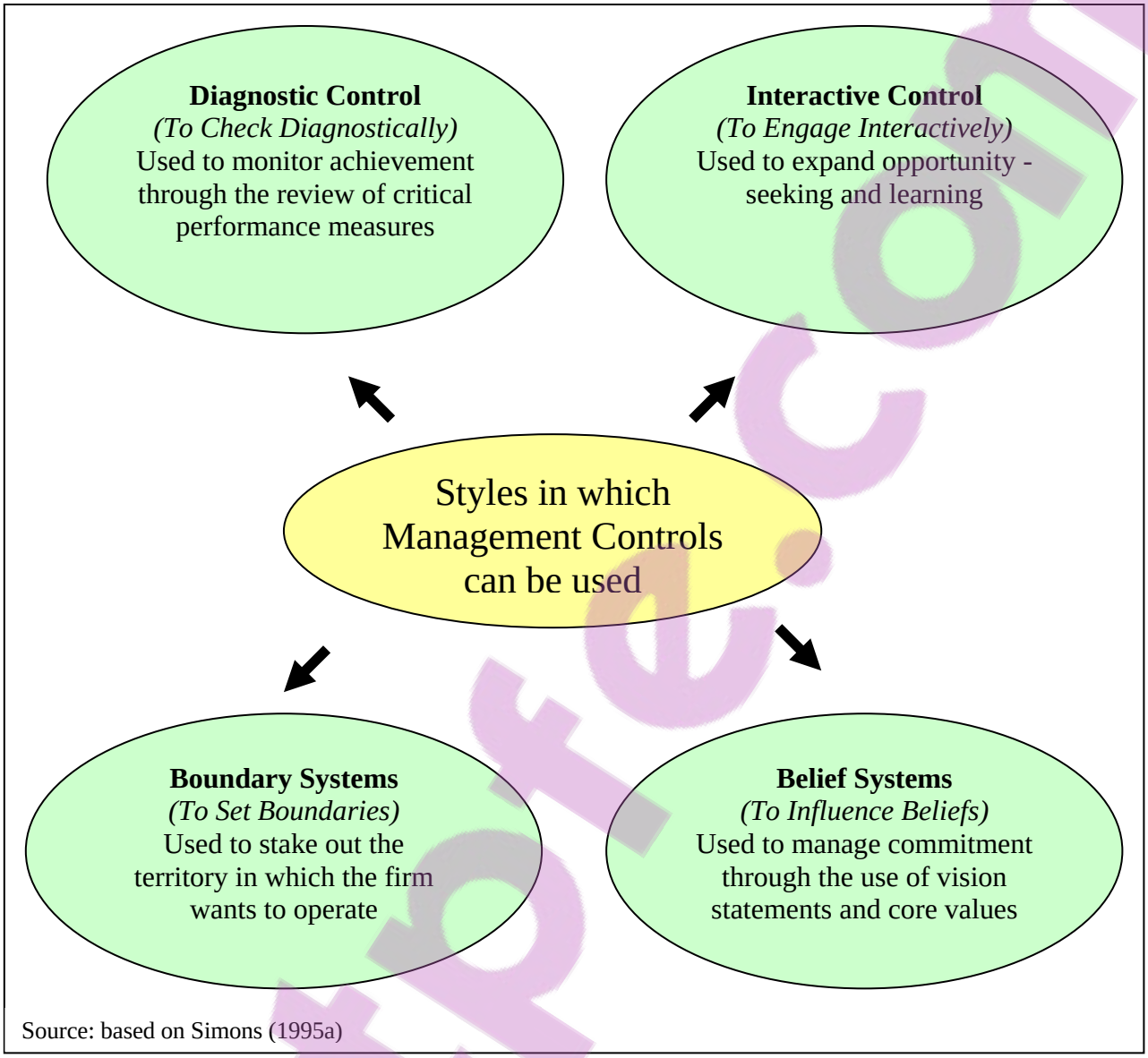
projects within a firm from the generation of new product ideas to the launch of new products onto the market.

Simons (1995a; 1995b) defines interactive control as a style of management control where managers engage interactively and regularly involve themselves in the decisions and problem solving activities of subordinates (see Figure 6). This style of management control is argued to be used when communities of practice; focus on organisation learning, use data about organisation processes, and engage in face-to-face meetings where they use information to challenge assumptions and debate action plans about the way forward.

Simons (1995a; 1995b) defines diagnostic control as a style of management control where managers check diagnostically critical performance variables in the form of quantitative data (see Figure 6). This style of management control is argued to be used when communities of practice; use feedback systems to monitor outcomes, establish guidelines for corrective action, use project monitoring systems that include information on time-to-market, project cost, product cost and profitability. While face-to-face discussions may take place in the firm concerning these diagnostic criteria this does not signify the use of interactive control but instead just an intensive use of diagnostic controls.

Simons (1995a; 1995b) defines boundary systems as a style of management control where managers actively set boundaries which limit the territory in which communities of practice can operate (see Figure 6). This style of management control is argued to be used when communities of practice; design and use systems which help the firm avoid risks but also allow creativity within defined limits.

Figure 6: Management Control Styles of Use



Source: based on Simons (1995a)

Simons (1995a; 1995b) defines belief systems as a style of management control where managers influence beliefs through the creation and use of a vision statement and core values (see Figure 6). This style of management control is argued to be used when communities of practice actively manage purpose and commitment and give directions which provide guidance to opportunity seeking behaviour.

Finally, Bonner et al (2002) examine six types of control mechanism which they classify as either formal controls or interactive controls. The formal controls they examine are process controls such as the product development process, output controls such as budgets, and team rewards (Bonner et al., 2002). The interactive controls were based on Simons (1994) and are operationalised in terms of team strategic control influence, team operational control influence and management intervention (Bonner et al., 2002).

They survey ninety five product development professionals to see which of these controls they use in practice and the effect these controls have on project performance. The findings suggest that while interactive control is important it needs to be done early in the product development process. Once projects have reached the design stage the findings suggest that interactive controls have a negative effect on product performance. The findings also suggest that formal controls are important at the start of new projects but should not be used extensively. These results were consistent across both incremental and radical projects.

Bonner et al (2002) contributes to the research in this area by examining a wide range of controls used in practice in relation to both incremental and radical project types. The management control constructs examined are based on the literature although the extent to which the interactive control constructs follow Simons' interactive controls has been a topic of recent debate (see, Bisbe, Batista-Foguet, & Chenhall, 2007). Their study, though only examines management controls in relation to the goal congruence role of management control and not the use of controls to reduce uncertainty (see Davila, 2000).

The findings of Bonner et al (2002) are not consistent with the findings of Bisbe and Otley (2004) as Bonner et al (2002) show that management controls used in an interactive way are not always beneficial. Bonner et al (2002) show that while interactive control may have a positive effect during the early part of the product development process it can have negative consequences during the later part of the process. Thus, there is still debate as to which style of management control is appropriate during the product development process. This thesis addresses this inconsistency by examining all the stages and gates during the product development process to explain the way (s) in which organisation members use management control in practice.

Another limitation of the studies by Bonner et al (2002) and Bisbe and Otley (2004) is that they do not examine all of Simons' (1995a; 1995b) levers of control. While boundary and belief systems may not be thought of as styles of control, Simons (1995b) argues that these are an integral part of a management control structure. Simons (1995a; 1995b) states that to influence beliefs managers need to communicate both core values and a shared vision to organisation members within the company. These beliefs are generally broad and designed to appeal to all organisation members. Thus, organisation members need to be able to see these key values practiced within the firm. As for boundaries, Simons (1995a; 1995b) states that managers need to set out the areas in which organisation members are permitted to operate. The aim is to allow employees to create and define new solutions and methods within defined constraints (Simons, 1995a, 1995b).

2.4.3 Conclusion

This thesis adds to the studies by Hertenstein and Platt (2000), Davila (2000), Bonner et al (2002) and Bisbe and Otley (2004) and contributes to the literature on management

controls in product development by examining the role of management controls in relation to both the promotion of goal congruence and uncertainty reduction during each stage and gate of the product development process as well as the four styles (Simons, 1995a, 1995b) in which management controls are used by communities of practice in relation to the activities that take place during the product development process.

2.5 Summary

This chapter has reviewed the literature that deals with product development and management controls by reviewing the product development literature and by examining the use and effect of management controls in this context. It has also shown that different types of product development projects may need to be managed in different ways.

From the review of the product development literature it can be seen that many factors influence product development. The rational plan stream stresses the involvement of senior managers, the use of cross-functional teams and the effect of product attributes during the product development process. The communication web stream emphasises the communication both within the project team and between team members and managers, suppliers and customers. The disciplined problem solving stream shows the importance of cross-functional teams, extensive supplier networks, subtle top management control, planning, and environmental factors.

While few studies have examined product development from a management control perspective there is now a growing recognition of its importance (Bisbe & Otley, 2004; Bonner et al., 2002; Davila, 2000; Hertenstein & Platt, 2000). This review of the management control literature on product development has shown that there is a gap in the

literature concerning the role and style of the use of management controls during the product development process. This thesis examines this gap in relation to the activities that communities of practice carry out during the stages and gates that make up the product development for different product development project types.

2.6 First research question

The review of the literature on management controls and product development helps to motivate and refine the first research question presented at the start of Chapter 1.

1) How do communities of practice use management controls during product development?
    a. What are the role(s) of management control during product development?
    b. Which management control styles are used during product development?

Chapter 3: Practice Theory

3.1 Introduction

The aim of this chapter is to present a practice theory perspective to motivate the second research questions in Chapter 1. Key concepts discussed in this chapter include practice theory (Section 3.2), ethnomethodology (Section 3.3), communities of practice and community of interest (Section 3.4), organisation boundaries (Section 3.5) and boundary objects (Section 3.6). The chapter concludes with a summary (Section 3.7), a restatement of the second research question (Section 3.8) and concluding comments (Section 3.9).

3.2 Practice theory

As discussed in Chapter 1.4 there are a number of theorists whose work has been labeled "practice theory". These include Bourdieu's structural constructivism, Latour's actor-network theory (ANT) and Garfinkel's ethnomethodology (Reckwitz, 2002). While it may not be clear why such a diverse group of theorists have been put together under the term "practice theory", they do form an alternative to the more classical and modern types of social theorists (Reckwitz, 2002).

Bourdieu's focus is on the active role people play in reproducing structure through habitual routines, styles and skills which link social practices (Bourdieu, 1977). Latour on the other hand, focuses on how networks of human and non-human actors play a role in interactions. Latour's research aims to identify the qualities of these actors as defined during negotiations (Latour, 1999a). According to Latour the most important of these

negotiations is “translation”, where actors construct common definitions and meanings, define representativities, and work together in the pursuit of individual and collective objectives (Latour, 1999a). Latour (1999a: 19) has stated that ANT has a close association with Garfinkel’s ethnomethodology “*ANT was simply another way of being faithful to the insights of ethnomethodology*.” Garfinkel’s ethnomethodology seems to fit well with the first part of Latour’s aim relating to the construction of common methods people use to work together, but it does not appear to fit with the second part of Latour’s aim or Bourdieu’s aim which both focus on interactions and meaning.

Stern (2003) pointes out some of the commonalities of these practice theories. According to Stern (2003:185) practice theory is “*any theory that treats practice as a fundamental category, or takes practice as its point of departure*.” He argues that practice theory has two important characteristics. The first characteristic “*holism about meaning*” is meant to undermine the traditional distinctions between subject and object, structure and action, and representation and represented (Stern, 2003:185). The second characteristic is “*an emphasis on the importance of close attention to particular practices and the context within which they are located*” (Stern, 2003:185).

In the practice theory literature the words “practice” and “theory” have their own particular meanings. According to Stern (2003:186) “*a practice is something people do, not just once, but on a regular basis*.” But practice is more than what people do, it is also connected to “*the significance their actions have and the settings in which they occur*” (Stern, 2003:186). As for “theory”, practice theorists are opposed to a theory of practice that attempts to produce formal hypotheses that generate explanations or predictions (Stern, 2003). Instead practice theorists use the term “theory” in a wider sense to include

activities such as "*providing models, offering exemplary studies of particular cases, developing conceptual frameworks or categories or providing genealogy*" (Stern, 2003:187).

For practice theory an understanding of structure [6] is necessary as it provides the background to the actions that take place. Structure is thus used in an active sense as something that is continually constructed and re-constructed through the actions of organisation members. On the other hand, action is not only about what organisation members do but is also concerned with the methods they use to accomplish their practice (Stern, 2003).

3.3 Ethnomethodology[7]

The use of "practice theory" in this thesis is informed by ethnomethodology (Garfinkel, 1967, 2002; Lynch, 1993; Rawls, 2002). Rawls (2002:6) states that ethnomethodology is "*the study of the methods people use for producing recognisable social order.*" The meaning of the word "ethnomethodology" can be seen through an analysis of the three elements of the term. The first element "ethno-": refers to social or cultural groups. These groups are said to interact in a "context" or "scene" where practice takes place (Rawls, 2002). "-method-" refers to the things people do to create and re-create practices that others recognise (Rawls, 2002). Finally, "-ology" refers to the study of these methods (Rawls, 2002). The focus of ethnomethodology, therefore, is examining what people do in particular situations to create and re-create order (Rawls, 2002). This assumes that order is produced as people try to understand the situation they are in (Bailyn, 2002).

[6] This is referred to as the "scene" or "setting" in ethnomethodology research.
[7] Ethnomethodology is not a methodology or a set of designated methods, but the study of ethno-methods. In contrast to the formal typologies of sociology, ethno-methods are the locally produced and situated practices of members as they engage with and make sense of the world around them (Garfinkel, 2002).

A major difference between the ethnomethodology of Garfinkel and the writings of Bourdieu and Latour is their ontological and epistemological positions. While the first two theorists are usually thought of as applying interpretivist ideals of understanding and multiple meanings, this is not the case with Garfinkel's ethnomethodology. Some accounting researchers have labelled ethnomethodology as an interpretivist sociology (Jönsson & Macintosh, 1997; Willmott, 2005). Peyrot (1982: 263), though, states that "*the characterization of ethnomethodology as a subjective or interpretive approach…is unsupported (and I believe unsupportable) by reference to Garfinkel's work.*" Peyrot (1982: 270) goes on to argue that the focus of ethnomethodology is on "*activity*" which "*does not in itself require explanation or explication; the activity is organized so as to be intelligible (accountable) to its participants.*" Thus the focus of the report on practice in Chapters 5 and 6 is on the methods organisation members use during the product development. From an ethnomethodological perspective these activities are organised to be intelligible to organisation members within a firm.

Garfinkel has based this approach on a different interpretation of Durkheim's fundamental principle of sociology which is the discovery of "*the objective reality of social facts*" (Craig, 2003: 471) Garfinkel objects to the way in which mainstream sociology claims to discover these facts. Mainstream sociology has argued that social facts can only be found through surveys and statistical analysis. Garfinkel, on the other hand, argues that social facts can be found only in practice in a specific situation (Garfinkel 2002).

The emphasis of an ethnomethodology study is thus on the "*study of members' methods based on the theory that a careful attention to the details of social phenomena will reveal social order*" (Rawls, 2002:6). For this reason ethnomethodology is grounded in the

practices of people rather than in relating social theories to these practices (Garfinkel 2002). Latour (1999a:19) states that people "*know what they do and we have to learn from them not only what they do, but how and why they do it.*" 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, 2002:7).

In practice theory the word "structure" is used in an active sense as something that is continually constructed and re-constructed through action (Stern, 2003). It is not intended to limit what people do. On the other hand, "action" is not only about what people do but more importantly how they go about doing it. According to Laurier (2003:1) this is important as ethnomethodology is interested in

> *the relation between practices and accounts of those practices…how things get done by members of particular settings with the resources they have at hand.*

To apply ethnomethodology, practice is argued to proceed in orderly and expected ways as people interact within a given scene or context (Garfinkel, 2002). This is because it is only through this recognisable 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 actual practice 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 and re-production of order in a particular scene (Garfinkel, 2002).

From an ethnomethodological perspective, it is necessary to understand how management control is accomplished through the production of order in an organisation context. The following two sections examine practice theory concepts in relation to management control and the organisation.

3.3.1 Ethnomethodology, management control and the organisation

From an ethnomethodological perspective organisation members have to continuously create and re-create the management control structure. This management control structure must then be integrated into the practices of organisation members. This is because management controls must be recognisable to others for them to have any effect on practice.

When the practice of an organisation member is recognisable to other organisation members they are said to have achieved "mutual intelligibility" (Garfinkel, 2002). For actions to achieve this level of mutually intelligibility Garfinkel (2002) argues that they need to be orderly. The use of management controls by organisation members needs to be an orderly and recognisable part of their practice. These controls need to be achieved on a continuous basis through the practices which organisation members engage in during their day-to-day activities.

For ethnomethodology the focus is on the account of the activities that take place in practice (Jimerson & Oware, 2006). Ethnomethodology is used in this thesis to report on

the activities which show how management control is accomplished in practice; it is not used to inform an account of management controls themselves - this would be the focus of an ethnography-based study. While an analysis of the differences between ethnography and ethnomethodology is outside the scope of this thesis it has been argued that "*ethnographers tend to focus on settings…, while ethnomethodologists tend to focus on activities*" (Jimerson & Oware, 2006:25). An important feature of ethnomethodology is the utility of the report on practice. In other words, the focus is on the usefulness of the explanation provided by the report for practitioners.

According to Rawls (2002) the concept of mutual intelligibility has been shown to help explain ordinary social actions, although it has been criticised for its inability to explain the creation of new knowledge in these settings. However, Rawls (2002) argues that ethnomethodology does not deny that actors create new knowledge; only that, to influence other organisation members, they must position this knowledge within practices that others recognise and of which they understand the meaning. Thus the use of knowledge in practice can only meaningfully occur against a background of mutually constituted intelligibility.

The idea that the creation of new knowledge by organisation members in practice needs to be positioned in a way that other organisation members understand is a critical point in this thesis. This is because the use of management controls during the product development process requires not only the creation of new knowledge but also mechanisms that enable this new knowledge to be understood and used by others in the organisation. Thus, it is important for organisation members to position their newly-created knowledge in practices

that others recognise and understand. The following section develops this view by examining knowledge in practice from an ethnomethodological perspective.

3.3.2 Knowledge in practice

Within ethnomethodology, and practice theory in general, is the idea that an understanding of the practices of organisation members is necessary to explain how knowledge is structured and used in organisations. This idea has its base in the writings of Ryle (1949) and Polanyi (1967) who both emphasise knowledge in practice. Ryle (1949) claims that knowledge is essentially about "knowing how", which puts the actions of organisation members at the centre of understanding knowledge and focuses attention on their "*capacity to act or perform in certain circumstances*" (Orlikowski, 2002: 251).

Polanyi (1967) brought out the tacit aspects of knowledge in his writings. He argued that even if we know how to do something we often cannot say how we do it. This observation of "know how" led him to distinguish between tacit and explicit knowledge. The split between tacit and explicit knowledge by Polanyi (1967) has resulted in two distinct streams of research on knowledge in organisations.

One stream of research has focused on how to make tacit knowledge explicit so that it can be classified, stored and transferred within an organisation (Nonaka & Takeuchi, 1995; Teece, 1998). Nonaka and Takeuchi (1995) develop a model to show how tacit knowledge can be turned into explicit knowledge through a process they call "SECI" (socialisation, externalisation, combination and internalisation) which they present in the form of a "knowledge spiral." Nonaka and Takeuchi (1995) argue that through their "knowledge spiral" tacit knowledge can be brought to the surface with the aim of making knowledge

amenable to being captured, stored and transferred within an organisation. This view of knowledge as a distinct entity with static properties reduces all knowledge to an objective state so that it can be used by all organisation members to the benefit of the organisation.

Another stream of research is critical of this view of knowledge and argues that the separation of knowledge into categories, such as tacit and explicit, contradicts the inseparable aspect of knowledge in practice (Boland & Tenkasi, 1995; Cook & Brown, 1999; Davenport & Prusak, 1998; Tsoukas, 1996). These writers support the need for an holistic understanding of knowledge. According to Tsoukas (1996:14) "*tacit knowledge is the necessary component of all knowledge*" and because of this he argues for an integrated approach which views knowledge as "*procedural and inherently indeterminate*" (1996:22).

This stream of research presents knowledge as inseparable from practice. Brown and Duguid (2001) note that, in practice, knowledge becomes specific to groups of organisation members through the activities in which they participate. The type of activities in which organisation members take part is influenced by job specialisation and hierarchal stratification. This leads to a variety of cultures within an organisation with contrasting knowledge of practice. These differences between organisation groups can lead to boundaries which hinder understanding (Carlile, 2002). As new knowledge is created, managing these organisation boundaries becomes increasingly difficult, while at the same time the importance of communication between the different groups increases (Carlile, 2002). To overcome these boundaries groups within an organisation need a way to link their practical knowledge (Carlile, 2002). This applies particularly during product development where organisation members with different specialised knowledge from across the firm need to interact to bring a new product to market.

To study these organisation groups necessitates an holistic conceptualisation of knowledge in practice. Instead of viewing knowledge as a separate entity this thesis seeks to understand knowledge through the practices of groups within an organisation; knowledge cannot be separated from the everyday actions of organisation members as they go about their practice. This is because it is only through the practices of these groups that knowledge has meaning. This understanding of knowledge in practice is best viewed through communities of practice who need to work together in a community of interest. These two concepts are presented in the next section.

3.4 Communities of practice and the community of interest

An understanding of communities of practice (Brown & Duguid, 1991; Lave & Wenger, 1991; Wenger, 1998; Wenger et al., 2002) and community of interest (Arias, 1996; Arias & Fischer, 2000; Fischer, 2001a, 2001b) is useful to examine knowledge in practice. The following two sections examine these concepts to show how they enable a view of knowledge in practice.

3.4.1 Communities of practice

Wenger, McDermott and Snyder (2002) trace the communities of practice concept back to the shared strategies that were evident in ancient Greece where groups of craftsmen would get together to develop their crafts. In recent years the concept is used by Lave and Wenger (1991) in their study of how learning takes place in organisations. Wenger (2004:2) defines communities of practice as "*groups of people who share a concern or a passion for something they do, and who interact regularly in order to learn how to do it better*."

Wenger, McDermott and Snyder (2002:6) argue that in today's business environment firms need to be more "*intentional and systematic in managing knowledge*" and that communities of practice are central to this. The communities of practice literature has stated that the defining features of a community of practice are

- An exposure to common issues or problems (Lesser & Storck, 2001)
- Sharing a common domain and sense of identity (Wenger et al., 2002)
- Having a common sense of purpose (Brown & Duguid, 2001)
- The ability to collaborate directly and learn together (Lave & Wenger, 1991)

According to Wenger (1998) a community of practice has three dimensions which connect the community to its everyday practice. These include the mutual engagement of members within a community, a joint enterprise or domain that keeps the community together and finally the use of shared resources in practice that the community creates over time for negotiating meaning. The community of practice literature suggests that knowledge is locally embedded in the shared work practices of a community (Brown & Duguid, 1991). The shared practice of each community creates differences between them and other communities that are difficult to overcome. These differences become pronounced when communities of practice are dependent on each other and have to work towards some common end.

While much of the literature on communities of practice has focused on informal communities it has been recognised that formal communities of practice are also important (see for example Brown & Duguid, 1991). This thesis focuses on formal hierarchical and functional-based communities of practice within an organisation setting. Within an organisation formal communities of practice are defined by the organisation through its

formal structure. These communities are determined by the types of work in which organisation members are involved. Hierarchical communities of practice are made up of organisation members from different hierarchical levels within a firm and include executive managers, functional managers and functional staff (see Figure 7). Differences between communities exist because their members have different skills, backgrounds, responsibilities and experiences (Carlile, 2004).

Figure 7: Hierarchal Communities of Practice

Executive Manager Community	CEO	CFO	GM Sales	GM Marketing	GM Operations	GM Technology	GM Human Resources
Functional Manager Community		Finance managers	Sales managers	Marketing managers	Operations managers	Technology managers	HR managers
Functional Staff Community		Finance personnel	Sales personnel	Marketing personnel	Operations personnel	Technology personnel	HR personnel

While all organisation members belong to a hierarchal community of practice most also belong to a functional based community. These functional communities are presented in Figure 8 and include the different functional departments within an organisation.

Figure 8: Functional Communities of Practice

Technology Community	***Marketing Community***	***Sales Community***	***Finance Community***	***Operations Community***	***HR Community***
General Manager	General Manager	General Manager	General Manager	General Manager	General Manager
Functional Managers	Functional Managers	Functional Managers	Functional Managers	Functional Managers	Functional Managers
Functional Staff	Functional Staff	Functional Staff	Functional Staff	Functional Staff	Functional Staff

A general manager, usually a member of the executive manager community, leads each functional community which comprises other functional managers and staff members. Differences arise between functional communities as the members of these communities have different skills, backgrounds, responsibilities and experiences (Carlile 2004).

From this brief overview of formal hierarchal and functional communities of practice recognisable divisions of identity can be seen. This makes communication between the communities of practice within an organisation problematic (Brown & Duguid, 2001). When several communities of practice are needed to achieve some outcome or solve a problem they come together and form a community of interest (see for example Arias & Fischer, 2000; Fischer, 2001a, 2001b) which is examined in the next section.

3.4.2 Community of interest

A community of interest needs to develop ways to get a job done (Fischer, 2001b). This is not always easy as the communities of practice involved in a community of interest may define their desired outcomes or goals differently from one another (Brown & Duguid, 1991). Communities of practice must, therefore, overcome organisation boundaries when joining together in a community of interest. The community of interest that is the focus of this thesis comprises communities of practice concerned with product development within an organisation.

A community of interest faces challenges as the different communities of practice involved have to break down organisation boundaries to build a shared understanding of the activity at hand (Fischer, 2001a). This is because a shared understanding does not usually exist at the boundary but evolves incrementally through interaction and collaboration. Thus a

community of interest has to establish ways to span organisation boundaries to develop a shared understanding through the use of shared practices (Arias & Fischer, 2000).

Suchman (1995) notes that organisation boundaries can be spanned through the objects that are produced and used by communities of practice in a community of interest. Star and Griesemer (1989) and Star (1989) show that these objects, which they call "boundary objects" can assist interaction and collaboration between communities of practice within a community of interest. They argue that these objects enable a shared understanding of the issues that communities of practice face when they need to interact in a community of interest (Star & Griesemer, 1989).

The discussion in the following two sections draws on Carlile's (2004) framework which is used to identify and discuss the different types of boundaries that communities of practice have to overcome when working together in a community of interest and the types of boundary objects needed at each boundary. The aim is to show the effect organisation boundaries have on the way communities of practice work together in a community of interest and the role boundary objects play in spanning these boundaries.

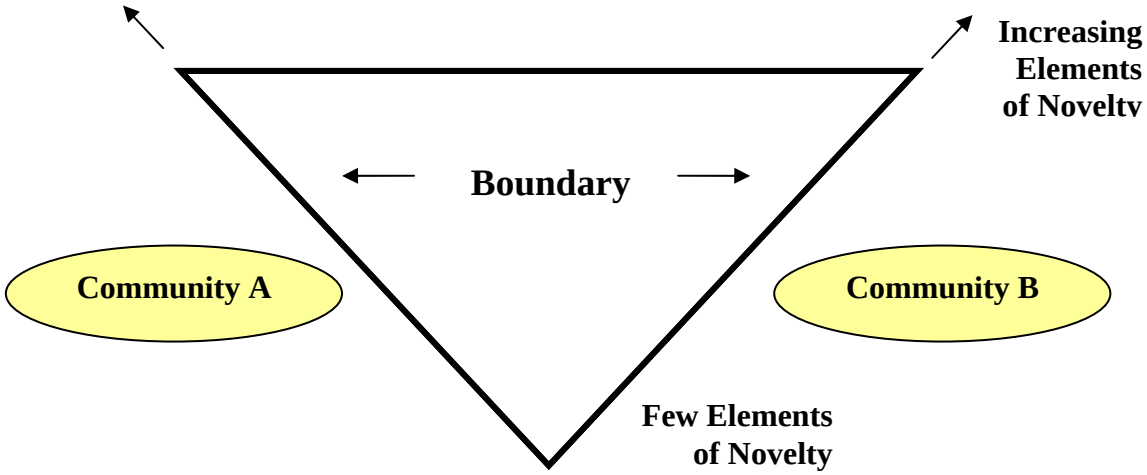
3.5 Organisation Boundaries[8]

This thesis uses Carlile's (2004) framework (see Figure 9) to examine organisation boundaries caused by differences between communities of practice within an organisation. The framework draws on Carlile's (1997) field work based on practice theory. Carlile examines how different functional communities within an organisation create and use knowledge in practice during the development of a new automobile component. Carlile's

[8] Carlile (2004) also refers to these boundaries as 'knowledge gaps'.

research is informed by Bourdieu's (1977) practice theory and his framework provides a useful way of understanding organisation boundaries.

Figure 9: Carlile's Framework



Source: based on Carlile (2004)

The first part of Carlile's framework deals with novelty.[9] It shows that when there are only a few elements of novelty in a given context the boundary between communities of practice (Community A and B in Figure 9) is narrow. In other words, the number of new elements is low, thus enabling a high level of common understanding during interactions between communities as organisation members have dealt with these elements before in a similar context. As the number of novel elements increases the boundary widens. In this context communities of practice have to work on ways to collaborate with each other. Thus, the communities of practice not only have to understand the novel elements but, at the same time, they must build a common understanding of what the novel elements mean for the other members of the community of interest.

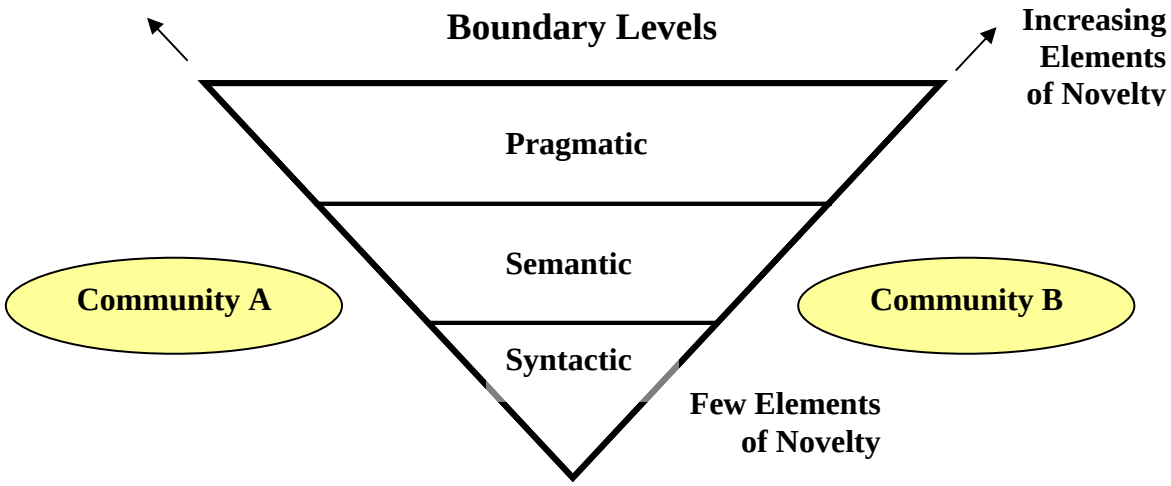
[9] Novelty is defined in terms of the newness of the components of technologies or business models needed for a new product.

Carlile's (1997) study examines how different functional communities involved in the development of a new product (the community of interest) interact during the product development process. The communities he observes include sales/marketing, design engineering, manufacturing engineering, and production. Carlile (2002) notes that differences between these communities of practice came about because members of the communities have different skills, backgrounds, responsibilities and experiences. Although all the members of these functional communities worked in the same location they often experienced boundaries while working on the project (Carlile, 2002). Carlile focuses on what enables communities to span these boundaries to design and manufacture a new product. He shows how knowledge in each of the four functions is localised and embedded in practice and structured in a way that makes sense to that specific community. Because each community uses knowledge specific to that function, this localised knowledge presents a barrier to the development of new products. According to Carlile (2002) as the number of novel elements increased the communities found it increasingly difficult to interact at a level necessary for the successful development of a new product.

This can be seen by the extending arrows in Figure 9 which show that as the elements of novelty increase the boundary between the communities of practice widens. Carlile (2004) explains that the boundary widens because the knowledge being used by each community in practice is becoming increasingly different. At the base of Carlile's framework in Figure 10 knowledge in practice is stable as there are few elements of novelty. As the elements of novelty increase the boundary widens resulting in differences that need to be understood by each community. Carlile (2004) calls these boundaries syntactic, semantic and pragmatic knowledge boundaries. He shows that these boundaries correspond to three

different levels of knowledge in practice that separate communities of practice when they join together in a community of interest.

Figure 10: Boundary Levels in Carlile's Framework



Source: based on Carlile (2004)

The boundary levels in Carlile's framework provide a way of examining how differences between communities of practice affect how they work together in a community of interest. This is because, as the elements of novelty increase, the boundary between the communities of practice changes. The following sections discuss the three boundary levels of Carlile's framework in relation to the elements of novelty.

3.5.1 Syntactic boundaries

The first boundary, at the base of the inverted triangle in Carlile's framework (see Figure 10 on page 54), is called a "syntactic boundary" and represents a context in practice where there are few elements of novelty. Carlile (2004) argues that when there are few elements of novelty in a context a common syntax or language is sufficient for communities of

practice to work across the boundary within a community of interest. In practice that happens when a common syntax or language used by all communities of practice in the past enables interaction across the boundary between the communities of practice. When there are few elements of novelty and the context is stable it is relatively easy for communities of practice to understand their differences and how to deal with them. According to Carlile (2004) this boundary is largely unproblematic and the primary concern is to transfer knowledge across the boundary. Thus, interactions between the communities of practice at this level can take place by transferring knowledge through the use of a common syntax or language across the boundary.

When the elements of novelty in a context increase beyond the capabilities of the syntax or language the syntactic boundary becomes unstable. Under these conditions a syntax or language that had been shared and was sufficient in the past may not be able to address the issues surrounding a context that involves more elements of novelty. Thus, increasing elements of novelty may make the current syntax or language obsolete. If a common syntax or language cannot be used communities of practice will start to face what is called a "semantic boundary" (Carlile, 2004).

3.5.2 Semantic boundaries

At a semantic boundary the communities of practice find it difficult to interact with one another as the context in which they develop their knowledge in practice is different (Carlile, 2004). This is because as the elements of novelty increase the interpretations and meanings of events differ between the communities of practice. However, when communities of practice interact across a boundary where tasks and methods are quite different, effective resolution of differences is precluded because few practices are shared

(Carlile, 2004). Carlile (2004) argues that when communities are no longer able to use a common syntax or language, knowledge transfer cannot be used to span a boundary. Therefore, communities of practice have to explore new ways to interact. According to Carlile (2004) a key challenge to managing knowledge across a semantic boundary arises when organisation members lack a shared understanding of the issues they face. To span this boundary communities of practice need to develop a means of translating knowledge by learning new meanings (Carlile, 2004).

As the elements of novelty continue to increase (the top part of Figure 10 on page 54) the differences between communities of practice become even more pronounced and semantic knowledge translation across a boundary becomes problematic (Carlile, 2004). This leads to the final boundary level which Carlile (2004) refers to as a pragmatic boundary.

3.5.3 Pragmatic boundaries

Carlile (2004) argues that at a pragmatic boundary communities of practice must transform their knowledge by creating new knowledge rather than simply translating knowledge by learning new meanings or transferring knowledge through a given syntax or language (Carlile, 2004). Only in this way can the communities of practice deal with the different kinds of knowledge in practice (Carlile, 2004). To do this each community of practice needs to identify what is relevant to their own community, negotiate alternatives with the other communities of practice and then collectively transform the knowledge currently being used in relation to the elements of novelty in the new context (Carlile, 2004). The key challenge at a pragmatic boundary is to recognise the effects that novelty has on understanding differences so that learning about their consequences can support the

knowledge transformation process (Carlile, 2004). In this way the pragmatic boundary represents the greatest challenge of all the boundary types (Carlile, 2004).

Based on Carlile's (2004) framework the following section examines some of the types of boundary objects that communities of practice may use to span the different boundary levels, thereby facilitating communication.

3.5.4 Organisation boundaries and management control

In this thesis I argue, using Carlile's (2004) framework (see Figure 9 above), that for management control to be accomplished in practice it must overcome the boundaries that exist within the organisation (see Figure 10). This is because control is dependent on knowledge, which needs to be communicated to other organisation members to enable management control to take place (Yates, 1993). According to Yates (1993) communication such as the sending of messages to others, along with the feedback and subsequent corrections which may occur, is the key to management control.

As shown by Carlile's (2004) framework (see Figure 9 above), in settings where there are few elements of novelty a firm can use a common syntax to communicate their knowledge and thus accomplish management control. In the management control literature this is the type of setting that is normally assumed. Thus, the use of budgets and other financial information are used to control across this syntactic boundary. In settings where novelty is high and no common syntax exists management control needs to be accomplished differently. Thus, organisation members need to use different types of boundary objects to accomplish management control when facing different types of organisation boundaries.

3.6 Boundary objects

Star and Griesmer (1989) and Star (1989) introduce the boundary object concept and examine how communities of practice join together in a community of interest. Star (1989) argues that because communities of practice have different viewpoints the means of accomplishing tasks in each community is based on local contingencies and constraints. Star (1989:45) summarises the idea by stating that

> *there is no guarantee that the same information reaches participants at any time, nor that people are working in the same way toward common goals. People's definition of their situations are fluid and differ sharply by location; the boundaries of a locality or workplace are simultaneously permeable and fluid*.

Through the examination of scientific communities of practice Star (1989) shows how these communities create and use objects that were both plastic enough to be used and understood by each community of practice yet coherent enough to allow a collective course of action. Star (1989) concludes that in the face of heterogeneity produced by local constraints and divergent viewpoints, one way that communities can solve the heterogeneity problem is to create and use boundary objects. This is supported by Haraway and Harvey (1995:516) who state that;

> *such objects are stabilised enough to travel recognisably among different communities, but flexible enough to be moulded by these different communities of practice in ways that are close enough to what the practitioners already understand how to do, in order for them to actually do something. And so it's a way of modelling working together in a scene of radically different languages.*

Boundary objects help communities of practice overcome the heterogeneity problem as they can situate local meanings in a larger context. This enables them to be used by different communities of practice for different purposes, thus providing an interface for those communities to understand their differences (Star & Griesemer, 1989). Boundary objects can play this role because they provide a way for communities of practice to

interact with each other that does not require consensus. In other words, boundary objects provide a means for communities of practice to learn about their differences and dependencies and thus facilitate a shared practice (Carlile, 2002; Star, 1989).

Star and Griesemer (1989) categorise the different types of boundary objects depending on the characteristics of the heterogeneous information which is joined to create them. They derive this from their field studies examining a community of neurophysiologists (Star, 1989) and a zoological museum (Star & Griesemer, 1989). Star (1989:47) found that

> *the structure and attributes of the information brought in from the different participants were distributed and heterogeneous, yet were successfully reconciled.*

Thus, the different local interpretations of boundary objects mean that the knowledge embedded in an artefact during its creation is not simply re-extracted, but that a degree of knowledge is necessary to make use of it.

The following sections present three boundary object categories[10] which can be used by communities of practice participating in a community of interest to span boundaries caused by novelty in the product development context.

3.6.1 Numbers

Star and Griesemer (1989:410) describe numbers in terms of data repositories which they define as "*ordered 'piles' of objects that are indexed in a standardised fashion*" and are "*built to deal with problems of heterogeneity caused by differences in the unit of analysis.*"

[10] These are not the only boundary object categories in the literature. Both Star (1989) and Carlile (2004) examine four boundary object categories while Briers and Chua (2001) present a fifth boundary object category which they call 'virtual objects'.

Different communities of practice can thus "*borrow from the 'pile' for their own purposes without having directly to negotiate differences in purpose*" (Star & Griesemer, 1989:410). According to Carlile (2004) these are useful boundary objects because different communities of practice can take and use them to show how they view a particular issue within the organisation.

In this study numbers include both the financial numbers gathered and reported by the firm's accounting system, such as product costs, earnings before interest and tax, gross margin, and contribution after marketing, as well as non-financial data gathered and reported by the marketing department such as market share. It also includes data about the firm's technology such as product formulations and engineering and manufacturing specifications.

3.6.2 Documents

In this study documents include the product development process documents, marketing and sales reports, project reviews and presentations, as well as strategy and brand plans. Star (1989) states that standardised forms and methods (i.e. documents) are integrating devices when enable communication across communities of practice. These integrating devices are needed to overcome differences between communities of practice by translating the learning on both sides of the boundary (Carlile, 2004). Documents are used to bring these differences to the surface so that they can be discussed by the communities and overcome.

3.6.3 Models

In this study models include product samples, packaging samples, packaging artwork, engineering drawings and models as well as manufacturing trials and market trials. Star (1989) argues that models, objects and maps (i.e. models) have a complex structures onto which people can project interpretations, which makes them compatible with more than one point of view. These models show either a current state or possible future states and are thus able to be understood in different ways by different organisation members (Carlile, 2002). Carlile (2004) argues that models can be useful boundary objects as they can be used to resolve differences between communities of practice that face high levels of novelty. This is because these objects enable different perspectives to come to the surface.

3.6.4 Summary of boundary objects

The literature on boundary objects has focused on the role of boundary objects as devices that mediate two or more communities of practice. Therefore boundary objects can be seen as key resources and a critical integrating mechanism between communities of practice (Bowker and Star, 1999).

3.7 Summary

This chapter has set out a practice theory-based perspective to help build an understanding of the theoretical context in which management controls are used. It presents a brief overview of practice theory which stresses a holism of meaning and the idea that research needs to pay close attention to specific practices in their context. Practice from this perspective is related to what people do on a regular basis as well as the significance of their actions for other organisation members. It shows that the aim of a practice theory is

to provide models or develop conceptual frameworks or categories to understand practice in a given context from the practitioners' point of view.

This thesis uses ethnomethodology to narrow the field of practice theory to a set of specific concepts to help focus on critical aspects of practice. Ethnomethodology is shown to focus on the methods that people use in practice within a given context for producing order. This is linked to management control which, from an ethnomethodology perspective, is concerned with how management control is accomplished by communities of practice with the resources they have at hand.

Organisation members are seen to belong to formal communities of practice, which, while beneficial to their specific practice, can also create boundaries between these communities which need to be overcome when they work together in a community of interest. Three organisation boundary types from Carlile's (2004) framework were presented and include a syntactic boundary, a semantic boundary, and a pragmatic boundary. To manage across these boundaries three of Star's (1989) boundary objects are used. The three boundary objects followed in this study includes numbers, documents and models.

3.8 Second research question

The review of the literature on practice theory, ethnomethodology, communities of practice and interest, organisation boundaries and boundary objects helps to motivate and refine the second research question presented at the start of Chapter 1.

2) How do communities of practice accomplish management control through the use of boundary objects during product development?

3.9 Conclusion: Chapters 2 and 3

Chapters 2 and 3 motivate the two research questions in this thesis. Chapter 2 shows that there is a gap in the literature concerning the role of management control (as Davila (2000) has examined this only in relation to the product design stage), and that there is conflicting evidence concerning the ways in which management controls are used during product development. Chapter 3 presents a way to understand how management control can be accomplished in practice. It shows that the boundary object concept can be used to understand how functional and hierarchal communities of practice span boundaries when interacting in practice during the activities that take place during the product development process. This helps to develop an holistic understanding of the role and style of use of management controls in practice.

The following chapter presents an overview of the field site and research method used to follow and understand the use of boundary objects by communities of practice and to examine the role and style of management control in practice during product development.

Chapter 4: Field Site and Research Method

4.1 Introduction

As outlined in Chapters 1, 2 and 3, this thesis seeks to examine how communities of practice use management controls; in relation to the role of management controls and the style in which they are used, as well as how communities of practice use boundary objects to accomplish management control during product development. To answer these questions requires good access over a period of time to different hierarchal and functional communities in a firm that has a history of successful product development.

This chapter starts with an overview of the field site and the material collected (Section 4.2). It then discusses ethnomethodology field studies and the use of participant observation (Section 4.3). This is followed by some background information on *OpCo* including an overview of its operations, structure, communities of practice, boundary objects and product development process (Section 4.4). The chapter concludes with the ethical considerations (Section 4.5), the confidentiality agreement with AusFood (Section 4.6), and a summary (Section 4.7).

4.2 Field site and material

Finding a firm that would allow access to their product development activities was one of the most challenging aspects of this study. To examine the use of management controls during product development the field site needed to be active in the development of new products. Further, to add weight to the study the firm needed to be seen as a successful producer of new products.

The firm to which I sought access is a multinational Australasian food company (AusFood). This firm is one of the largest in Australasia and is a global leader in the food industry. AusFood has assets of US$3.3 billion with an annual turnover US$8.4 billion. It sells its products in 140 countries. It has an R&D centre for inter-company research along with R&D centres at each operating company. In total it has an R&D staff of 550 and spends about US$40 million on product development annually.

With the assistance of The University of Auckland Business School contact was made with the strategy department of AusFood. After a long process of writing and presenting my ideas, a product development manager became interested in the study. A meeting was arranged at the firm's head office at which I presented my research plan to a group of senior executives and project managers. At the end of the presentation the firm agreed both to sponsor the study through a scholarship that gave me access to one of their operating companies.

The Scholarship was approved in August 2003 and research commenced in February 2004. Unfortunately, due to a restructuring within AusFood in late 2003 all my contacts resigned before I started my study. It took about six months to find a new contact within the firm who was prepared to assist me with this study. With the help of this new contact I was able to get good access to AusFood's head office where I spent about four months learning about their product development process. At the end of November 2004 I gained access to the best performing operating company (*OpCo*) within AusFood and started my field work in December 2004.

The field material reported in this study was collected at *OpCo* over a nine-month period from December 2004 to August 2005. Throughout the field study a wide spectrum of materials was collected. I made 113 site visits (i.e. observation days) during which I compiled detailed field notes from my observations of project selection meetings, product development project meetings, functional and executive manager meetings, and other informal interaction observations related to the product development activities of the communities of practice (see Table 1). Other material collected in relation to the eight projects followed included documents created and used by functional and hierarchal communities of practice within *OpCo*.

Table 1: Field Notes

Field Notes	**Number**
Project selection meeting observations	10
Project development meeting observations	150
Functional manager meeting observations	20
Executive manager meeting observations	25
Other informal interaction observations	270

These field notes were entered in real time into a hand-held computer which I carried around the firm during every site visit. The computer had a foldaway keyboard making it both easy to carry (as both the computer and keyboard could be kept in my pocket) and easy to use as the keyboard opened up into a regular size keyboard. The computer had 256 MB of memory, large enough to keep all the field note files. Thus I was able to refer to my field notes and make connections between events during field study site visits.

The details of the interactions that occurred between the different communities of practice were entered into field notes. These field notes included the context or details of the scene as well as brief conversations between communities of practice where possible with particular emphasis on the role and style of management controls and the types of boundary objects being used.

At the start of the study I made a list of possible boundary objects based on the work of Star (1989), Star and Griesemer (1989), Briers and Chua (2001) and Carlile (2002). These included repositories, standardised forms and methods, objects and models, maps, ideal types, coincident boundaries and virtual objects. As this study is based on ethnomethodology the selection of boundary objects was driven by the organisation members in the field study firm. The three boundary objects (numbers, documents and models) used in this study were commonly used and understood by organisation members. The focus on these three boundary objects excluded other potential boundary objects being explicitly studied during the field work although I acknowledge that others did exist.

4.3 Ethnomethodology and participant observation

Although a field study approach is commonly used in ethnomethodology studies there is no mandatory set of research methods to follow in the field (Lynch, 1996). Some of the more commonly used research methods include the collection of archival documents, recording conversations, interviews and participant observation. As this study was concerned with how management controls are used in practice and the boundary objects used by communities of practice during the product development process a participant observation approach was chosen.

A participant observation method provides a strong link with practice theory presented in Chapter 3 which argues that a close-up view of practice is required to understand how boundary objects are used in different communities of practice. To study these types of interactions requires immersion in the situation being studied (Rawls, 2002). The ideal in an ethnomethodological study is to become part of the scene by learning to be a competent practitioner in the phenomena being studied. Garfinkel (1967; 2002) refers to this as gaining "unique adequacy." According to ethnomethodology this enables a researcher to understand members' actions within a particular context (Garfinkel, 2002). Therefore, before a researcher enters the field they need to attain a level of "unique adequacy" to enable them to understand the world of a practitioner. The ethnomethodology literature argues that through participation in the everyday practices of communities of practice researchers can experience the world from the viewpoint of a practitioner. According to Adler and Adler (1987:34) by

> *Repeatedly dealing with the practical problems members face, researchers ultimately organise their behaviour and form constructs about the setting's everyday reality in much the same way as members.*

While the constructs I bring to the field are informed by the literature on the role and style of management controls and boundary objects, ethnomethodologists argue that through participant observation researchers can experience the world of the communities of practice and thus, can say something about how they would categorise their actions in terms of these constructs (see for example Adler & Adler, 1987).

According to ethnomethodology, participation is an important aspect of research. This is because ethnomethodologists believe that only by participating can a researcher truly understand the methods communities of practice use in practice (see for example Adler & Adler, 1987; Rawls, 2002). Ethnomethodologists do not believe that participation affects

the results of a study as a researcher with "unique adequacy" would only act in the same ways as any other competent practitioner. According to Adler and Adler (1987:32) researchers "*will only alter settings in ways similar to other members, so their actions are condoned*."

In practice this involves participation in the daily activities of communities of practice. It is generally acknowledged in ethnomethodology research that to do this the researcher needs to obtain as close to full membership of the group under study as possible (Adler & Adler, 1987). This was difficult in this study as it would have required me to gain membership of a number of different communities of practice within the firm to be able to follow all the communities of practice who were involved in product development. For this reason my aim was to get close enough to each community of practice to be able to understand the issues they faced and learn how they dealt with them without gaining full membership.

To gain the level of "unique adequacy" required to do an ethnomethodology field study I spent four months at the head office of AusFood, the parent company of *OpCo*. During this time I worked with the AusFood's product development best practice manager, learning how the firm carried out its product development activities. This interaction resulted in a report on innovation which was distributed around the firm (see Appendix 1). This was significant as it enabled me to be seen as a competent practitioner in product development and how it was organised within the firm.

Following the completion of this report I was introduced to the technology general manager at *OpCo*. When I arrived at *OpCo* I was asked to participate in some of the firms'

meetings and product development activities. This was a good sign as it showed that my time spent at AusFood enabled me to be regarded by all the communities of practice as an adequate practitioner within the firm. Participation in the activities at *OpCo* allowed me to follow communities of practice, observe their interactions and have access to information to which I might otherwise not have had access. According to Adler and Adler (1987) access to "secret" information reinforces the researchers' membership of a community of practice.

Adler and Adler (1987) set out three levels at which participant observation can take place in a field setting. Those researchers who attain the highest level of participant observation are called "complete members." These researchers assume functional roles and are not necessarily known as researchers at the field site. Adler and Adler (1987) argue that this enables a researcher to attain emotional and ideological alignment. Researchers at the second level of participant observation are called "active members." These researchers assume functional roles but are able to maintain perspective on their settings by carrying out debriefing sessions with colleagues. Finally, researchers with the lowest level of participant observation are called "peripheral members." These researchers do not assume functional roles and are usually known to group members as a researcher.

As I sought to be included in the activities within different communities of practice I entered *OpCo* as a "peripheral member." This enabled me to get close to each community to understand how they carried out their work in practice, but allowed enough distance for me to move freely between different communities. As a "peripheral member" I was asked by communities of practice at *OpCo* to participate in many of the support activities that took place during the product development process. This enabled me to gain an

understanding of the role and style of management control and the use of boundary objects by the different communities of practice.

During the study I was able to get close enough to many of the communities of practice within the firm to gain access to confidential materials, meetings and interactions where product development projects or issues were discussed. This included access to executive management meetings and reports presented at these meetings, functional manager meetings and reports as well as meetings and project reports of all project teams within *OpCo*. I was also able to follow functional interactions in the technology, marketing, sales, and operations departments. During the study organisation members within all the communities of practice went out of their way to include me in their activities throughout the firm. This could be because they were always interested in learning more about what they were doing.

In addition to access to the formal interactions between the different communities of practice, I was given a desk in the technology department which gave me access to many informal interactions between the communities of practice that occurred throughout the firm. This enabled me to follow the informal interactions between project team members, functional managers and executive managers that took place in different parts of the firm during the product development process.

On entering the firm my first interaction was with the technology department general manager and functional managers. During these first few weeks these managers showed me around the firm and introduced me to organisation members in other functions. They also gave me extensive tours of the operations, describing how things worked. During this

initial stage I was introduced to the business process manager who was in charge of the project management office. The project management office ran the project management training for all new employees in the firm. During my first week at *OpCo* the business process manager took me thorough a project management training session as if I were a new employee at *OpCo*.

At the start of the study the executive managers at *OpCo* gave me a list of projects that the firm was undertaking. I was then able to talk to the executive managers about these projects and was able to choose a number of them to follow. I usually gained access to projects through an executive manager who introduced me to the project manager of the project I was interested in. Some projects, though, were not put on the official project list as they were secret. The only way to find out about these projects was through an executive manager. In two cases I was approached by executive managers and invited to take part in these secret projects. During the field work I followed eight different product development projects in total, although it should be noted that I followed about three at any one time. This was possible as some projects were short, lasting only a few months, while other projects were much longer with one project covering the whole nine-month period. One of the projects followed during the study was awarded the supreme award for the best new product at both a local industry event and at an international awards event.

4.4 Overview of *OpCo*

OpCo was chosen for the study because it was active in product development. *OpCo* had recently been named by a well known management consulting firm as having the best product development process among a group of leading fast-moving consumer companies

in Australasia. Thus the firm was both active in product development and was seen as a leader in its field, thus meeting the requirements for a suitable site.

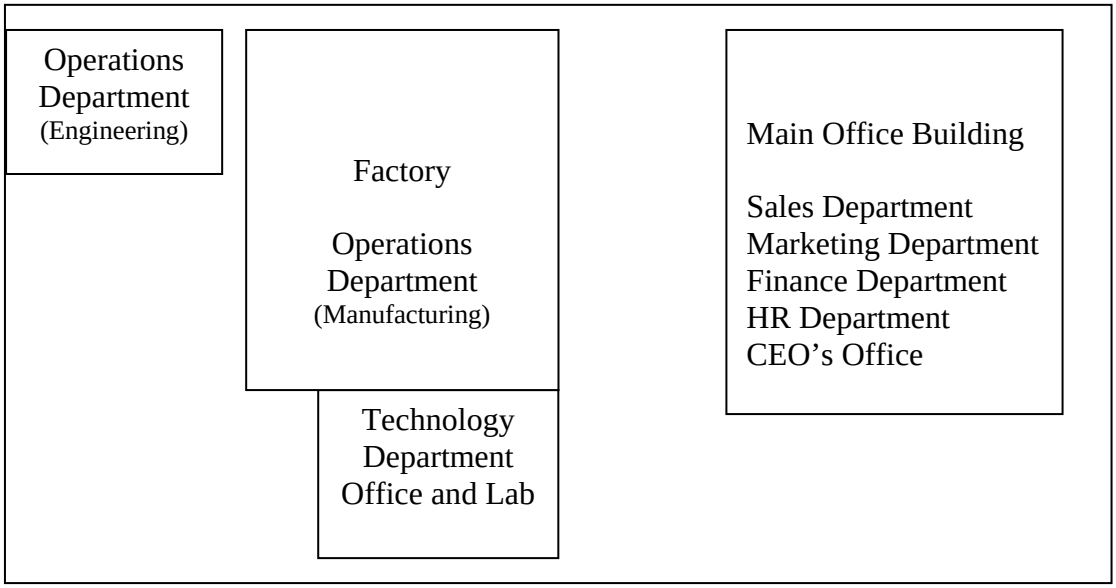
Within the AusFood group *OpCo* was thought to be a highly innovative firm. *OpCo* has released many successful new products in recent years and has patented some highly innovative manufacturing processes. Not only was *OpCo* a successful innovator but was the market leader in every category in which it competed. It had many competitors in the market including the worldwide market leader in the category in which it operated. *OpCo* was a successful exporter and sold its products around the world.

4.4.1 *OpCo's* operations

To give the reader a feel for the field site this section presents an overview of *OpCo's* operations. At the time this study took place *OpCo* had operations on two different sites. The main site, which was the focus of this study, contained all the functional departments, as well as a large manufacturing, storage and distribution facility (see Figure 11 below). The second site was much smaller and contained a specialised export-focused manufacturing, storage and distribution facility.

There were three main buildings on the main *OpCo* site. The operations department (engineering) was located in a dedicated building at the rear of the site. The next building contained the factory as well as the storage and distribution facility. The technology department was located at one end of the factory across from the main office building which housed the other functional departments.

Figure 11: Main *OpCo* Site Layout



On the ground floor of the technology department was a reception area, the general manager's office, a large meeting room, an innovation room, a pilot plant, a storage facility and the main technology laboratory. On the second floor was an open plan office which housed the technology department staff members. Inside the office was a small room used by technology staff for meetings and as a lunch room.

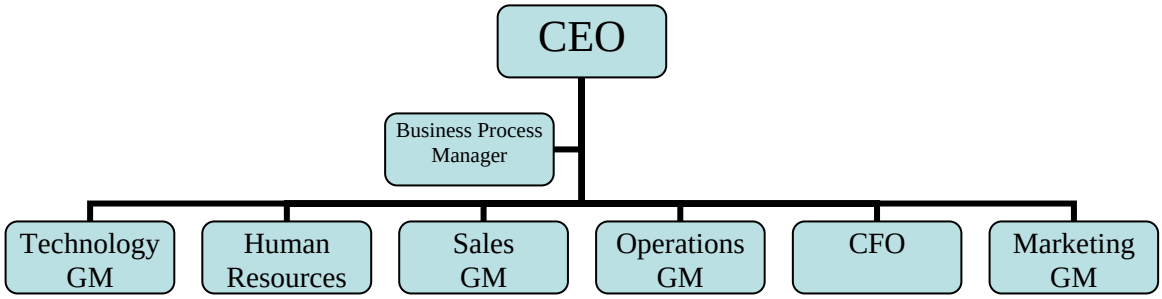
The other business functions such as marketing, sales and finance were located across a narrow road which separated the factory and technology department from the main office building. It was about 30 meters from the technology department to the main office building. The marketing, sales and human resources sections were located on the ground floor of this building. The general managers of marketing, sales and human resources had their offices along the side of the office complex with other functional managers. The other staff members had desks in the middle of the room with narrow walkways between the side offices and staff working area.

The ground floor also contained a number of meeting rooms which were used for product development project meetings. The finance department and IT function were located on the second floor. The CFO had an office in one corner on this floor with other functional managers' offices along the wall. The CEO also had an office on the second floor near the CFO. There were also a number of meeting rooms and a cafeteria on this floor. The third floor housed the board room and a small meeting room which was mainly used by project teams when they needed a dedicated project room. The board room was used for executive meetings and other important company events.

4.4.2 *OpCo's* structure

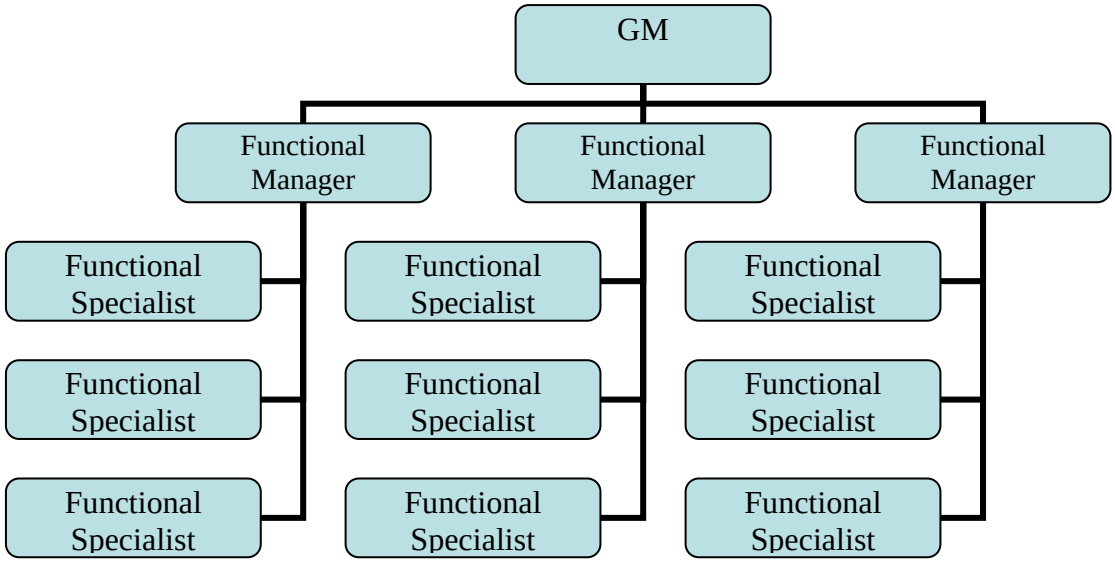
OpCo's structure consisted of three levels. The top management level was called the executive management level. This was made up of the CEO, CFO and the general managers of the five functional areas; human resources, sales, technology, operations and marketing as shown in Figure 12. The business process manager reported to the executive managers and was in charge of the project management office, which played a central role in managing the product development process.

Figure 12: Executive Management Structure at *OpCo*



Each of the functional general managers (GM) had three or four functional managers reporting to them (see Figure 13). The second management level was made up of the functional managers from the functional departments. These managers then had three or four staff members (functional specialists) in that function reporting to them.

Figure 13: Functional Department Structure at *OpCo*



4.4.3 Communities of practice at *OpCo*

This section presents a brief overview of the communities of practice I observed at *OpCo* during the product development process. As noted in Chapter 3, communities of practice include executive managers, functional managers and other staff members who are part of both hierarchal and functional communities. Chapter 3, Section 4 showed that in a product development setting management teams and product development teams are increasingly cross-functional and thus have to work together closely during the product development process.

As shown below in Figure 14 and Figure 15 all organisation members at *OpCo* (except for the CEO) were part of at least two communities of practice, one at the functional level (see Figure 14) which included the department's general manager (GM), functional managers and functional staff members (called "functional specialists" in this thesis), and one or more within a hierarchal level (see Figure 15).

Figure 14: Functional Communities of Practice at *OpCo*

Technology ***(CoP_T)***	***Marketing*** ***(CoP_M)***	***Sales*** ***(CoP_S)***	***Finance (CoP_F)***	***Operations*** ***(CoP_O)***	***Human Resources*** ***(CoP_{HR})***
GM Technology	GM Marketing	GM Sales	CFO	GM Operations	GM HR
Functional managers	Functional managers	Functional managers	Functional managers	Functional managers	Functional managers
Functional specialists	Functional specialists	Functional specialists	Functional specialists	Functional specialists	Functional specialists

Figure 15: Hierarchal Communities of Practice Observed at *OpCo*

Executive Manager-CoP ***(CoP_{EM})***	CEO	GM Technology	GM Marketing	GM Sales	CFO Finance	GM Operations	GM HR
Functional Manager-CoP ***(CoP_{FM})***	Business process manager	Technology managers	Marketing managers	Sales managers	Finance and IT managers	Operations managers	HR managers
Functional Manager Product Development-CoP ***(CoP_{FMPD})***		Technology managers	Marketing managers	Sales managers	Finance specialists	Operations specialists	HR specialists
Functional Specialist ***(CoP_{FS})***	Business process specialists	Technology specialists	Marketing specialists				
Project Team ***(CoP_{PT})***		Technology managers and specialists	Marketing managers and specialists	Sales managers and specialists	Finance and IT managers	Operations managers and specialists	

During the field work I participated in the work of four functional communities of practice and five hierarchal communities of practice. The functional communities included the technology community (CoP_T), the marketing community (CoP_M), the sales community (CoP_S), and the operations community (CoP_O). While the finance community (CoP_F) was also involved in some of the product development activities they did not play a major role and thus I did not follow them as closely as the other four communities.

The hierarchal communities I participated in included the executive manager community (CoP_{EM}), two functional manager communities, one being a general functional manager community (CoP_{FM}), and another a more specialised community which included managers from technology, marketing and sales departments who were involved in the product development process (CoP_{FMPD}), a functional specialist community (CoP_{FS}), and eight product development project teams made up of functional managers and specialists (CoP_{PT}).

The CoP_{EM} was made up of the chief executive officer (CEO) and the general managers of the functional departments. The CoP_{EM} was charged with developing the strategy and checking on its implementation. It also reviewed product development projects at the gates in the process. The CoP_{EM} met frequently to discuss issues related to project development projects and to check on the development status of projects. Each executive manager was also in charge of a functional department.

Members of the CoP_{FM} came from the technology, marketing, sales, finance, operations and human resource department and had overall responsibility for activities in their functional areas. A sub-set of the CoP_{FM} (the CoP_{FMPD} in Figure 15) included members

from the marketing, technology and sales departments. This community took responsibility for implementing the product development strategy and was responsible for the selection of projects as well as overseeing project teams within the firm (it also took part in projects as team members).

The functional specialists (CoP_{FS}) belonged to functional departments and carried out the day-to-day activities within their department. These included technologists, as well as marketing, sales, finance, operations, business process and human resource personnel. As well as their functional responsibilities functional specialists also assisted the CoP_{FMPD} during the first half of the product development process.

Finally the members of the project teams (CoP_{PT}) belonged to functional departments and carried out product development project activities. These teams included technologists, as well as marketing, sales, finance and operations personnel.

During the field study, product development project discussions took place at both the functional departmental level in weekly departmental meetings as well as in weekly cross-functional project team meetings with members coming from across the functional departments within the firm. The project teams (CoP_{PT}) reported to managers from the CoP_{FM}. Members of the CoP_{FM} reported to members of the CoP_{EM} and presented project updates at weekly and monthly CoP_{EM} meetings. The CoP_{EM} made the final decisions on project selection and checked the development of all projects at various stages during the product development process.

4.4.4 Boundary objects at *OpCo*

During the collection of data at *OpCo* I categorised the objects being used into three categories (numbers, document and models). I observed communities of practice at *OpCo* using various kinds of numbers which came from existing data repositories. These included both financial data such as product costings, earning before interest and tax, gross margin, net present value, and contribution after marketing as well as non-financial data such as market share, product formulation specifications, engineering specifications and manufacturing specifications.

A wide range of documents were also used at *OpCo* during the product development process. These included product development process documents, project management office (PMO) documents, marketing and sales reports, project reviews and presentations as well as strategy and brand pyramids. While these forms sometimes contained numbers, these numbers usually did not come from data repositories within the firm but were forecasts or came from external sources.

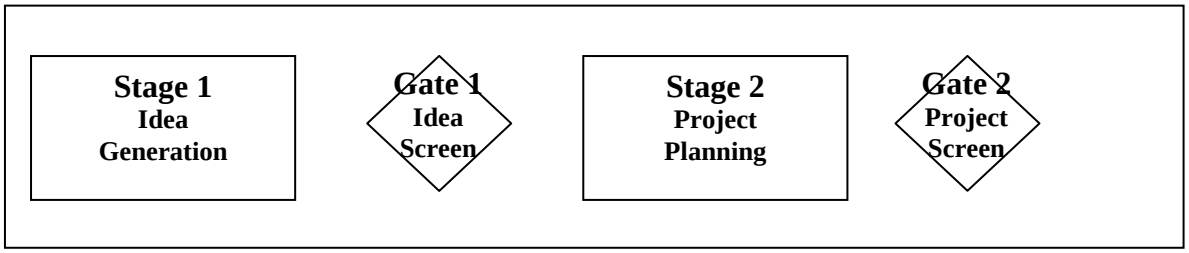
Finally, the models used at *OpCo* during the field study included product and packaging samples, packaging artwork, engineering drawings as well as manufacturing and market trials.

4.4.5 An overview of *OpCo's* product development process

The product development process at *OpCo* was based on a typical product development process which includes stages and gates (see for example Cooper, 2001; Crawford & Di Benedetto, 2006; Ulrich & Eppinger, 2000). The first half of the process started with the generation of new product ideas and ended when projects passed through the project screen

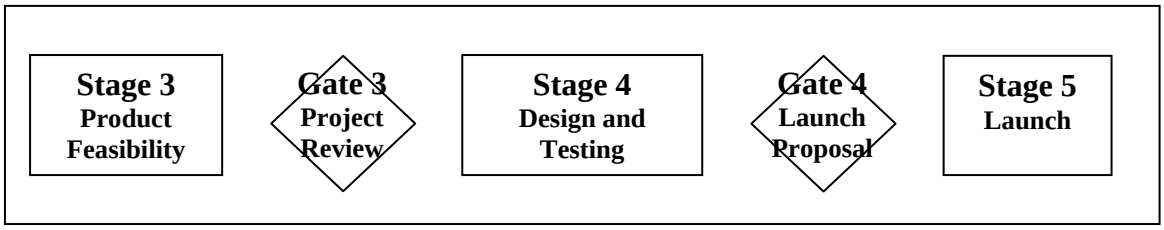
gate (see Figure 16 below). The rectangles represent the stages within the process. The members of the CoP_{FMPD} had overall responsibility for the stages during the first half of the process and were assisted by members of the CoP_{FS}. The diamonds represent the gates or decision points within the product development process. At these gates the CoP_{EM} and the CoP_{FM} would meet to make decisions about which product ideas to continue investigating.

Figure 16: The Product Development Process at *OpCo*: Idea Generation to Project Screen



The second half of the product development process at *OpCo* covered the stages from product feasibility of new products to their launch onto the market (see Figure 17 below). The second half of the process was where the projects were developed and launched. The rectangles represent the stages within the process. Members of the CoP_{FMPD} had overall responsibility for projects during the stages in the second half and were assisted by members of the CoP_{FS}. Members of the CoP_{FM} and CoP_{FS} would form project team communities (CoP_{PT}) to take projects from the design and testing stage to launch. The diamonds represent the gates or decision points within the process. At the gates the members of the CoP_{FMPD} presented project updates to the CoP_{EM} who reviewed the progress of projects.

Figure 17: The Product Development Process at *OpCo*: Product Feasibility to Launch



The following two field study chapters, Chapter 5 and 6, report on the activities that took place during product development at *OpCo*. A summary is given at the end of each activity report on the role of management control and the ways in which it was being used, as well as an overview of the boundary objects communities of practice used to accomplish management control during the product development process for the different projects. Chapter 5 reports on the stages and gates that took place during the first half of the product development process while Chapter 6 reports on the stages and gates that took place during the second half of the product development process. To preserve confidentiality this thesis does not use the vocabulary used at *OpCo* when discussing the process but instead uses generic product development terminology.

4.5 Ethical considerations

Ethical considerations are important as this study relied on getting close to the practices of many communities of practice both at different hierarchical levels and within different functional departments at *OpCo*. It was thus important to assure the anonymity of the firm and the organisation members who took part in the study to prevent their being recognised by other *OpCo* members and to assure the firm that it would not be recognised by outside firms. This guarantee of anonymity was stated clearly to the organisation members at

every stage of the field study and was explicitly stated in the ethics documentation given to the firm as part of the ethics approval process at The University of Auckland.

This does cause some issues when reporting the activities at *OpCo* as project details and the people who worked on them cannot be used. The focus of these chapters is thus on the communities of practice and not on the individuals who made up the community. In this thesis organisation members are referred to by their hierarchal level, such as; executive manager community of practice (CoP_{EM}), functional manager community of practice (CoP_{FM}), functional manager product development community of practice (CoP_{FMPD}), functional specialist community of practice (CoP_{FS}), and project team community of practice (CoP_{PT}). At times it is necessary to give more detail and in these cases the functional community the organisation members belonged to is given. These communities include the; technology community of practice (CoP_{T}), marketing community or practice (CoP_{M}), sales community of practice (CoP_{S}), finance community of practice (CoP_{F}), operations community of practice (CoP_{O}), and the human resources community of practice (CoP_{HR}). The material reported in this thesis is of a general nature and examines the two research questions presented at the start of the thesis and developed further in Chapters 2 and 3.

My position, as a researcher, was made known to all the members of *OpCo* I came into contact with during the study. The purpose of the study was always openly stated to these organisation members. I was introduced to organisation members as a "PhD Enterprise Scholar" who was being sponsored by their parent company (AusFood) to learn how *OpCo* developed new products.

4.6 Intellectual property and confidentiality agreement

As part of the "Enterprise Scholarship" agreement with AusFood any intellectual property (IP) created or developed in the course of this project and derived directly from the use of the confidential information is owned by AusFood. In exchange AusFood granted me a perpetual, non-exclusive, non-assignable, non-sub-licensable, royalty-free licence to use the project IP for carrying out research and directly related activities only. AusFood also gave me permission to publish research information of general scientific and academic interest (including the thesis) in scholarly journals that may contain reference to the project IP and confidential information. It was also agreed that I would provide AusFood with a copy of any such proposed publications related to the research at least 60 days prior to submission for publication. If AusFood considered the publication to contain confidential information or project IP, then AusFood could request that such information be deleted. If AusFood requested information to be deleted, I had to either delete the details of the project IP as requested, or delay publication of the research for one year.

4.7 Summary

The aim of this chapter was to present an overview of how the research reported in the following two chapters was carried out and to better understand the context in which the research took place. This started by linking ethnomethodology with the field study methodology and the participant observation method needed to gain the depth of understanding needed to understand practice. This was followed by an overview of (1) the field site, and (2) the field materials collected during the study and (3) how they connected to the product development process. The longitudinal field study methodology set out in

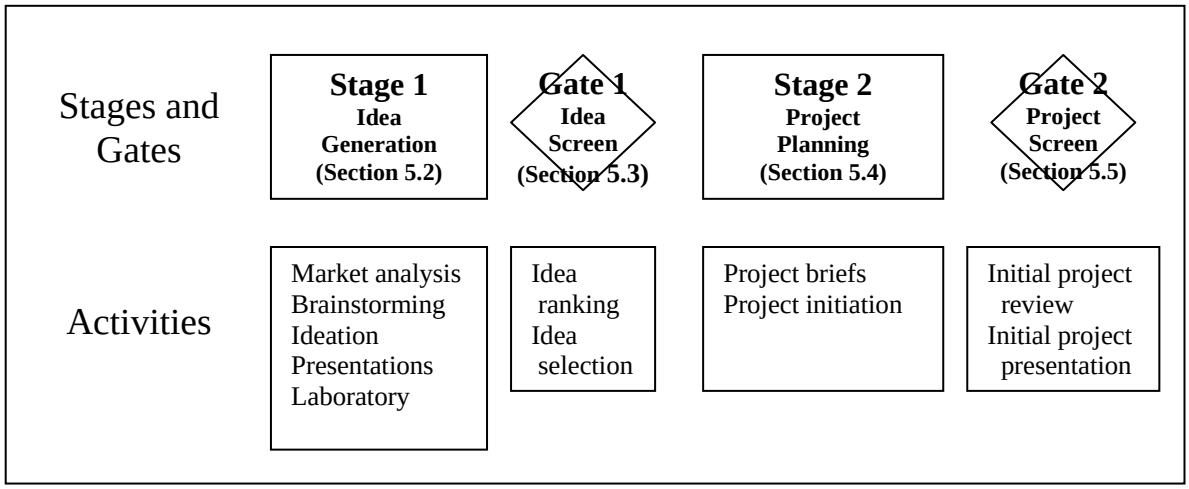
this chapter connects with the call for more grounded field studies in the management control literature (Otley, 2001).

Chapter 5: Field Study Part 1 - The Product Development Process at *OpCo*: Idea Generation to Project Screen

5.1 Introduction

The first half of the product development process at *OpCo* consisted of the stages and gates which dealt with idea generation (Stage 1), idea screening (Gate 1), project planning (Stage 2) and project screening (Gate 2) as shown in Figure 18 below.

Figure 18: The Product Development Process at *OpCo*: Idea Generation to Project Screen



This chapter reports on the product development activities in which communities of practice at *OpCo* were involved during the different stages and gates that made up the first half of the product development process. As ethnomethodology requires a close-up view of practice, I followed as closely as possible the activities of the communities of practice.

The communities of practice observed during the first half of the product development process at *OpCo* (see Figure 19) included an executive manager community of practice (CoP_{EM}), a functional manager product development community of practice (CoP_{FMPD}), a functional manager community of practice (CoP_{FM}) and a functional specialist community of practice (CoP_{FS}).

Figure 19: Communities of Practice Observed

Executive Manager-CoP (CoP_{EM})	CEO	GM Technology	GM Marketing	GM Sales	CFO	GM Operations	GM HR
Functional Manager Product Development-CoP (CoP_{FMPD})		Technology managers	Marketing managers	Sales managers			
Functional Manager-CoP (CoP_{FM})	Business process managers	Technology managers	Marketing managers	Sales managers	Finance managers	Operations managers	HR managers
Functional Specialist-CoP (CoP_{FS})		Technology personnel	Marketing personnel	Sales personnel			

The CoP_{EM} was a formal top management community which included the CEO, CFO and the five functional general managers (technology, marketing, sales, operations and HR). The CoP_{FM} was also a formal community and consisted of all the functional managers in *OpCo*. The CoP_{FMPD} was a community made up of functional managers from the marketing, sales and technology departments who worked together closely during the first part of the product development process. Finally the CoP_{FS} was a cross-functional community made up of members of the technology, sales and marketing departments who were involved in product development activities (see Figure 18) during many of the stages during the first part of the product development process at *OpCo* and who regularly interacted with one another during both formal meetings and informally within the firm.

There were also interactions between members of the different functional communities at *OpCo* during the activities that took place during the first half of the product development process (see Figure 18). The main functional communities I observed during the first half of the product development process are presented in Figure 20. They included a technology community of practice (CoP_T), a marketing community of practice (CoP_M) and a sales community of practice (CoP_S). I also observed to a lesser extent the activities of members of other functional communities including the finance community of practice (CoP_F) and the operations community or practice (CoP_O).

Figure 20: Functional Communities of Practice (CoP) at *OpCo*

***Technology-CoP* (CoP_T)**	***Marketing-CoP* (CoP_M)**	***Sales-CoP* (CoP_S)**	***Operations-CoP* (CoP_O)**	***Finance-CoP* (CoP_F)**
GM Technology	GM Marketing	GM Sales	GM Operations	CFO
Functional managers	Functional managers	Functional managers	Functional managers	Functional managers
Functional specialists	Functional specialists	Functional specialists	Functional specialists	Functional specialists

The following sections report on the product development activities in which organisation members from the different communities of practice at *OpCo* were involved during the first half of the product development process. These consisted of an idea generation stage, a project planning stage, an idea screening gate and project screening gate.

The focus of this report on practice is on the boundary objects; numbers, documents and models (see Carlile, 2002; Star, 1989; Star & Griesemer, 1989) communities of practice used to accomplish management control in practice. At the conclusion of each report I

comment on why communities of practice used certain boundary objects and categorise control in relation to the role of management control (see Davila, 2000) and the style in which management controls were used (see Bisbe & Otley, 2004; Simons, 1995a, 1995b).

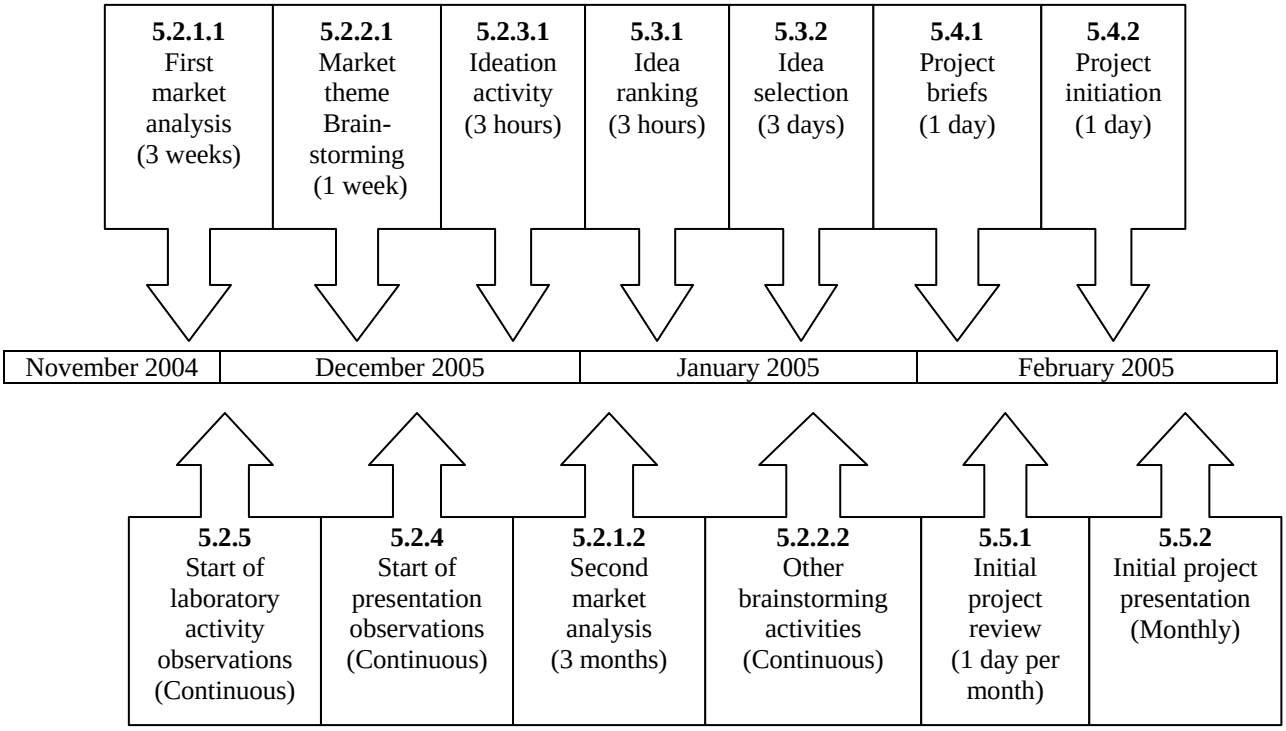
Section 5.2 reports and comments on the activities undertaken during the first stage of the product development process at *OpCo*, the idea generation stage (Stage 1 in Figure 18, on page 86). The CoP_{FMPD}, organised the product development activities during this stage, which included market analysis, brainstorming, ideation, internal and supplier presentations and laboratory activities (see Figure 21, on page 90). Members of the CoP_{EM}, CoP_{FM} and CoP_{FS} were also involved.

OpCo then screened new product ideas (Gate 1 in Figure 18, on page 86) to narrow down the number of potential projects coming out of the idea generation stage. This consisted of an idea ranking activity and an idea selection activity, which are reported and commented on in Section 5.3 (see Figure 21, on page 90). Members of the CoP_{EM} and the CoP_{FM} took part in the idea ranking activity which was focused on ranking the new product ideas that had come out of the idea generation stage. The CoP_{FMPD} then met to select the product ideas to develop further. During this activity the CoP_{FMPD} examined new product ideas that had been ranked along with a list of new product ideas that the marketing and technology departments recommended for strategic reasons.

The project planning stage was the second stage in the product development process at *OpCo* (see Figure 18, on page 86) and is reported on commented on in Section 5.4. During this stage two activities were carried out. The first, which involved writing project briefs, was organised and carried out by the CoP_{FMPD} with assistance from members of the CoP_{FM}

and the CoP_{FS}. The second activity, project initiation, was carried out by the CoP_{FMPD} with the assistance of other members of the CoP_{FM} (see Figure 21 below).

Figure 21: The Product Development Cycle at *OpCo*: Idea Generation to Project Screen



The final gate in the first half of the product development process at *OpCo* was a project screen (Gate 2 in Figure 18, on page 86) which is reported and commented on in Section 5.5. This gate involved two activities. The CoP_{FMPD} developed an initial project review which they presented to the members of the CoP_{FM}. Once a project had been approved by this group a member of the CoP_{FMPD} gave an initial project presentation to the members of the CoP_{EM} (see Figure 21 above).

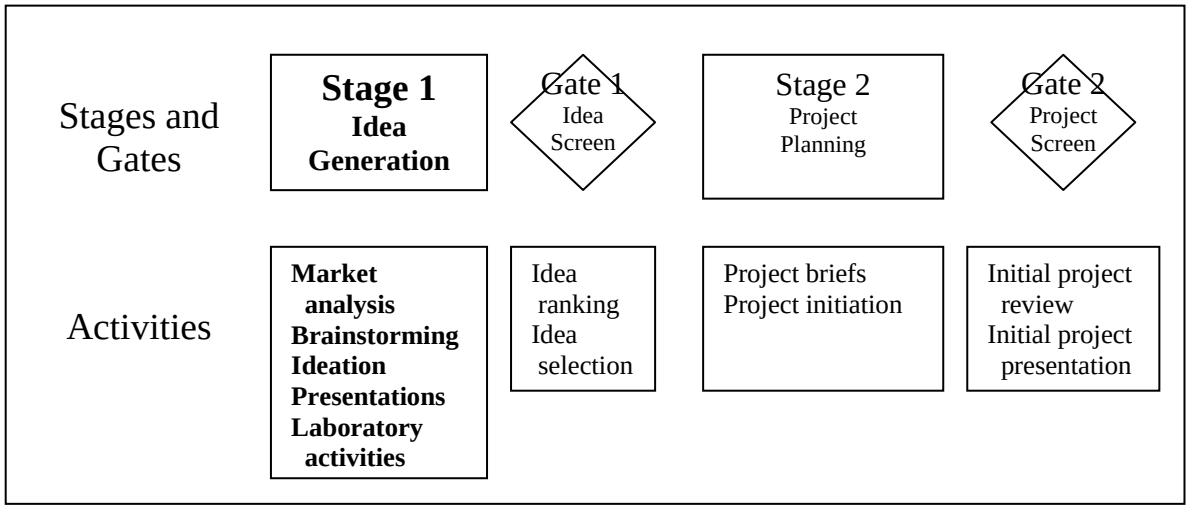
Section 5.6 concludes the chapter with a summary and commentary on the boundary objects (numbers, documents and models) communities of practice used to accomplish

management control in practice. This summary includes an overview of the boundary objects used for each type of product innovation as well as the role of management controls and the way in which they were used during the first half of the product development process. It also comments on how and why boundary objects were used in practice and discusses their use in relation to the role of management control and the way in which management controls were used.

5.2 Stage 1: Idea generation

This section briefly reports on the activities that took place during the idea generation stage, the first stage of the product development process at *OpCo* (see Figure 22).

Figure 22: The Product Development Process at *OpCo*: Stage 1 - Idea Generation



I observed five activities at *OpCo* which were used to generate new product ideas. These consisted of; market analysis, brainstorming, ideation, internal and supplier presentations and laboratory activities.

5.2.1 Market analysis

This section focuses on two types of market analysis. I observed the first type during the start of my field work. At this time a general market analysis was being carried out to spark new product ideas in *OpCo's* current product categories.[11] I observed the second type about two months later when laboratory activities led the firm to carry out market analysis in a product category within which the firm did not operate at that time.[12]

5.2.1.1 The first market analysis activity at *OpCo*

When I first arrived at *OpCo* I observed members of the CoP_{FMPD} spending much of their time examining recent consumer trends in the local and international markets. The purpose of this activity was to understand the product categories where new product varieties for incremental innovations and new product lines for semi-radical innovations might be successful. As this was critical in this stage in the process the CoP_{FMPD} allocated it a significant amount of time. A member of the CoP_{FMPD} said that "*without a good understanding of the marketplace the product development process would not have any focus*." Through my interactions with the members of the CoP_{FMPD} I learnt that "focus" meant having a good understanding of recent market trends in the food industry, which enabled the members of the CoP_{FMPD} to say where new product ideas might come from.

From the market information gathered during this time the CoP_{FMPD} managers focused on eight themes that they thought represented promising areas to develop new products in the domestic market.[13] These eight themes were then documented and given to the members of the CoP_{FM}. To better communicate the eight themes the CoP_{FMDP} gave each of them a

[11] These current product categories included incremental product innovations (new product varieties) and semi-radical product innovation (new product lines).
[12] This new product category led the firm to examine a radical product innovation which included new technology and a new business model.
[13] This came from a CoP_{FMPD} meeting that I attended.

name so that communities of practice throughout the firm would be able to remember them. When interacting with members of the CoP_{FM} and CoP_{FS} I observed that the members of the CoP_{FMPD} used these names when talking about the eight market themes.

These eight themes were then used by the CoP_{FMPD} to plan the daily product development activities of the CoP_{FS}. This included gathering more information related to these themes which was distributed around the organisation by email.[14] This first market analysis activity led directly to the brainstorming activity examined in Section 5.2.2.

5.2.1.2 The second market analysis at *OpCo*

The above market analysis activity was carried out early in the product development cycle (see Figure 21, on page 90), and although it was broad it covered only product categories in which *OpCo* currently operated, i.e. new product varieties for incremental innovations and new product lines for semi-radical innovation. Later on in the product development cycle I observed how laboratory activities (for more details on this activity see Section 5.2.5) had sparked new product ideas which required the analysis of radical innovation ideas in product categories in which *OpCo* did not operate at that time.

It was during this time that I observed the CoP_{FMPD} carrying out analysis of market segments that they thought were close to the new market category in which they were interested.[15] This market activity was different to the one above, because the organisation was attempting to develop a new product category where no products currently existed. To do this, communities of practice gathered samples of different products and packaging that

[14] I was on *OpCo's* email list and thus received this information
[15] I took part in the CoP_{FMPD} meeting related to this activity which was later documented in a marketing report to the CoP_{EM}.

were available in segments surrounding the new product idea. They also searched for business plans that firms in those market segments were using.

Three communities of practice, the CoP_{FMPD}, CoP_{FM} and CoP_{FS} met regularly during this time to discuss the different options surrounding the new market category. During these interactions they would use packaging, product and business models to talk about aspects of the product idea that they thought were important. At this stage I did not see the communities of practice using either numbers or documents.

5.2.1.3 Commentary on market analysis activities

The CoP_{FMPD} used the eight market themes (document) as a boundary object to signal to members of CoP_{FM} and CoP_{FS} their desire for new product ideas in these eight areas.[16] This was done through documenting the eight themes and sending them to members of the CoP_{FM} and CoP_{FS}. As this document outlined the CoP_{FMPD} members' understanding of the market it could be used to communicate their knowledge to other communities of practice. The eight themes were used to set a boundary around the areas that CoP_{FMPD} wanted the members of the CoP_{FS} and CoP_{FM} to develop new product ideas. Thus, the style in which management controls were being used seemed to set a boundary around the acceptable areas for incremental and semi-radical product development.

This boundary setting through signalling helped the CoP_{FMPD} reduce market uncertainty for the CoP_{FS} and CoP_{FM} as it gave these communities guidance on where to look for new product ideas and the kinds of information for which they should be looking. As the focus of this activity was on the collection and analysis of information it connects to the

[16] This came from my observations of the communities of practice.

uncertainty reducing role of management controls. Thus, when the CoP_{FMPD} faced an uncertain market they created and used a document about eight market themes to communicate to the other communities their understanding of the market.

During the second market analysis activity the CoP_{FMPD} gathered and used packaging, product and business models (models) and used them as boundary objects when communicating with the CoP_{FM} and $CoP_{FS.}$ The use of these models enabled these communities of practice to understand new market and business categories and thus reduce uncertainty about how each community of practice viewed the development of this area.

The CoP_{FMPD} saw this as a learning exercise as it incorporated ideas from across different market categories and different business segments. The models were used interactively as communities of practice discussed and debated product innovation ideas and the different options they had available to them. Thus, the style of management controls during this activity connects to an interactive use with an emphasis on learning about how to understand the different options available and discussing and debating the best way forward.

When there was uncertainty about radical innovation ideas the CoP_{FMPD} seemed to be uncertain about what they needed to know and thus used models to learn about different ways of understanding the possible options.[17] It can be seen from this example that the CoP_{FMPD} seemed to know the activities they needed to undertake but were unsure of what the results of these activities meant for their own practice and for the practice of the other communities.

[17] I came to this conclusion through my observations of the CoP_{FMPD} during the market analysis activity.

When comparing the two market analysis activities one reason that communities of practice at *OpCo* used documents instead of models for incremental and semi-radical product innovation ideas was that there were fewer elements of novelty that had to be understood for these types of products (see Carlile's framework in Figure 10). Documents may not have been sufficient to communicate radical product ideas as there were more elements of novelty. Thus, the main differences between in the boundary objects used during each of the above market activities relate to the level of novelty of the product innovation being attempted.

While the role of management control during both these activities seemed to focus on reducing uncertainty the style in which management control was used differed. During the first market analysis activity the documents were seen to be used to set boundaries around areas where the CoP_{FMPD} wanted innovation for incremental and semi-radical innovation to take place. This was possible as the CoP_{FMPD} could use the market analysis document to communicate to the other communities of practice that they understood the market. This changed during the second market analysis activity as the CoP_{FMPD} could not communicate to the other communities their understanding of the market and instead focused on learning how to understand a new market. Because of this the CoP_{FMPD} had to use models when communicating with other communities of practice.

5.2.2 Brainstorming

Brainstorming activities that were used at *OpCo* to generate new product ideas both at the start of the product development process and when communities of practice perceived a need to understand a product development idea better (see Figure 21, on page 90). The first brainstorming activity I observed took place shortly after the first market analysis activity.

This section reports on the initial brainstorming activity as well as on other brainstorming activities.

5.2.2.1 Market theme brainstorming activity

After the first market activity was completed and after the CoP_{FMPD} had sent the eight market themes to the other communities, the CoP_{FMPD} organised a brainstorming activity for each of the eight themes. Each session was run by a team which included members of the CoP_{FM} and CoP_{FS} [18] from across different functions. The CoP_{FMPD} selected the members for each of the eight brainstorming teams. The main criterion for choosing a brainstorming team was the market category in which the members of the CoP_{FM} and CoP_{FS} worked. Each team was responsible for planning and carrying out one brainstorming session. The process followed for each brainstorming session is shown in Figure 23 below.

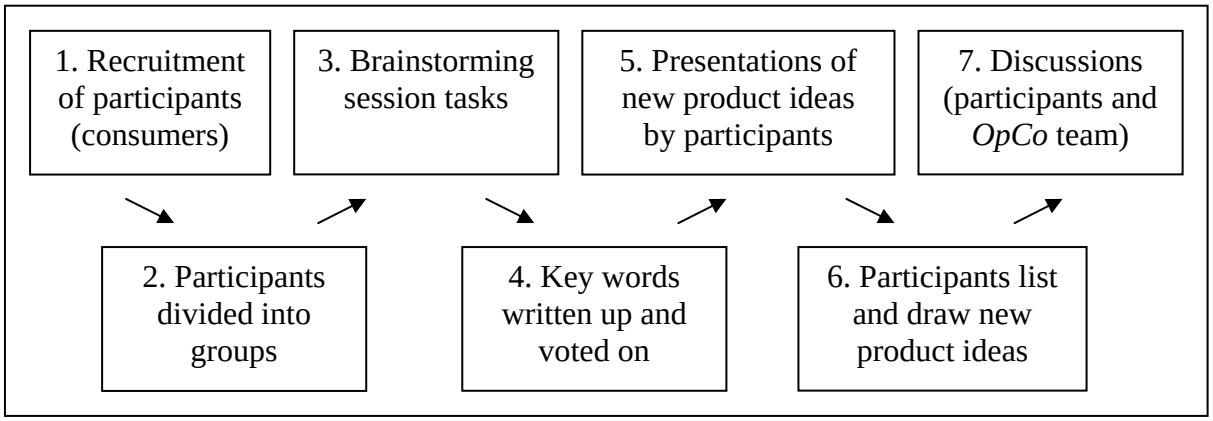
First each team recruited consumers [19] from outside the firm to participate in their brainstorming session, because the CoP_{FMPD} wanted to elicit new product ideas from the market place. In selecting consumers to participate in their brainstorming session the teams aimed to choose people who fitted the market theme and would thus be a prospective purchaser of the new products in that category. I attended one of the brainstorming sessions to (1) see how it was run, (2) to gain a deeper understanding of the brainstorming activity, and (3) to identify its role in the selection of product development

[18] These teams are not considered communities of practice in this study because they came together only during this activity

[19] No internal *OpCo* members were allowed except for those organising the session

projects at *OpCo*.[20] Although I could have observed this without participating I chose to participate as a consumer[21] to become immersed in the activity.

Figure 23: The Brainstorming Activity at *OpCo*



The brainstorming session I attended took place in a meeting room at *OpCo* and ran for about two hours. At the start of the session the participants were divided into groups. Each of the groups was assigned to an *OpCo* team member, who came from the CoP_T, CoP_M or CoP_S. Once all the participants had been divided into groups the functional manager in charge of the session gave us an overview of the session and the schedule of tasks for each group.

These tasks were designed to stimulate thinking about the theme in question. At the end of each task all participants wrote down a word on a post-it-note describing how they felt. When all the groups had completed their tasks the functional manager stuck all the post-it-notes onto a wall in the meeting room. She asked the participants to look at all the post-it-notes and vote for their favourite three words. The functional manager then collected all

[20] This was the only activity at *OpCo* where I chose to be an outsider. I felt I would gain a deeper understanding of the brainstorming activity by taking part in the activity as a consumer.
[21] While I participated in this activity as a consumer I also took notes on how the *OpCo* team ran the activity

the votes to see which words gained the most votes. The participants then drew or described new product ideas which had the qualities represented by the three most popular words in the group. Finally each group of participants presented their best new product idea. The *OpCo* team then discussed the ideas with the participants to learn more about them. At the completion of all the tasks the *OpCo* team took all the participants' drawings and the ideas they had written down and made them into posters.

5.2.2.2 Other brainstorming activities

While the above brainstorming activity involved interactions between *OpCo* members and consumers the other brainstorming activities I observed involved mainly internal communities of practice. The focus of these brainstorming activities was different from the above activity as they were designed to get a deeper understanding of specific issues that were important for *OpCo*. These brainstorming activities often involved packaging, marketing and technical issues and also led to the generation of radical innovation ideas.

On one occasion I observed members of the CoP_{FM} and CoP_{FS} carrying out brainstorming activities concerned packaging, which these communities of practice felt they needed to understand better. This brainstorming activity was held in the technology lounge, a room next to the technology laboratory (Figure 11, on page 74). The aim of this brainstorming activity was to better understand some radical[22] product packaging ideas developed to add product appeal.

The discussion in this brainstorming activity focused on the shape and functionality of the packaging. Communities of practice had brought some packaging samples and pictures

[22] As with all projects the level of innovation reported on in this thesis was determined by the firm.

which were used to discuss different packaging ideas and the effect they would have on different departments. During the session the members of the CoP_{FM} and CoP_{FS} both created and used packaging samples to discuss technical issues such as packaging materials, retail shelf space usage, pallet configurations and marketing issues such as product differentiation and customer use. Other issues triggered by the use of the packaging samples included the lead time necessary to arrange supply, and environmental issues concerning the recycling of packaging.

5.2.2.3 Commentary on brainstorming activities

The first brainstorming activity consisted of eight formal sessions which were run by teams made up of members of the CoP_{FM} and the CoP_{FS}. These formal sessions were used to create a number of posters containing drawings and lists of new product ideas (documents[23]) which were used by the CoP_{FMPD} to communicate current consumers' new product ideas. These documents were used as boundary objects to help the CoP_{FMPD} signal the kinds of products in which customers were interested. During this activity members of the CoP_{FM} and the CoP_{FS} interacted to learn more about the types of new products in which customers were interested.

Following this activity the CoP_{FMPD} used these documents when communicating to other *OpCo* members to show them that they understood what consumers wanted, as the drawings and project ideas on the documents came from the end consumers who were members of the target market. Thus, these documents enabled the CoP_{FMPD} to reduce market uncertainty about customer expectations.

[23] The drawings and lists of ideas that brainstorming participants made do not qualify as models in this study because they did not contain enough detail in relation to the practice of *OpCo* members.

The other brainstorming activities were less formal and focused on specific issues of interest to many communities of practice. Members of the CoP_{FM} and the CoP_{FS} participated in these activities and used packaging models and drawings (models) to discuss different radical packaging designs. These packaging models and drawings were used as boundary objects as they were able to deal with the many elements of novelty surrounding radical product ideas.

During this activity communities of practice focused on bringing together critical pieces of information on important issues that different communities faced. The role of management control in this context seemed to be on reducing information. These communities of practice were using the information to create new ideas and solve differences for radical product innovation and thus they engaged interactively to learn about how others viewed these ideas and how possible solutions would affect their practice.

After examining the boundary objects created and used during the two brainstorming activities the main difference between them was the level of product innovation attempted. The first brainstorming activity was concerned with documenting consumers' ideas for incremental and semi-radical product development projects. The second brainstorming activity was aimed at developing new product ideas for radical product innovation with a high level of novelty and thus communities of practice had to communicate how various issues affected their community of practice differently.

One reason why communities of practice at *OpCo* used documents for incremental and semi-radical product innovation ideas and models for radical innovation ideas was that there were fewer elements of novelty that had to be understood for incremental and semi-

radical products. Listing ideas on documents may have been sufficient for communities of practice to talk about incremental and semi-radical product innovations as there were few elements of novelty that had to be understood for these types of products. On the other hand, documents were not sufficient for radical product innovations as there were a greater number of elements of novelty. In these cases communities of practice at *OpCo* used models because they were able to capture and facilitate a deeper understanding of more novel elements.

The role of management control during both of the brainstorming activities seemed to be to reduce uncertainty. This was done during the first brainstorming activity by including consumers who produced new product ideas related to specific market themes and during the second brainstorming activity through the use of packaging samples and drawings.

The style in which management control was used differed for each of the brainstorming activities. The first brainstorming activity was focused on setting boundaries about with consumers wanted from new products while the second brainstorming activity was interactive as members of different communities of practice met face-to-face to debate information and challenge assumptions about innovation ideas.

5.2.3 Ideation[24]

Following the initial market research and brainstorming activities I observed an ideation activity (see Figure 21, on page 90). During this communities of practice examined the ideas of consumers which had come from the initial brainstorming activity. It also gave

[24] Ideation is used to get individuals to open up and share ideas which can produce new collaborations and developments (Day, Gold, & Kuczmarski, 1994).

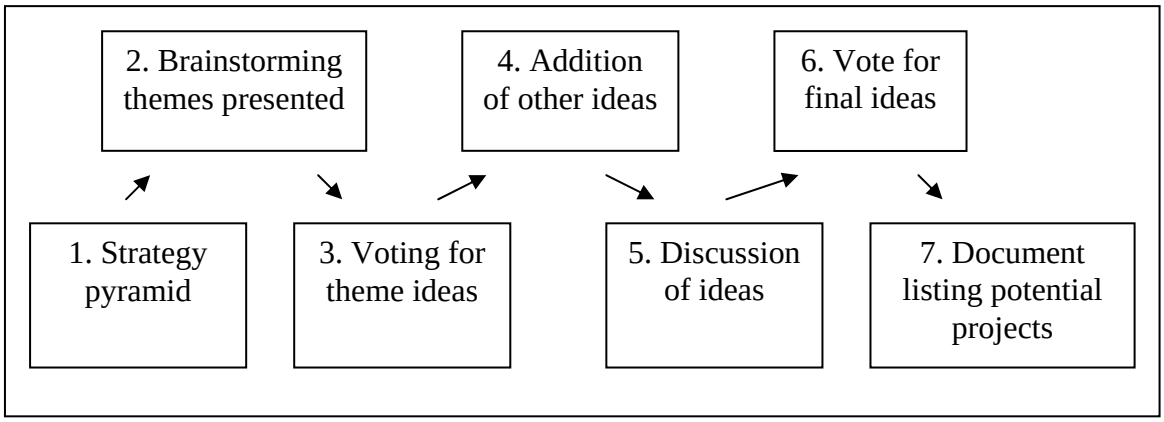
communities of practice a chance to present other ideas which had been generated in their community during their daily activities.

5.2.3.1 The ideation activity

The ideation activity was organised by the CoP_{FMPD} who were also responsible for the initial market analysis and brainstorming activities. A diverse group of *OpCo* members attended this activity including two members of the CoP_{EM}, six members of the CoP_{FM}, which included all the CoP_{FMPD} members, and six members of the CoP_{FS}. A member of the CoP_{FM} facilitated the three hour activity. According to the facilitator the aim was to "*Think outside the box*", and to "*Focus on ideas that would support [OpCo's vision and strategy]*."

The activity was held in the technology training room which was a large room on the ground floor of the technology department. Chairs were set out in a circle which allowed for free and open discussions. At the front of the room was a large white board. One of the walls was used to display the documents (posters containing the drawings and lists of projects ideas) that had came out of the brainstorming activity held earlier in the month. Figure 24 below shows how the ideation activity was run.

Figure 24: The Ideation Activity at *OpCo*



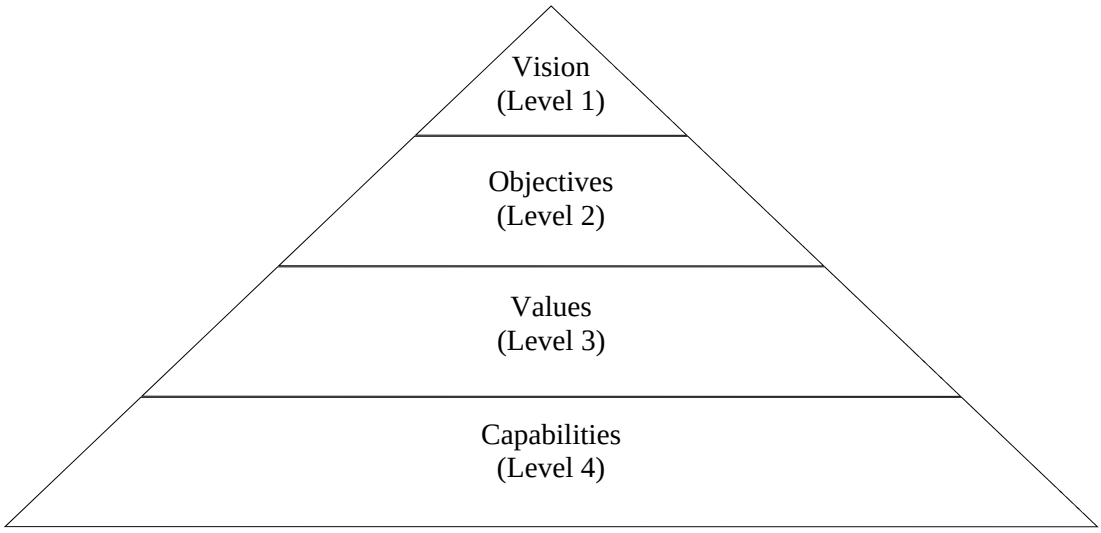
The ideation activity took place in a relaxed and informal atmosphere. Music played in the background and drinks and snacks were served at regular intervals. The activity started with a review of *OpCo's* strategy pyramid (see Figure 25) by the facilitator and the members of the CoP_{EM} (#1 in Figure 24, on page 103). The facilitator and members of the CoP_{EM} stressed the importance of the firm's vision and key performance objectives outlined in the strategy pyramid. During the activity the facilitator repeatedly told the organisation members to "*focus on new ideas that are consistent with our vision*." The members of the CoP_{EM} emphasised *OpCo's* strategy pyramid and in particular the firms' vision and objectives before each brainstorming team presented its theme.

OpCo's strategy pyramid was divided into four sections and included the firm's vision, objectives, values, and capabilities (see Figure 25). At the top of the strategy pyramid was *OpCo's* vision for the firm. The second layer of the strategy pyramid comprised two objectives which the CoP_{EM} had set for the firm. One of the objectives related to the domestic market and the other related to export markets. The third layer of the pyramid was a list of three values that the CoP_{EM} thought were necessary for *OpCo* to reach its vision and objectives. Finally the bottom layer of the strategy pyramid had a list of

capabilities that the CoP_{EM} thought were critical for *OpCo* to build for the firm to be successful.

Following the overview of *OpCo's* strategy pyramid the facilitator went over the instructions for the session. Following the instructions each brainstorming team was given about fifteen minutes to present their posters, which contained drawings and lists of new product ideas (#2 in Figure 24, on page 103). The first brainstorming team started the process by putting up their posters. The organisation members gathered around the posters and started reading through the ideas, looking at the diagrams and talking to the brainstorming team members. During this time the organisation members were allowed to vote for three of the theme ideas (#3 in Figure 24, on page 103) by putting a pen mark next to the idea on the poster. When all the organisation members had voted the facilitator counted the votes and wrote the ideas with the most votes onto the white board at the front of the room. This process was repeated for the other seven brainstorming teams. On average each team had between four and six posters with twenty to thirty new product ideas on each poster**.**

Figure 25: *OpCo's* Strategy Pyramid



After all the teams had been given a chance to present their posters the facilitator went around the room asking for other ideas which were not on the brainstorm session lists (#4 in Figure 24, on page 103). There was usually a debate about these new ideas and only those ideas with enough support were written on the white board. Organisation members were then asked to talk about the project ideas about which they were most passionate. This "sell time" as it was called gave all organisation members a voice in the process (#5 in Figure 24, on page 103). Finally the organisation members voted for the three ideas on the white board (#6 in Figure 24, on page 103). At the end of the session the ideas with the most votes were put on a potential new project list for further consideration (#7 in Figure 24, on page 103).

Members of different communities of practice were involved in this activity. Although it was organised by the $CoP_{FMPD,}$ members of the CoP_{EM} played an important role in stressing the importance of the firm's strategy and objectives during the activity. Other members of the CoP_{FM} were also present. Members of the CoP_{FS} were also involved in the

voting process as they would be the ones who would have to carry out the product development activities for any new project, and thus needed to buy into the process.

Members of the different hierarchal levels were present during the ideation activity. This provided the opportunity for differences arising from different levels to come to the surface. Members of the CoP_{EM} stressed the firm's vision and goals from the strategy pyramid as that represented a major part of their practice (strategy formulation). Organisation members used the documents which had come out of the brainstorming activity to talk about strategy implementation and functional work issues.

The ideation activity resulted in a new document containing a list of potential product development projects that fitted the firm's strategy and connected to the different market categories in which the firm operated. This document became the input into idea screening (Gate 1) presented in Section 5.3.

5.2.3.2 Commentary on the ideation activity

The members of the CoP_{FM} and CoP_{FS} used boundary objects in the form of documents (drawings and new product ideas) which had been generated from the initial brainstorming session. As these new product ideas were not very different from the kinds of products the firm currently made communities of practice were able to use them when communicating with each other as they could understand how the new ideas would affect their practice. Thus the use of boundary objects in the form of documents was useful when there were only a few elements of novelty.

The role of management control during this activity seemed to have two purposes. At the start of each brainstorming presentation the CoP_{EM} used the firm's overall objects from the strategy pyramid document to stress the growth expectations of the firm, thus a goal congruence role. This is because these managers wanted the organisation members to evaluate each new product idea in relation to its ability to help the firm meet those objectives. During the activity product drawings and new product idea documents were created. As the ideas in the drawings and product ideas documents had come from consumers they were viewed as good source of market information which helped to reduce uncertainty about what types of products consumers were interested in purchasing in the future.

Communities of practice used these documents interactively to examine new project ideas and challenge assumptions about their likelihood of success. There was another style of management control being used relating to the influencing of beliefs. Through the use of the strategy pyramid the members of the CoP_{EM} continually stressed that it was important for all communities of practice to think about the firms' vision, objectives, values and capabilities. These were mentioned at the start of each new theme presentation and were referred to during discussions.

5.2.4 Presentations

During my time at *OpCo* I observed other idea generation activities (see Figure 21, on page 90). There were presentations by members of the CoP_{FM} and the CoP_{FS} from the CoP_{M} the CoP_{S} and the CoP_{T}, as well as presentations by ingredient and packaging suppliers concerning market trends and new technologies in their specific fields. Some of these

presentations were broad, covering all the market categories in which *OpCo* operated, while others were more narrowly focused on a specific marketing or technical issue.

5.2.4.1 Internal presentations

I observed internal presentations being organised periodically by members of the CoP_{FM} and CoP_{FS} throughout the time I was at *OpCo*. Organisation members from across *OpCo* would attend these activities. One of these presentations was a market update organised by members of the CoP_{FM} one Friday afternoon. The organisation members at this activity came from the CoP_{M} and the CoP_{FM} and included a member of the CoP_{EM}, two members of the CoP_{FM}, and four members of the CoP_{FS}. It started with a formal presentation which contained reviews of the latest consumer and technology trends in the food industry by a member of the $CoP_{FS.}$ It ended with a group discussion.

At the start of the activity the presenter summarised the market analysis that CoP_{FMPD} members had done to put the views in context. The presenter then showed a few product models which were connected to new trends in the market. One of the product models presented that had recently gained a significant market share was a premium[25] product. After a brief introduction by the presenter on this product and the types of ingredients it used a member of the CoP_{EM} started the discussion.

CoP_{EM} "*We need to understand the links between premium and natural. To what degree do they link*? *Is natural the same as premium or is it a new category*?"
CoP_{FS} "*[I think] natural is even more premium*."
CoP_{FM} "*When customers think of premium they think of taste*."
CoP_{FS} "*Natural will still add value but it still must be premium*."
CoP_{FM} "*Customers look for premium clues on the product's packaging*."

[25] Premium food products are defined in terms of the ingredients that they use

As can be seen in this discussion the "premium" verses "natural" debate brought out differences between the different communities of practice. This was because perceptions of the terms "premium" and "natural" affected them in different ways. The member of the CoP_{EM} wanted to know if this was a new category as it had implications for *OpCo's* strategy. If "natural" was a new category then this could represent some opportunities for radical product innovations. The CoP_{FM} members were interested in understanding the customers' perception as this would affect their work in understanding the market. Finally the CoP_{FS} members were interested in what "natural" and "premium" meant for their work which included selecting ingredients for product formulations as well as selling the product to customers (retailers) and marketing it to consumers.

5.2.4.2 Supplier presentations

I observed ingredient and packaging supplier presentations being organised periodically by CoP_{FM} members. Organisation members from across the communities of practice at *OpCo* would attend these activities. These presentations often involved the generation of specific packaging or product formulation ideas.

Two supplier presentations that I observed are reported below. The first presentation was an ingredient supplier presentation which focused on *OpCo's* current market categories (i.e. incremental and semi-radical product innovation ideas). The second was a packaging supplier presentation which was focused on a new packaging concept for a new product category involving new technology (i.e. a radical product innovation idea).

Ingredient supplier presentation

A CoP_{FM} member organised one of the ingredient supplier presentations I observed. The organisation members at this activity included a member of the CoP_{EM}, two members of

the CoP_{FM}, and five members of the CoP_{FS}. The first part of the activity involved ingredient sampling, organised around different product flavours. In total about 30 different product samples were presented by the ingredient supplier. All the organisation members sampled and rated the different flavours. This was followed by a formal PowerPoint presentation by four ingredient supplier representatives on worldwide market trends in the categories in which *OpCo* operated. A copy of the PowerPoint document was put on *OpCo's* intranet at the end of the activity.

One of the CoP_{FM} members noted that it was "*hard to decide on which flavour is best without seeing the price. A cost benefit analysis would be useful.*" Other organisation members wanted to know which flavours were approved for domestic markets and the firm's key international markets. The suppliers did not know this and said they would check. The organisation members felt that this had made it difficult to evaluate the flavours as they were not sure of their use. Thus, just tasting the flavour samples was not sufficient to communicate the value it may have for the organisation members. After the session the organisation members discussed how the product samples had not added much value as there was no information on the cost and use of the flavours.

After the ingredient sampling the ingredient supplier representatives gave a formal PowerPoint presentation which examined general consumer trends. At the end of the presentation the supplier representatives showed two new incremental product ideas they had recently developed using the ingredients they had presented. This led to a lengthy discussion about the kinds of products in which customers were interested. The organisation members felt that there was more value in these types of activities than in tasting flavour samples.

Packaging supplier presentation

As packaging was a critical product component at *OpCo* there were continuing interactions with packaging specialists. One of the packaging presentations I observed during my time at *OpCo* is reported below. The aim of this presentation was to present some new technical packaging ideas for a new product category in which *OpCo* did not currently operate.

The presentation took place one morning at *OpCo* in the meeting room in the technology department. The organisation members included four members of the CoP_{EM}, four members of the CoP_{FM} and three members of the CoP_{FS} as well as four packaging firm representatives. The presentation was on a specific type of packaging that the supplier was developing for *OpCo* for use in a radical product innovation. The packaging representatives started with a PowerPoint presentation outlining some of the critical issues they were going to discuss. They then presented some models of different possible packaging options which the organisation members passed around the room while the suppliers outlined on PowerPoint slides each model's strengths and weaknesses. Finally the suppliers presented their suggested solution and explained why they thought it should be used as the base for a solution.

After the suppliers had left, the *OpCo* members used the packaging models to discuss the different options. The discussion included manufacturing issues, the types of materials and how they would bond together, packaging cost issues, and how the materials would look and feel to consumers.

5.2.4.3 Commentary on presentation activities

The suppliers and members of the CoP_{EM}, CoP_{FM} and CoP_{FS} used boundary objects in the form of documents and models to communicate with each other during the presentations. The internal presentation and the packaging supplier presentation concentrated on radical product innovations in new product categories in which *OpCo* did not currently operate. During the internal presentation the different communities of practice used product models as boundary objects to facilitate an understanding of the novel elements and enabled the different communities to interact and discuss key issues concerning new product ideas. During the packaging supplier presentation communities of practice used packaging models as boundary objects to help them understand and communicate how the many elements of novelty surrounding the radical product idea affect their community of practice.

While the ingredient supplier presentation also used models, in the form or flavour samples, these models did not work well as boundary objects for incremental and semi-radical product innovation as there was no information on the cost of the flavour or where it could be used. As incremental innovation ideas are close to the firms' current products numbers may have been better to build a joint evaluation of the new ingredient samples. Thus, the communities of practice did not use the model type boundary objects when discussing and debating these product innovation ideas. The documents type boundary objects did seem to be useful as they helped communities of practice discuss important issues that affected their practice.

The main difference between the boundary objects being used during the different presentations was the level of product innovation being attempted. While the first supplier

presentation was concerned with understanding ideas for incremental and semi-radical product innovations in current product categories, the internal and packaging presentations were concerned with getting a deeper understanding of product and packaging issues for radical product innovations in new product categories that required the use of new technology and a new business model. Thus, the use of boundary objects in the form of documents was seen to be useful in practice for incremental and semi-radical product innovation ideas as there were only a few elements of novelty, but models were necessary for communities of practice to talk to each other about radical product innovation ideas where there were more elements of novelty.

During each of the presentations communities of practice focused on the market and technical information being presented. They used this information to discuss and debate the development of new products for each of their specific areas. At no stage were the strategic or financial goals of the firm mentioned during these presentations. Thus the role of management control during these activities seemed to focus on reducing market and technical uncertainty. The style in which management controls were being used was interactive, with communities of practice learning about new ideas and challenging assumptions about the best way forward.

5.2.5 Activities in the technology laboratory

While following activities in the technology laboratory I observed members of the CoP_{FM} and the CoP_{FS} experimenting with new ingredients, concepts, product formulations and packaging (see Figure 21, on page 90). Two of the eight projects I followed originated from the activities that took place in the technology laboratory. These ideas led to the

development of radical product innovations in categories that were new for *OpCo* and involved some new-to-the-world components.

Often when new CoP_{FS} members joined *OpCo* they would be given time to experiment with new concepts and ingredients in the technology laboratory. These activities led to the generation of new ideas. I noticed that some functional specialists were employed because they had experience in categories in which the firm did not operate. In these cases the aim of *OpCo* was to understand these categories to create new solutions to current operational issues that could result in the development of new products for these categories.

5.2.5.1 Radical project one

One of the eight projects I observed started when the firm employed a new functional specialist to investigate new product ideas in relation to a category that had seen rapid growth in recent years. This project was quite radical for the firm as it represented a new category and necessitated a good understanding of the operational issues faced.

5.2.5.2 Radical project two

At other times new product ideas come from the everyday activities of members of the CoP_T working in the technology laboratory. During the time I was at *OpCo* I was able to follow one of these ideas from its first inception in the technology laboratory all the way to market launch. This product idea came from a regular laboratory procedure. During this procedure some CoP_T members noticed that a product sample had been prepared incorrectly. The CoP_T members were interested in the results of this mistake which led them to further investigate new product ideas.

During the next few weeks different members of the CoP_T experimented with different ideas. Based on the findings of their experiments the CoP_T members involved submitted a patent for the idea and then organised a meeting to discuss the idea with the members of the $CoP_{EM.}$ I was invited to attend this meeting by a member of the CoP_{EM}.

5.2.5.3 Commentary on laboratory activities

During the laboratory activities that I observed communities of practice at *OpCo* created and used boundary objects in the form of models to help them communicate when there was uncertainty about radical product innovation. For example, during the lab activities that lead to radical project one, a new functional specialist developed models made in the technology laboratory extensively to communicate the issues that this category faced to other communities of practice within the organisation. Through the use of models the functional specialist built an understanding of the operational issues faced in this category and how the new products could be used to address these issues.

The use of models such as product and packaging samples, enabled communities of practice to communicate specific issues of importance to their practice. This is important for radical innovations as radical innovation ideas lead communities of practice to undertake activities which others find hard to understand.

This is consistent with the other activities at this stage where models were used for radical product innovations. The reason for this was that there are more elements of novelty in radical product innovations. Thus, communities of practice at *OpCo* used models as boundary objects to understand and deal with the differences caused by an increase in the elements of novelty in this context.

As models facilitated the communication of technical information, the role of management controls during the laboratory activities seemed to be focused on reducing technical uncertainty. At this point there was no market information as the firm was interested only in whether they could make the product or not. The style of management control was interactive as communities of practice engaged to learn and develop new product ideas. The models they produced were used to challenge assumptions and map out the best way forward.

5.2.6 Summary and commentary on the idea generation stage

This section has reported and commented on the idea generation activities at *OpCo*. The idea generation activities that I observed during my time at *OpCo* consisted of market analysis, brainstorming, ideation, presentations, and laboratory activities. These activities are summarised below in Table 2 in relation to the communities of practice involved, the innovation type, the boundary objects used, the role of management control and the style of management control.

Communities of practice from all the levels of *OpCo's* hierarchy, including the CoP_{EM}, CoP_{FM}, CoP_{FMPD} and CoP_{FS} took part in these activities. They used boundary objects in the form of models such as product and packaging samples, and documents such as the firm's strategy pyramid, market themes, brainstorming drawings and lists during the idea generation activities. Communities of practice used boundary objects in the form of documents to communicate with each other when dealing with incremental and semi-radical product ideas, and used model type boundary objects to communicate with each other when dealing with radical product ideas.

Table 2: Summary of Stage 1 - Idea Generation

Product Development Activities	Communities Involved*	Innovation Types and Boundary Objects	Control Role*	Control Style*
Market analysis	CoP_{FMPD} CoP_{FS}	Incremental - Documents Semi-radical - Documents Radical - Models	RU RU RU	SB SB IC
Brainstorming	CoP_{FMPD} CoP_{FM} CoP_{FS}	Incremental - Documents Semi-radical - Documents Radical - Models	RU RU RU	SB SB IC
Ideation	CoP_{EM} CoP_{FM} CoP_{FS}	Incremental - Documents Semi-radical - Documents Radical - Documents	RU & PGC RU & PGC RU & PGC	IC & IB IC & IB IC & IB
Presentations	CoP_{EM} CoP_{FM} CoP_{FS} Suppliers	Incremental - Documents Semi-radical - Documents Radical - Models	RU RU RU	IC IC IC
Lab activities	CoP_{FM} CoP_{FS}	Radical - Models	RU	IC

*(CoP_{EM}: Executive manager community of practice, CoP_{FM}: Functional manager community of practice, CoP_{FMPD}: Functional manager product development community of practice, CoP_{FS}: Functional specialist community of practice, RU: Reduce uncertainty, PGC: Promote goal congruence, IC: Interactive control, DC: Diagnostic control, SB: Set boundaries, IB: Influence beliefs)

The initial market research, brainstorming and ideation activities used documents extensively. While it was not the purpose of these sessions to generate incremental and semi-radical product ideas the use of documents did seem to limit the generation of new ideas to these categories. This could be because documents were not adequate when there was a high number of novel elements. Thus, communities of practice were not able to use these documents to communicate some of the more radical product innovation ideas they had. For this reason most of the new product ideas generated during these initial stages were for incremental and semi-radical product innovations. While there were some radical

product ideas generated during this time they did not proceed very far through the product development process because documents were being used.

On the other hand, the technology laboratory activities and some of the internal and supplier presentations facilitated the generation of radical product innovation ideas. During these activities communities of practice used product and packaging models extensively which enabled them to communicate early to other communities of practice in the idea generation process. Following the initial communication of these ideas the firm carried out market analysis and brainstorming activities to better understand these new ideas. Again these activities relied on the use of product and packaging models which communities of practice used to progress the idea and to challenge assumptions about the way forward.

It can be seen from the report on practice, and the summary of Stage 1 (see Table 2), that the role of management control during this stage of the product development process was on reducing market and technical uncertainty. There was only one time during this stage (the ideation activity) that CoP_{EM} members talked about the strategic and financial goals of the firm to promote goal congruence. At all other times the focus was on collecting and understanding market and technical information to reduce uncertainty.

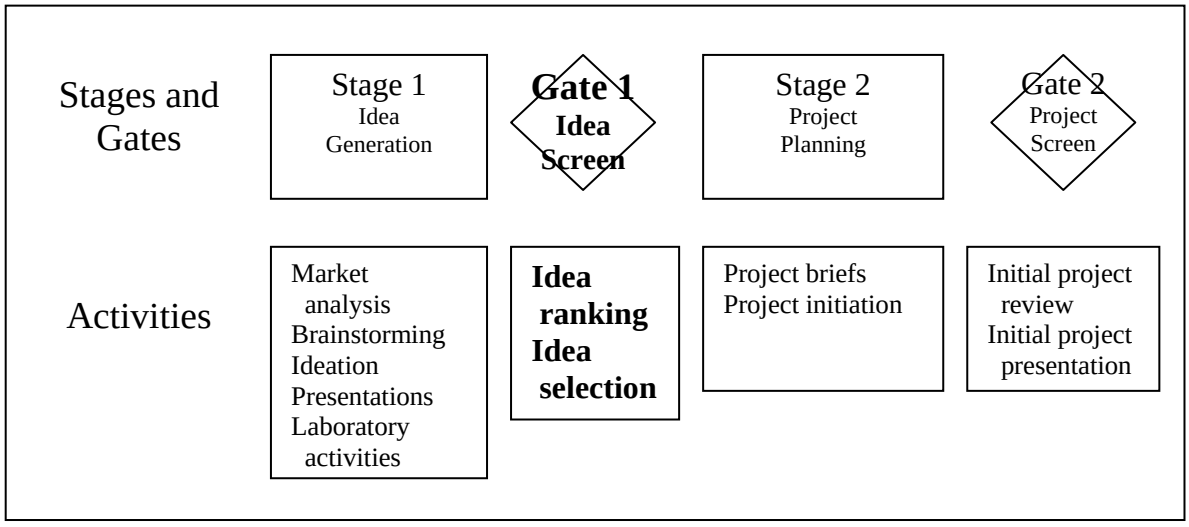
From the report on practice, and the summary in Table 2, it can be seen that the style in which management controls were used differed for each project type for some activities but was the same for others. The CoP_{FM} managers used the market analysis and brainstorming activities to set boundaries for incremental and semi-radical projects but used interactive controls for radical projects. Later on during ideation, presentations and

laboratory activities the communities of practice used interactive control as they focused on learning about different markets and technologies, and discussed and debated how to progress new product ideas while challenging each others assumptions about the best way forward. During the ideation session members of the CoP_{EM} also used the firm's strategy pyramid to influence the beliefs of the other communities of practice.

5.3 Gate 1: Idea screen

Following the initial three idea generation activities (market analysis, brainstorming and ideation) which occurred at the start of new product planning was an idea screen which was the first gate in *OpCo's* product development process (see Figure 26).

Figure 26: The Product Development Process at *OpCo*: Gate 1 - Idea Screen



At this gate the projects that had been listed on the potential new project list from the ideation activity (presented in Section 5.2.3, on page 102) were examined in more detail. This involved two activities. The first was an idea ranking activity which was carried out by members of the CoP_{EM} and CoP_{FM} (including all the members of the CoP_{FMPD}). After

the idea ranking activity the project list was given to the CoP_{FMPD}, which consisted of managers from the CoP_M and CoP_T, who carried out an idea selection activity.

5.3.1 Idea ranking

After the ideation activity an idea ranking activity was organised. The ranking of new product ideas involved communities of practice from across the different functions and hierarchal levels at *OpCo*. It involved two members of the $CoP_{EM,}$ seven members of the CoP_{FM} and included all the members of the CoP_{FMPD}. These organisation members came from across different functions and included representatives from the CoP_M, CoP_T and CoP_S. The activity lasted for about three hours in the *OpCo* boardroom and was facilitated by a member of the CoP_{FM}. The organisation members sat around a large oval table with an excel spreadsheet beamed onto a screen at one end of the room. The spreadsheet contained a list of all the potential new projects which had scored the most votes during the ideation activity.

The idea ranking activity started with the facilitator emphasising that "*potential product development project ideas need to be consistent with [OpCo's] vision [specific details] and objectives [specific details] as set out in the strategy pyramid*." To evaluate the ideas on the project list the facilitator presented a set of five dimensions to the group. These dimensions were: revenue/market share potential, cost and complexity, wow factor, brand alignment, and time to market. Each of the forty ideas on the potential new project list was discussed in relation to these dimensions.

Following the presentation of the firm's strategic goals and the five dimensions the facilitator went through the list of forty potential projects. First a product champion gave

an overview of each potential new project idea.[26] A vote was then taken on each of the five dimensions using a scale of low, medium, and high. Voting was by show of hands. This was followed by a discussion of the project and the ranking, which sometimes led to changes in the rankings. The facilitator then entered the agreed rank onto the project selection spreadsheet**.** When all forty projects had been ranked the list was given to the CoP_{FMPD} to carry out an idea selection activity.

5.3.2 Commentary on idea ranking

Members of the CoP_{EM} and CoP_{FM} from the CoP_M, CoP_T and CoP_S took part in the idea ranking activity. During this activity the communities of practice used a document listing proposed new projects as well as five ranking dimensions as boundary objects. The document containing proposed new projects came the from the ideation activity. This document was used along with a ranking system to help communities of practice communicate during the activity. The communities of practice used the document and ranking system as boundary objects to create a space for interactions and to signal what was important for their community.

The five dimensions brought functional differences to the surface. An example of this was the ways in which different communities of practice interpreted the "cost and complexity" dimension. During the activity communities of practice used the term "cost" in relation to packaging costs, distribution costs, and launch costs. There were also differences in the use of the term "complexity". Some communities of practice referred to technical complexity while others talked about production and distribution complexity.

[26] The product champion was the person who supported the idea at the ideation session

The focus of the activity was to make sure that the projects chosen matched *OpCo's* strategy and objectives. In other words, the role of management control seemed to be focused on promoting goal congruence between the members of the CoP_{EM} and CoP_{FM}. The style in which this was being done was interactive, as the communities of practice met face-to-face and discussed and challenged assumptions about projects and decided how to progress new product ideas.

5.3.3 Idea selection

After the idea ranking activity the new product ranking document was given to the CoP_{FMPD} which met to select the projects that would go forward to the next stage. The selection of projects was based in part on the project rankings which had come out of the idea ranking meeting but included other new project ideas from the marketing and technology departments that were not on the project ranking list.

During the discussions I observed that the members of the CoP_{FMPD} aimed to get a good balance between the types of product development projects so that *OpCo* could reach its long term strategic and financial goals. The CoP_{FMPD} members also considered during their discussion the resources needed for each project. The CoP_M managers wanted to do as many projects as possible as their market share numbers were not as good as expected while the CoP_T managers were constrained by the number of CoP_T technologists they had available to do the product feasibility and design work. Thus the CoP_T managers only wanted a certain number of product development projects.

These functional driven projects were contained in documents outlining why they thought certain projects needed to be done. The CoP_M members showed how the activities of

competitors in a market had affected an *OpCo* product and argued that a product was needed in that area to counter the competitors' moves.

During this activity the CoP_{FMPD} divided the projects into four portfolios. These project portfolios were incremental, semi-radical (business), semi-radical (technical) and radical project types[27] (see Figure 2, on page 9). Incremental innovation projects were defined by the firm as current products needed to maintain market share. These product innovations related to markets in which *OpCo* currently operated, using familiar technology. The semi-radical innovation projects were split into two groups, one focusing on new business models and one focusing on new technology. Finally the radical product innovation projects were defined as new products designed for new market categories. These innovations required the development of new technologies and new business models which were outside the firm's current operations. The CoP_{FMPD} discussed the projects and entered them onto a chart with expected launch dates (see Figure 27 below).

The aim of the activity was to put together a project portfolio that included the highest ranking projects from the idea ranking activity supplemented with projects from the technology and marketing departments that were necessary for competitive reasons. The input to this activity was the document containing the project ranking list from the idea ranking activity as well as documents from the marketing department showing competitors actions and from the technology department showing the resources they had available to do product development projects. During this session the CoP_{FMPD} took into consideration both the resources available and the goals of the organisation. The output of this activity was a document (Figure 27) that listed the projects that would go to the next stage. This

[27] These are not the names used in the firm but have the same meaning

project portfolio was determined in an interactive way as the CoP_M and CoP_T managers discussed organisation goals and resources issues.[28]

Figure 27: The Product Development Project Portfolio at *OpCo*

Incremental (actual 54% - aim 60%)
- Project A– Date
- Project B – Date
- Project C – Date
- Project D – Date
- Project E – Date
- Project F – Date
- Project G – Date
- Project H – Date

Semi-radical (business) (actual 6% - aim 20%)
- Project I – Date

Semi-radical (technical) (actual 15% - aim 10%)
- Project J – Date
- Project K – Date

Radical (actual 25% - aim 10%)
- Project L – Date
- Project M – Date
- Project N – Date
- Project O – Date

5.3.4 Commentary on idea selection

The CoP_{FMPD} members met during this activity to decide how to get a good balance between the types of product development projects so that *OpCo* could reach both its short-term and long-term strategic and financial goals. Because there were no other hierarchal groups involved in this activity I divided them up into their functional communities - CoP_M and CoP_T. During idea selection these communities of practice used the project ranking document as well as marketing and technology documents as boundary objects. These

[28] While the product development project portfolio list had some radical projects listed, none of these projects proceeded to the next stage of the product development process.

helped them discuss how the communities of practice viewed the projects that had come through the idea generation stage. They also used the marketing and technology documents to see what was important for each function. The CoP_M manager brought information about projects that they argued were necessary to combat moves by competitors in certain market segments while the CoP_T manager brought a list of available resources. During this activity the CoP_{FMPD} jointly created a new boundary object which divided the projects into portfolios which they used during project planning (Stage 2).

These documents were good at managing incremental and semi-radical product innovation as there were few elements of novelty. They were not as successful at managing radical projects. I could see each time the members of the CoP_{FMPD} and CoP_{EM} used documents during their discussions on radical project ideas at this gate the conversations became very confused. One project idea in particular was viewed so differently by the CoP_{FMPD} and the CoP_{EM} that it was officially terminated because "*no one could agree on what it was meant to achieve*" (CoP_{FMPD}). This could be because documents were not able to capture the many elements of novelty necessary to understand the issues surrounding radical product innovation.

The role of management control during this activities seemed to be focused on promoting goal congruence in relation to the firms' strategic and financial goals as the CoP_{FMPD} aimed to put together a project portfolio that aligned with the firms' goals. The style in which management controls were used was interactive as communities of practice met face-to-face to decide how to progress new product ideas and challenge assumptions about the best way forward.

5.3.5 Summary and commentary on the idea screen gate

The communities of practice involved at the idea ranking were the CoP_{EM} and CoP_{FM} while the two members of the CoP_{FMPD} (which consisted of two functional communities, the CoP_M and CoP_T) carried out the idea selection activity. Table 3 below summarises the idea screen activities at *OpCo* in relation to the communities involved, innovation type, boundary objects and the role and style of management controls.

Table 3: Summary of Gate 1 - Idea Screen

Product Development Activities	Communities Involved*	Innovation Type and Boundary Objects	Control Role*	Control Style*
Idea ranking	CoP_{EM} CoP_{FM} (CoP_M, CoP_T and CoP_S)	Incremental - Documents Semi-radical - Documents Radical - Documents	PGC PGC PGC	IC IC IC
Idea selection	CoP_{FMPD} (CoP_M and $CoP_{T)}$	Incremental - Documents Semi-radical - Documents Radical – Documents	PGC PGC PGC	IC IC IC

*(CoP_{EM}: Executive manager community of practice, CoP_{FM}: Functional manager community of practice, CoP_{FMPD}: Functional manager product development community of practice, CoP_M: Marketing community of practice, CoP_T: Technology community of practice, CoP_S: Sales community of practice, PGC: Promote goal congruence, IC: Interactive control)

Organisation members from the CoP_{EM}, CoP_{FM}, and CoP_{FMPD} who were members of the CoP_M, CoP_T and CoP_S took part in these activities. They used boundary objects in the form of documents for incremental and semi-radical project ideas. These documents included a potential new product list and a product development project portfolio list. While the use of documents seemed to work well for incremental and semi-radical new product ideas none of the radical product ideas listed on the project portfolio list ever went

to the next stage of the process. It may be that these documents were not able to capture the elements of novelty in radical product innovation. The radical projects discussed in the following sections all came from the laboratory activities (see in Section 5.2.5.2, on page 115).

The CoP_{EM} were concerned with making sure that the projects chosen at this gate would enable the firm to reach its strategic goals. The members of the CoP_{FM} brought a different perspective as they were also concerned about how the projects selected could be undertaken with the resources they had available.

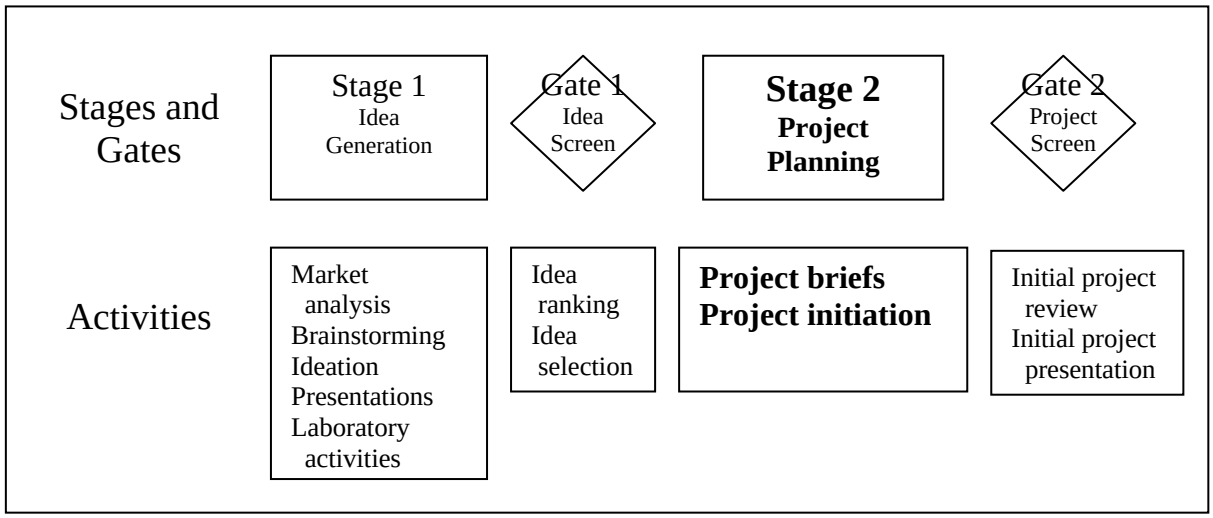
From the report on practice it can be seen that the role of management control during these activities was promoting goal congruence. During both activities managers often referred to strategic goals such as growth expectations, and the types of innovation they thought were needed to reach those goals. There was also talk of financial goals such as revenue and profit. Thus, communities of practice seemed to be deciding which project ideas would help the firm reach these strategic and financial goals.

During these activities the members of the CoP_{EM}, CoP_{FM}, and CoP_{FMPD} used the project ranking list and project portfolio list documents in an interactive way. This can be seen through their meeting face-to-face and discussing the five dimensions, which involved debating and challenging how to progress and which projects would add the most value to the firm.

5.4 Stage 2: Project planning

The second stage of the product development process at *OpCo* was project planning (see Figure 28).

Figure 28: The Product Development Process at *OpCo*: Stage 2 - Project Planning



There were two activities at this stage, both of which I observed. First, members of the CoP_{FMPD} and CoP_{FS} wrote project briefs and second, CoP_{FMPD} members wrote project initiation documentation.

5.4.1 Project briefs

Following the idea ranking and selection activities, the CoP_{FMPD} organised an activity for members of the CoP_{FM} and CoP_{FS} who were members of the CoP_{M} and CoP_{T} to get together to write up project brief documents for each of the projects selected at the idea screening gate. Project briefs played an important role in signalling the start of a project and broadly defined the type of product to be developed and the market for which it was being developed. It was also a signal to all the functional departments of the firm that

resources would soon be needed to develop the product. According to a CoP_{FMPD} member the aim of this activity was to get "*Technology and marketing members together so as to increase communication and understanding between the two groups*."

The members of the CoP_{FMPD} were in charge of the activity and were joined by members of the CoP_{FM} and six members of the CoP_{FS}. At the start of the activity the group met in one of the meeting rooms at *OpCo*. One of members of the CoP_{FMPD} started the meeting by summarising the idea selection activity and showed the other communities of practice how they had decided on the product development project portfolio (see Figure 27, on page 125). This included an overview of the firm's strategy pyramid (see Figure 25, on page 105). All the projects were then assigned to teams of two people consisting of one technology and one marketing representative. After all the projects had been allocated the teams went away to write up the project briefs they had been allocated. As there were an odd number of organisation members I was asked to participate as a marketing representative to assist with writing a project brief in relation to a market where I had practical experience.[29]

I was teamed with a technology member of the CoP_{FM} to fill out a project brief document. The project brief (see Figure 29 below) contained basic information such as the project's name, originator, proposed launch date, the project manager and project background. This background included information on the consumer insights that had been generated, consumer need, market dynamics, project deliverables, brand requirements, the product concept, estimated sales, financials and manufacturing issues. This document had to be signed off by the marketing and technology managers from the $CoP_{FMPD.}$

[29] As set out in Chapter 4.4 I participated in many of the activities at OpCo. This allowed me to experience activities from a practitioner perspective.

Figure 29: Project Brief Document

PROJECT NAME:
ORIGINATOR:
PROPOSED LAUNCH DATE:
PROJECT MANAGER:

BACKGROUND:

1. CONSUMER INSIGHT

From the key consumer insights identified

2. CONSUMER NEED

Target market
Outline consumer need
Why is this relevant to the target market
Relevant consumer research

3. MARKET DYNAMICS

Areas of growth/decline
Competitors
Emerging trends
NZ/Internationally

4. PROJECT DELIVERABLES

Strategic intent

5. BRAND REQUIREMENTS

Brand positioning
Personality
Values
Key attributes

6. PRODUCT CONCEPT

Product format
Size and volume
Packaging format
Appearance

7. ESTIMATE SALES

Number of units

8. FINANCIALS

Estimated CAM
Wholesale value

9. MANUFACTURING ISSUES

Capital requirements
Manufacturing complexity

APPROVED MARKETING MANAGER:
APPROVED TECHNOLOGY MANAGER:

We started the process by talking about the customer needs and market dynamics. We then wrote a brief summary of the brand requirements, product concept and manufacturing requirements. We did not estimate sales or do financial calculations. We did note that a high level of capital expenditure would be required to manufacture this type of product.

In the afternoon all the teams came back to the meeting room and discussed three of the six project briefs that had been completed during the day. This was followed by closing comments by members of the $CoP_{FMPD,}$ who said they were happy with what had come out of the project planning exercise and felt there was a good mix of short term and long term projects. The members of the CoP_{FMPD} felt that there were still some major issues facing the firm in relation to resources which they said were "*a major constraint*" and market research "*which is still a problem...needed earlier in the process.*"

The members of the CoP_{FMPD} then talked about what had happened during the previous year and said it would be good to review some of last year's projects as only two of the twenty projects briefed last year had been completed so far. Other projects started during the previous year were completed during the time I was at *OpCo*.[30] Finally one of the CoP_{FMPD} members said they would "*review all briefs after this meeting.*" and would "*Distribute briefs [to members of the CoP_{FS}] after Christmas.*" Product development project teams would then be formed to work on projects. The managers also said they would organise a hand sample day[31] in February where all new project ideas would be made, presented and sampled, but this did not happen due to time and budget constraints. They also said that some of the current projects would have to go through the project briefing activity again to make sure they still fitted into the firm's current strategic plan.

[30] I followed two of these projects while I waited for the new projects to start
[31] Hand samples were products made in the R&D technology lab to simulate a finished product.

5.4.2 Commentary on the project brief activity

The communities of practice involved in the project brief activity were the CoP_{FMPD}, CoP_{FM} and CoP_{FS} who were all members of the CoP_T and CoP_M. To bring as many differences as possible to the surface members from these to functional communities of practice teamed together to write up the project brief. The project brief document (Figure 29 on page 131) was used by communities of practice as a boundary object to collect and understand relevant market and technical information to reduce uncertainty about the new product idea. This was accomplished through the interaction of members of the CoP_T and CoP_M to better understand the market and technical uncertainties the product might face. This was done in an interactive way with the communities of practice discussing and debating how to process the project. Although the project brief activity included an overview of *OpCo's* vision and strategy the focus of the activity was on reducing uncertainty as the projects had already been analysed in relation to the firm's goals during the idea selection activity (Gate 1).

5.4.3 Project initiation

Once project brief documents had been completed they were given to the project managers listed on the document. At this stage of the process members of the CoP_{FMPD} were in charge of new product development projects. The CoP_{FMPD} members met to write up project initiation documents for the "Project Management Office" (PMO). They used the project brief document as a base when writing up these new documents as they contained valuable information from the technology and marketing CoP_{FS}.

The project management office (PMO) at *OpCo* was started three years before the start of this study. According to a member of the CoP_{FMPD} "*it was initially introduced to manage*

information technology and factory projects within the firm." About six months before the start of this study the responsibilities of the PMO had been expanded to include a large product development project so as to make it "*more visible to the members of the* CoP_{EM}"[32] I was told that in the past only one major product development project had gone through this activity and was made visible to the CoP_{EM}. After the changes to the PMO system were put in place all projects became visible to the CoP_{EM} and were reviewed monthly at executive management meetings. The PMO documentation included a project initiation document (see Figure 30 below) and a project scoring sheet (see Figure 31, on page 136) which was prepared by the project sponsor and project manager.

During the project initiation activity I observed the business process manager helping the CoP_{FMPD} with the preparation of the project initiation and scoring sheet. The CoP_{FMPD} organised a meeting to complete the project initiation and scoring documentation for each of the projects that had come out of the project selection gate and invited me to observe the activity. Once project initiation documents had been written up for all the projects the managers discussed the projects while filling out the scoring sheet. During the meeting CoP_{FM} members who were part of the CoP_M and CoP_T were brought into the meeting to assist the CoP_{FMPD} filling out the PMO project initiation and scoring sheet.

The PMO project initiation document (see Figure 30 below) had seven sections which included the project details, the scope of the project, the key benefits, the capital expenditure and operating costs, the time frame for delivering the project and the risks, including their probability, their impact and a mitigation strategy.

[32] This was a comment often stated by the members of the CoP_{FMPD} as the reason for expanding the PMO system.

Figure 30: PMO Project Initiation Document

1. PROJECT DETAILS

Project Name:
Description (brief):
Project Sponsor:
Project Manager:

2. SCOPE

Background:
Inclusions:
Exclusions:
Inter-Dependencies:

3. BENEFITS

Non-Financial Benefits (strategic, customer)
Financial Benefits (GSV and NPV)

4. COSTS

CAPEX:
Operating Costs:

5. RESOURCES

Function	**Resource Name**	**Activities**	**Time Commitment**
Technology			
Marketing			

6. TIME FRAMES

Key Milestones *(Major activities)*	**Planned Date**
1)	

7. RISKS

Risk	Probability (H/M/L)	Impact (H/M/L)	Mitigation Strategy	Person Responsible
1)				

The PMO project scoring sheet consisted of five sections (see Figure 31 below). Once the CoP_{FMPD} had completed the project initiation and scoring sheets they sent them to the other members of the CoP_{FM} so that they could independently review the projects. Once a month a PMO meeting was held which involved all the members of the CoP_{FM}. At these meetings project sponsors and managers would present their project initiation and scoring sheets and field questions about their project proposal.

Figure 31: PMO Project Scoring Sheet

Project Name:				
1. STRATEGIC ALIGNMENT				
Export objectives		Low (10)	Medium (20)	High (30)
Domestic objectives		Low (10)	Medium (20)	High (30)
2. FINANCIALS				
NPV	100K (20)	500K (40)	750K (60)	1,000K (80)
3. INTANGIBLE BENEFITS				
Customer relationship		Low (10)	Medium (20)	High (30)
Head office relationship		Low (10)	Medium (20)	High (30)
Supplier relationship		Low (10)	Medium (20)	High (30)
Employee satisfaction		Low (10)	Medium (20)	High (30)
Health and safety		Low (10)	Medium (20)	High (30)
4. RESOURCE REQUIREMENTS				
Resources required		High (10)	Medium (20)	Low (30)
5. BUSINESS NEED				
Business community		Low (10)	Medium (20)	High (30)
Parent company		Low (10)	Medium (20)	High (30)
Functional issues		Low (10)	Medium (20)	High (30)
TOTAL POINTS:				

5.4.4 Commentary on the project initiation activity

The CoP_{FMPD} organised this activity and CoP_{FM} from the CoP_{M} and CoP_{T} assisted when needed. The boundary objects consisted of a project initiation document and a scoring sheet (numbers). The project initiation document was used by communities of practice as a boundary object to collect and understand relevant market and technical information to reduce uncertainty about the new product idea. The scoring sheet (numbers) was used as a boundary object to get the communities of practice discussing their evaluation of the project. In particular resource constraints limited the number of projects that would go onto the final project list. Although the scoring sheet (numbers) asked for a "net present value" calculation in the financial section the managers used "contribution after marketing" as this was the number marketing members used to analyse the performance of

current products. Differences that came up during the activity centred on the number of projects that could be done.

The output of this activity was a document which contained an overview of the project and details about its scope, benefits, resources, and time frames and a scoring sheet which contained numbers. Communities of practice used the project initiation document and scoring sheet numbers when communicating with other members to reduce uncertainty about the project as the information in the project document and numbers came from multiple sources within the firm. The document and numbers were used to reduce uncertainty for incremental and semi-radical product innovation projects. These documents and numbers were used interactively by the communities of practice to decide how to progress issues related to new projects.[33]

5.4.5 Summary and commentary on the project planning stage

Table 4 summarises the activities that took place during the project planning stage and lists the communities involved, innovation types, boundary objects, and the role and style of management control. The organisation members involved in the project brief and project initiation activities were from the CoP_{FMPD}, the CoP_{FM} and the CoP_{FS} and were members of the functional CoP_M and CoP_T.

The communities of practice involved during project planning were the CoP_{FMPD}, CoP_{FM} and CoP_{FS} who were all members of the CoP_T and CoP_M. They used boundary objects in the form of documents (project brief and project initiation) and numbers (project scoring sheet) to bring functional differences to the surface.

[33] This was most evident in the interactions between the CoP_{FMPD} and the CoP_{FM}.

Table 4: Summary of Stage 2 - Project Planning

Product Development Activities	Communities Involved*	Innovation Type and Boundary Objects	Control Role*	Control Style*
Project briefs	CoP_{FMPD} CoP_{FM} CoP_{FS} (CoP_M, CoP_T)	Incremental - Numbers, Documents Semi-radical - Numbers, Documents	RU RU	IC IC
Project initiation	CoP_{FMPD} CoP_{FM} (CoP_M, CoP_T)	Incremental - Numbers, Documents Semi-radical - Numbers, Documents	RU RU	IC IC

*(CoP_{FM}: Functional manager community of practice, CoP_{FMPD}: Functional manager product development community of practice, CoP_{FS}: Functional specialist community of practice, CoP_M: Marketing community of practice, CoP_T: Technology community of practice, RU: Reduce uncertainty, DC: Diagnostic control, IC: Interactive control)

During the project planning activities communities of practice were concerned with how to understand project ideas better. To do this they used the project brief, project initiation documents and scoring numbers during interactions to better understand the importance of different issues and to learn how it affected each others practice. Communities of practice viewed this interaction as one of the strengths of the planning stage as it helped to bring out issues that would not have been made explicit otherwise. The numbers helped communities of practice manage the elements of novelty present in incremental and semi-radical product innovations as these types of innovations had only a few elements of novelty. The documents were also useful as the members of the different departments used them to show how the projects affected their practice.

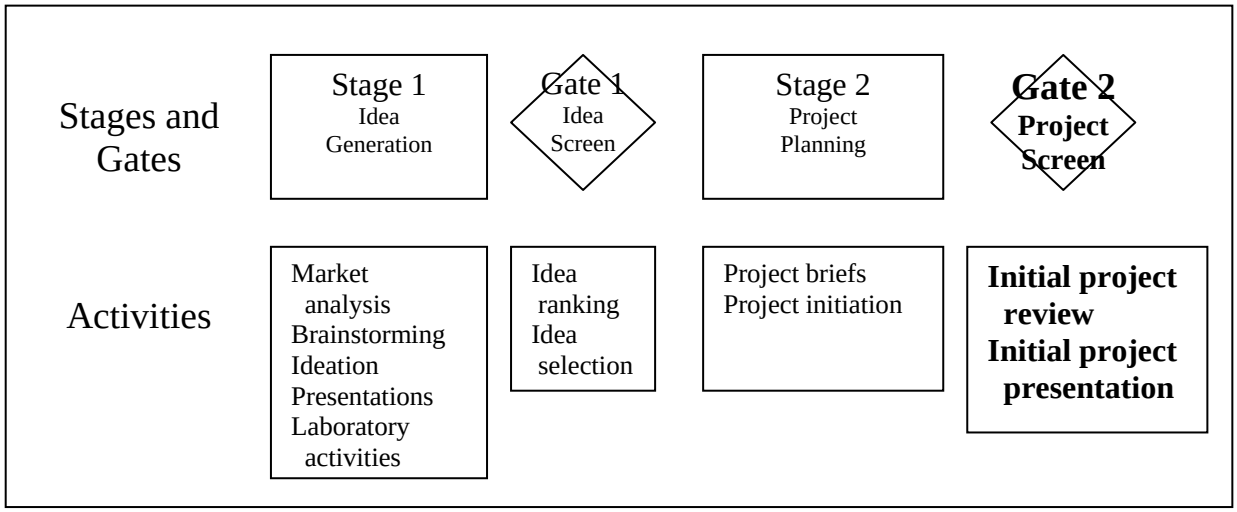
From the report on practice it can be seen that the role of management control during these activities was to reduce uncertainty. During these activities communities of practice used

the project brief and project initiation documents and the scoring sheet numbers to reduce uncertainty about the project as the information collected to put in these documents and numbers came from multiple sources within the firm. During these activities communities of practice used the documents and numbers in an interactive style. This can be seen through their face-to-face meetings where they discussed and debated project details learning about different perspectives while challenging assumptions and action plans.

5.5 Gate 2: Project screen

The purpose of Gate 2 was to screen projects. This involved an initial project review and an initial project presentation (see Figure 32).

Figure 32: The Product Development Process at *OpCo*: Gate 2 - Project Screen



I observed the two activities, the first of which was an initial review of product development projects. CoP_{FMPD} members presented the PMO initiation documents and scoring sheets that they had prepared during the project planning stage to other members of the CoP_{FM}. The second activity consisted of presentations by members of the CoP_{FM} to

the CoP_{EM} at executive meetings. CoP_{EM} evaluated these projects to see if they were ready to go to the feasibility stage.

5.5.1 Initial project review

After the CoP_{FMPD} had completed the project initiation document and project scoring sheet they presented these projects to the members of the CoP_{FM} at a project review. The CoP_{FM} managers came from the CoP_{M}, CoP_{T}, CoP_{S}, CoP_{F}, and CoP_{O}. The CoP_{FM} played an important role in this process as they were in charge of resource allocation in their area and thus had to sign-off on all new projects that they agreed to resource.

The CoP_{FMPD} started the activity by presenting the projects that scored highest on the project scoring sheet. Using the project initiation document and the project scoring sheet the members of the CoP_{FM} discussed and debated the projects and challenged the CoP_{FMPD} about how they came up with the scores and the resources these projects would need. The CoP_{FMPD} then presented the lowest scoring projects so that the CoP_{FM} could compare them with the highest projects. These were then debated in relation to the highest scoring projects.

The communities of practice then had a debate about the project scoring sheet and how the scores were calculated. These scores were important for the communities of practice as projects were compared with projects in other parts of the firm and competed for scarce resources. Using the projects they had presented as examples the CoP_{FMPD} questioned whether the project scoring sheet was able to capture significant differences between the projects. The CoP_{FMPD} and CoP_{FM} members decided to examine the project scoring sheet and make changes to how the project scores were calculated so that the true value of

product development projects could be judged in comparison to other projects undertaken within the firm.

At the end of the activity the CoP_{FM} and CoP_{FMPD} members informally discussed how to make the PMO work better. The business process manager said that this would require an iterative process to work out the necessary changes. After the meeting members of the CoP_{FMPD} said that they had found the PMO system beneficial as it had given them a better understanding of what these projects needed to deliver (in financial terms) to get resources.

5.5.2 Commentary on the initial project review

The CoP_{FMPD} presented project reviews to the CoP_{FM} to make sure that the projects they were planning added value to the firm and could get the resources they needed so that *OpCo* could reach both its short-term and long-term strategic and financial goals. During this activity the communities of practice used the project initiation document as well as the project scoring sheet as boundary objects. These helped the communities of practice discuss important project issues and in particular it helped the communities understand the value of these projects for the firm.

During this activity the CoP_{FMPD} argued that the project scoring sheet did not adequately capture the value these projects would create for the firm. The CoP_{FM} members agreed and decided to amend the project scoring sheet. This example shows that boundary objects are not constant and can change when needed. The communities of practice felt that the project scoring sheet needed to be changed as the scores would have a big impact on the ability of a project to get resources. They argued that if the project was important for the firm's long-term future then this needed to be captured in the project scoring sheet.

The project initiation document seemed to be good for managing incremental and semi-radical product innovation as there were few elements of novelty. The project initiation document and scoring sheet were not used for radical projects as none of the radical projects I followed went through this gate. The project scoring sheet (numbers) was also useful for managing incremental and semi-radical projects as communities of practice used it extensively in their discussions. The communities of practice also realised that the scoring sheet needed to be changed so as to reflect the real value of projects.

The role of management control during this activities seemed to be focused on promoting goal congruence in relation to the firm's strategic and financial goals as the CoP_{FMPD} aimed to choose projects that would help the firm reach its financial and strategic goals. The style in which management controls were used was interactive as communities of practice met face-to-face to decide how to progress new product ideas and challenge assumptions about the best way forward.

5.5.3 Initial project presentation

Once a project had been reviewed at a project review meeting, it was registered by the PMO and then went onto a project list which was presented to the CoP_{EM} for evaluation. These initial presentations were given by CoP_{FMPD} at both weekly and monthly executive meetings. Examples of the discussions surrounding incremental and semi-radical projects are given in the following two sections. There were no radical product innovations presented at this stage of the product development process.

5.5.3.1 Incremental project presentation

The focus of the communities of practice for incremental project presentations was on the financials and deciding if the firm had the resources to do the project. The CoP_{FMPD} member would start incremental project presentations with a list of financial indicators such as project revenue and profitability as well as expected market share gain. The CoP_{FMPD} member also used information from the project brief, project initiation and scoring sheets. The communities of practice used the financial indicators during most of the discussions around these types of products. While some of these numbers were set as expectations (such as gross margin) others were open to debate as to what each of these projects was expected to achieve. The communities of practice then discussed who would be able to work on the project. The CoP_{EM} then set some project expectations that they wanted the CoP_{FMPD} members to agree to before these projects could continue.

5.5.3.2 Semi-radical project presentation

The focus of the communities of practice for semi-radical project presentations was on the strategic fit with the firm's priorities and the resources available to carry out the project. The CoP_{FMPD} member would start semi-radical project presentations with a market research report (document) and the reasons why the firm needed to develop the product. The CoP_{FMPD} would then get project samples (models) delivered from the technology laboratory. While the communities of practice sampled the product they discussed project issues for the radical component of the project (either the technology or the market). Finally they would present the financials, such as project revenue and profitability, even though they stated that these numbers were hard to compute for these projects at this stage. The communities of practice then had a discussion on who would be able to work on the project. To do this the CoP_{EM} had a list of all the members of the CoP_{M}, CoP_{T}, CoP_{S}, and

CoP_O. The CoP_{EM} then set some project expectations that they wanted the CoP_{FMPD} members to agree to before these projects could continue.

5.5.4 Commentary on initial project presentations

The CoP_{FMPD} presented project reviews to the CoP_{EM} to make sure that the projects they fitted the firms financial goals and strategy. The communities of practice used the financial numbers and documents as boundary objects for incremental projects and financial numbers, market research documents and product sample models as boundary objects for semi-radical projects. The numbers helped the communities of practice discuss important project issues for incremental projects as these projects had low levels of novelty and were similar to the products the firm already manufactured. The documents and models helped the communities of practice understand the value of semi-racial projects for the firm and how the projects fitted into the firm's strategy.

During these project presentations the members of the CoP_{EM} seemed to be interested in two issues: (1) Will the project help the firm achieve its goals? (2) Does the firm have the resources available to do the project? For the CoP_{EM} the resource and goal issues seemed to be connected. The members of the CoP_{EM} often stated that it was important not to have members of the CoP_{FM} and CoP_{FS} working on too many projects as this would slow projects down. This in turn would lead to project time overruns and late product launches which they said would lower the new products' success rate and negatively affect the firms' ability to reach its goals. Because of this the members of the CoP_{EM} always challenged the workloads of the members of the CoP_{FM} and CoP_{FS} to make sure that these people did not have too many projects going on at any one time.

The role of management control during this activity seemed to be focused on promoting goal congruence in relation to the firm's strategic and financial goals as the CoP_{EM} focused on projects that would help the firm reach its financial and strategic goals. The style in which management controls were used was interactive as communities of practice met face-to-face to decide how to progress new product ideas and challenge assumptions, but there were also diagnostic control elements present as the CoP_{EM} had expectations that certain financial targets would be met.

5.5.5 Summary and commentary on the project screen gate

This gate consisted of two activities, namely an initial project review and an initial project presentation (see Table 5).

Table 5: Summary of Gate 2 - Project Screen

Product Development Activities	Communities Involved*	Innovation Types and Boundary Objects	Control Role*	Control Style*
Initial project review	CoP_{FMPD} CoP_{FM} (CoP_M, CoP_T, CoP_S, CoP_F, and $CoP_{O)}$	Incremental – Numbers/Documents Semi-radical – Numbers/Documents	PGC PGC	DC & IC DC & IC
Initial project presentation	CoP_{EM} CoP_{FM}	Incremental – Numbers/Documents Semi-radical – Numbers Documents/Models	PGC PGC	DC & IC DC & IC

*(CoP_{EM}: Executive manager community of practice, CoP_{FM}: Functional manager community of practice, CoP_{FMPD}: Functional manager product development community of practice, CoP_M: Marketing community of practice, CoP_T: Technology community of practice, CoP_S: Sales community of practice, CoP_F: Finance community of practice, CoP_O: Operations community of practice, PGC: Promote goal congruence, IC: Interactive control, DC: Diagnostic control)

The organisation members involved during this stage were from the CoP_{EM}, CoP_{FMPD} and the CoP_{FM} and were members of the CoP_M, CoP_T, CoP_S, CoP_F, and CoP_O. These communities used boundary objects in the form of numbers and documents to communicate with each other when dealing with incremental projects and numbers, documents and models to communicate with each other when dealing with semi-racial projects. The numbers from the scoring sheet and the numbers presented during the initial presentation helped the communities of practice discuss important project issues for incremental and semi-radical projects. Numbers, though, did not seem sufficient for communities to communicate with each other. Because of this they also used documents for both incremental and semi-racial projects. This shows that even for seemingly straight forward incremental projects there are still enough elements of novelty to need documents to communicate. Semi-radical projects also required the use of models during the initial project presentation as numbers and documents were not sufficient for communities of practice to communicate their ideas.

During the activities that made up this stage the communities of practice seemed to be focused on making sure the product development projects selected would help the organisation achieve its strategic and financial goals, and thus the role of control was see to promote goal congruence. There was a mix of control styles during these activities. While the communities of practice met face-to-face engaging interactively to better understand how best to progress these projects further, there were also some diagnostic checks which focused on the expected project revenue and profitability as well as the resources necessary to undertake the project.

5.6 Conclusion

This chapter has reported on the activities that took place at *OpCo* during the stages and gates that made up the first half of the product development process. It also commented on how and why boundary objects were used for different types of product innovations and categorised the ways in which communities of practice used management control in relation to its role and style.

At the start of each section a report on the details of the activity and how it took place in practice was given. This was followed by a commentary on how and why boundary objects were used by communities of practice for different product innovation types and the role and style of management control. Finally a summary and commentary on each activity was given which showed the interactions that took place between communities of practice during the activity, the boundary objects used for each product innovation type, and the role and style of management control.

This section concludes with an analysis of the findings in relation to the role of management control (Section 5.6.1), the style of management control (Section 5.6.2) and how communities of practice accomplished management control in practice (Section 5.6.3).

5.6.1 The role of management control during the first half of the product development process at *OpCo*

The role of management control seemed to change between the stages and gates of the product development process at *OpCo*. While uncertainty reduction was the focus during the stages of the process, the promotion of goal congruence was a feature of the gates.

This could also be related to the level in the hierarchy of the communities of practice who took part in the activities during the stages and gates.

On the one occasion that the promotion of goal congruence did occur during a stage it was because members of the CoP_{EM} wanted to stress the importance of organisation goals to the other communities of practice. This was because the members of the CoP_{EM} were focused on the firm's strategic and financial goals. Members of the CoP_{EM} promoted goal congruence by connecting the strategy pyramid to the selection of product development projects.

On the other hand, reducing uncertainty seemed to be the focus of control when members of the CoP_{FM} and CoP_{FS} were present at an activity and in particular during the activities that took place during the idea generation and project planning stages. This is because the CoP_{FM} was focused on implementing the strategy and managing the project selection process. The CoP_{FM} tried to communicate the firm's strategy by connecting it to the practices of the $CoP_{FS.}$ They did this by showing the CoP_{FS} their understanding of the market and technology.

5.6.2 The style of management control during the first half of the product development process at *OpCo*

Unlike the role of management control which was related to the stages and gates of the product development process the style of management control did not change much during the first half of the process. On the whole, communities of practice engaged in an interactive style of management control during both the stages and gates of the product development process. This included many face-to-face discussions between the members

of the $CoP_{EM,}$ CoP_{FMPD} and CoP_{FS} where they met face-to-face to discuss and debate how to progress product development project ideas and challenge assumptions about the best way forward.

The style of management control was interactive except during the first two idea generation activities (market analysis and brainstorming) where the style of management control for incremental and semi-radical product ideas did involve setting boundaries around the types of ideas where the CoP_{FMPD} wanted innovation to take place, and during ideation where the CoP_{EM} used the strategy pyramid to influence beliefs. At the final gate there were also some diagnostic checks on incremental and semi-radical projects.

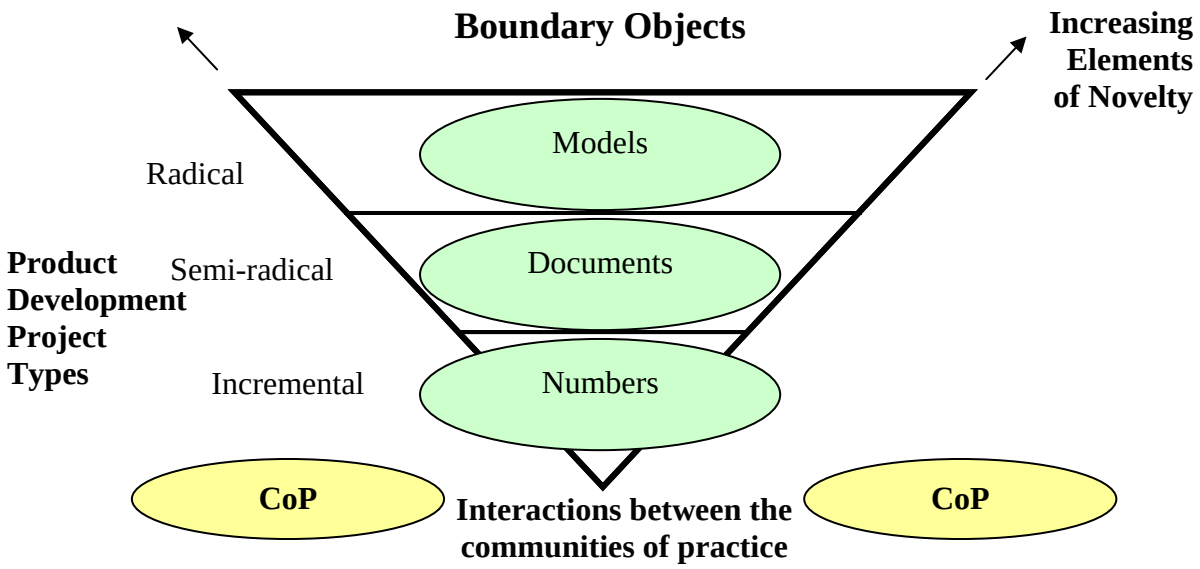
The use of a boundary setting style of management control early in the product development process was useful as members of the CoP_{FMPD} did not want to waste time on the generation of incremental and semi-radical product innovation ideas. Instead they wanted the CoP_{FM} and CoP_{FS} to concentrate their efforts on areas that they though would bring the highest reward. At the final gate the use of diagnostic checks was seen as necessary as the firm did not want to allocate scarce resources to projects that would not add much value to the firm.

5.6.3 How communities of practice used boundary objects during the first half of the product development process

During the first half of the product development process at *OpCo* I observed communities of practice use different boundary objects depending on the type of product innovation they were dealing with (see Figure 33 below).

While the figure shows that communities of practice should be able to discuss incremental projects using numbers, semi-radical projects using documents and radical project using models that is not exactly what I found during the first half of the product development process at *OpCo*. Instead I found that while communities of practice did used numbers when discussing incremental projects they also needed to use documents during many of the activities as there were more elements of novelty than numbers could deal with. As for semi-radical projects communities of practice did use documents extensively, as expected, but also used numbers and on one occasion even used a model. An explanation for this could be that because semi-radical projects are made up of an incremental half and a radical half (see Figure 1, on page 9) the use of numbers and models should be expected.

Figure 33: Boundary Objects and Project Types



Developed using Carlile's 3-T Framework (2002)

Communities of practice found interactions more difficult for radical product innovations as there were many elements of novelty. Communities of practice were more successful in advancing these projects when they used models to accomplish management control. When the communities of practice used documents during idea generation (Stage 1) and the idea screen (Gate 1) they could not progress their radical project ideas.

5.6.4 Differences between the communities of practice during the first half of the product development process

Differences between communities of practice related to the issues they had to face in their daily work. For members of the CoP_{EM} their work revolved around issues concerning the firm's strategic and financial goals. In relation to product development the CoP_{EM} were interested in understanding what kinds of new products would help the firm reach these goals.

Members of the CoP_{FS}, on the other hand, were involved with more operational issues on a daily basis. During the activities that took place during the first half of the CoP_{FM} members were interested in how product development projects would affect product formulation, packaging, production, branding, advertising, suppliers, and customer-related issues.

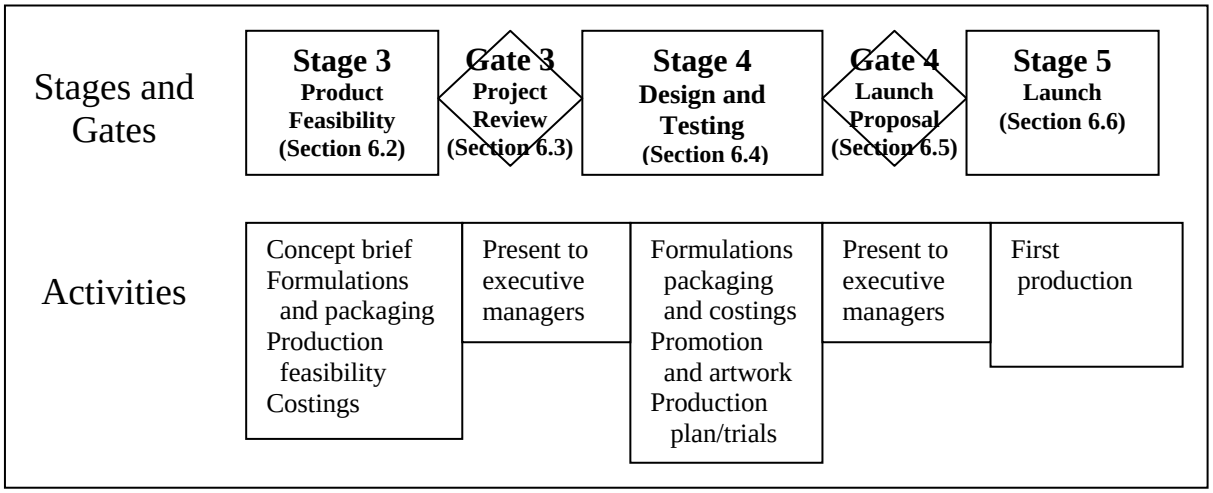
Members of the CoP_{FM} and CoP_{FMPD} had to deal with both the strategic and financial goals of the CoP_{EM} as well as the day-to-day activities of the CoP_{FS}. Because of this the members of the CoP_{FM} and CoP_{FMPD} were an important link between the operational issues of the CoP_{FS} and the strategic and financial issues of the $CoP_{EM.}$

Chapter 6: Field Study Part 2 - The Product Development Process at *OpCo*: Product Feasibility to Launch

6.1 Introduction

The second half of the product development process at *OpCo* consisted of the stages and gates that took projects from the product feasibility stage to their launch onto the market. At *OpCo* this started after projects had passed through the project screen (Gate 2) which was the last gate in the first half of the product development process presented in Chapter 5 (see Figure 18). The second half of the product development process at *OpCo* (see Figure 34) started with a product feasibility stage (Stage 3). This was followed by a project review gate (Gate 3), a design and testing stage (Stage 4), a launch proposal gate (Gate 4) and finally a launch stage (Stage 5).

Figure 34: The Product Development Process at *OpCo*: Product Feasibility to Launch



This chapter reports on the product development activities communities of practice at *OpCo* were involved in during the different stages and gates that made up the second half of the product development process. As ethnomethodology requires a close-up view of practice, I followed as closely as possible the activities of communities of practice.

The communities of practice observed during the second half of the product development process at *OpCo* (see Figure 35 below) consisted of an executive manager community of practice (CoP_{EM}), a functional manager product development community of practice (CoP_{FMPD}), a functional manager community of practice (CoP_{FM}) and eight project team communities of practice (CoP_{PT}). These communities were identified from the organisation structure (see Figure 12 on page 75 and Figure 13 on page 76) and through observations during the field work.

Figure 35: Hierarchal Communities of Practice (CoP) at *OpCo*

Executive Manager-CoP (CoP_{EM})	CEO	GM Technology	GM Marketing	GM Sales	CFO	GM Operations	GM HR
Functional Manager Product Development-CoP (CoP_{FMPD})		Technology managers	Marketing managers	Sales managers			
Functional Manager-CoP (CoP_{FM})	Business process managers	Technology managers	Marketing managers	Sales managers	Finance managers	Operations managers	HR managers
Cross-functional Project teams (CoP_{PT})		Technology personnel	Marketing personnel	Sales personnel	Finance personnel	Operations personnel	

The CoP_{EM} included the CEO, CFO and the five functional general managers (technology, marketing, sales, operations and HR). This community met at least once a week and also met for a whole-day once a month. The CoP_{FM} consisted of all the functional managers in *OpCo*. This community met at least once a week to discuss project issues and once a month to review new project proposals.[34] In addition to the CoP_{FM} there was a smaller functional manager community called the CoP_{FMPD} who had overall responsibility for product development projects. This group of functional managers included technology, marketing and sales managers. Finally functional managers and specialists were members of project teams (CoP_{PT}). Each project team had representatives from almost all the functional departments and consisted of either a member of the CoP_{FM} or CoP_{FS}. These teams met formally once a week and informally when necessary to discuss project issues.

There were also interactions between members of the different functional communities at *OpCo* during the second half of the product development process. The main functional communities I observed during the second half of the product development process are presented in Figure 36. They included a technology community of practice (CoP_T), a marketing community of practice (CoP_M), and a sales community of practice (CoP_S). I also observed to a lesser extent the activities of members of other functional communities such as the finance community of practice (CoP_F) and the operations community or practice (CoP_O).

[34] Ideas that had come out of the first half of the product development process at OpCo

Figure 36: Functional Communities of Practice (CoP) at *OpCo*

***Technology-CoP* (CoP_T)**	***Marketing-CoP* (CoP_M)**	***Sales-CoP* (CoP_S)**	***Operations-CoP* (CoP_O)**	***Finance-CoP* (CoP_F)**
GM Technology	GM Marketing	GM Sales	GM Operations	CFO
Functional managers	Functional managers	Functional managers	Functional managers	Functional managers
Functional specialists	Functional specialists	Functional specialists	Functional specialists	Functional specialists

The following sections report on the product development activities in which organisation members from the different communities of practice at *OpCo* were involved during the second half of the product development process. These sections report on the product feasibility, design and testing and launch stages and the project review and launch gates of the product development process at *OpCo*.

The focus of this report on practice is on the boundary objects; numbers, documents and models (see Carlile, 2002; Star, 1989; Star & Griesemer, 1989) and communities of practice used to accomplish management control in practice. At the conclusion of each report I comment on why communities of practice used certain boundary objects and categorise control in relation to the role of management control (see Davila, 2000) and the style in which management controls were used (see Bisbe & Otley, 2004; Simons, 1995a, 1995b).

Section 6.2 reports and comments on the activities undertaken during the product feasibility stage of the product development process at *OpCo* (Stage 3 in Figure 34, on page 152). This consisted of four activities which included (1) the preparation of a project

concept brief, (2) the development of initial product formulations and packaging designs, (3) a production feasibility report and (4) costings. The members of the CoP_{FMPD} managed these activities while the members of the CoP_{FS} assisted when required.

The product feasibility stage was followed by the first project review gate, which is reported and commented on in Section 6.3. The purpose of this gate was to evaluate how far projects had progressed following the product feasibility stage (Gate 3 in Figure 34, on page 152). At this gate, members of the CoP_{FMPD} presented project reports to the CoP_{EM}.

The next stage of the product development process at *OpCo* was design and testing (Stage 4 in Figure 34, on page 152), and is reported and commented on in Section 6.4. At this stage project teams (CoP_{PT}) made up of members from the CoP_{FM} and CoP_{FS} were formed. The CoP_{PT} had three main activities which included (1) designing the product formulation, packaging and costings, (2) designing packaging artwork and product promotions, and (3) putting together a production plan, which often included production, distribution and market trials.

When the CoP_{PT} had developed the final product a member of the CoP_{FMPD} put together a launch proposal (Gate 4 in Figure 34, on page 152). A member of the CoP_{FMPD} then presented the launch proposal to the CoP_{EM}. After the launch proposal presentation the CoP_{EM} discussed the project and voted on whether it should be launched. This gate is reported and commented on in Section 6.5.

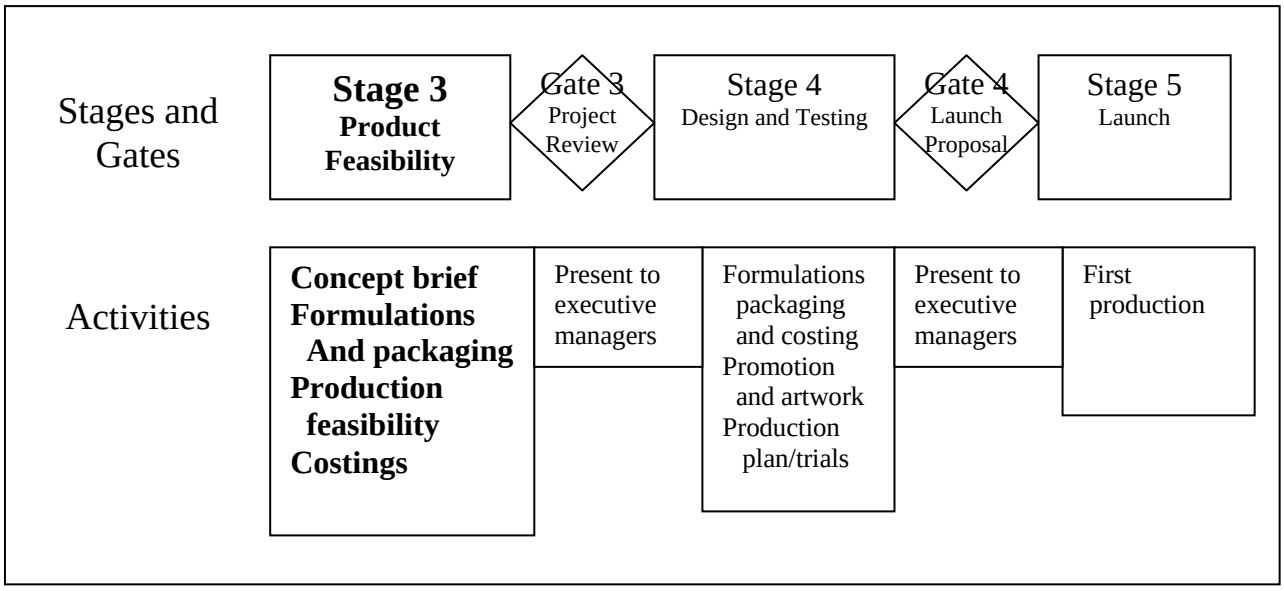
The final part of the product development process at *OpCo* was the launch stage (Stage 5 in Figure 34, on page 152), which is reported and commented on in Section 6.6. As the

members of the CoP_{PT} were only responsible for the project through to its first production run in the factory, I do not report on other activities that took place after production was completed. The first production run was organised by the CoP_{T} members of the CoP_{PT} and received assistance from members of the CoP_{FM} and the CoP_{EM} when necessary.

6.2 Stage 3: Product feasibility

When the CoP_{EM} added a new project to the active project list at the project screening gate (Gate 2 in Figure 32, on page 139) the project moved to the product feasibility stage (see Figure 37).

Figure 37: The Product Development Process at *OpCo*: Stage 3 - Product Feasibility



At this stage, members of the CoP_{FMPD} took the lead in writing up detailed product concept briefs (Section 6.2.1). When all the members of the CoP_{FMPD} had signed off the concept brief initial product formulations and packaging samples were developed by members of

the CoP_T (Section 6.2.2). While initial product formulations and packaging samples were being developed in the technology laboratory there were increasing interactions between the CoP_T and the CoP_O to examine production feasibility (Section 6.2.3). Finally indicative costings were developed by the CoP_T with the assistance of the CoP_F so that the financial viability of the project could be examined in detail (Section 6.2.4).

At this stage in the product development process at *OpCo* there were no formal project teams. The CoP_{FMPD} took the lead in organising these activities while CoP_{FS} members from the CoP_T, CoP_M, CoP_S CoP_O and CoP_F carried out activities as needed.

6.2.1 Concept brief

Once an incremental or semi-radical product idea had passed through the project screen in Gate 2 (see Figure 37 above) it was given to members of the CoP_{FMPD} who took the lead in preparing a product concept brief.[35] Members from the CoP_M, CoP_T and CoP_S were involved during this activity. Members of the CoP_M and CoP_S took the lead in writing concept briefs while the CoP_T examined the resources available to do the product feasibility work. According to a CoP_T member "*The key questions are: Does the project fit into our plans? And, is there someone who can do it*?"

The concept brief document (see Figure 38 below) was designed to get the functional communities of practice discussing critical aspects of the project and included sections on the project details, purpose, strategic intent, product specifications, resources, product attributes and benefits, and financials. The project details included a project manager and sponsor. The project manager usually came from the CoP_{FM} and was often a member of

[35] I did not see concept briefs being written up for radical projects. This could be because they originated in the technology laboratory and thus already had technology resources allocated to them.

the $CoP_{FMPD.}$ The project sponsor was a member of the CoP_{EM} and had overall responsibility for making sure the project delivered on its expected potential. The expected launch data was set by the project manager and sponsor but was often changed by the full $CoP_{EM.}$ The purpose, strategic intent and product attributes and benefit sections of the document were determined in relation to the firm's strategy and marketing plans in consultation with members of the CoP_S and $CoP_{M.}$ The product specification, resources and financials were determined in consultation with members of the $CoP_{T,}$ CoP_O and CoP_F.

Figure 38: Concept Brief

1. PROJECT DETAILS

Project name:
Project manager:
Project sponsor:
Expected launch date:

2. PURPOSE

Market:
Market segment:
Anticipated gain:

3. STRATEGIC INTENT

Product strategy:

4. PRODUCT SPECIFICATIONS

Brief concept description:
Packaging size:

5. RESOURCES

CAPEX:
Possible problems:

6. PRODUCT ATTRIBUTES and BENEFITS

Attributes:
Benefits:

7. FINANCIALS

Contribution before marketing:
Contribution after marketing:
Gross margin:

6.2.1.1 Incremental project concept briefs

For incremental projects this consultation involved members of the CoP_M and CoP_S filling in the brief document and sending it to the CoP_T, CoP_O and CoP_F for their input. I saw these communities examine the concept brief individually; I did not see them meet to discuss these projects. During my observations communities of practice concentrated on the resources the project would need (section 6) and the financial results (section 7) it would deliver. This is because they knew that the CoP_{EM} had some clear outcomes they expected these projects to deliver.

6.2.1.2 Semi-radical project concept brief

The CoP_S, CoP_M and CoP_T regularly meet to consult each other over semi-radical projects. An example of this consultation process took place at a meeting between a member of the CoP_M and member of the CoP_T, both members of the CoP_{FM}. The interaction took place in a meeting room in the technology department. In the meeting room was a desk with some packaging samples that were being considered for the product along with some advertising brochures for a competitor's product. The meeting started with CoP_M taking out the concept brief and some PowerPoint slides on the project that had been presented to executive managers at the project screen gate the week before.

CoP_M "*Here is a review of the demographics and current brand positions in this segment.*"
(CoP_T's picked up a packaging sample)
CoP_T "*Is the packaging a factor*?"
CoP_M "*Historically there has been no confidence in the brand.*"
CoP_T "*Other products using similar packaging are not in this category*."
CoP_M "*Yes, we should look more creatively at our packaging.*"
(CoP_T then picked up the competitor's brochure)
CoP_T "*The ingredients on this look very nice*."
CoP_M "*Our current brand portfolio is important and we need to be able to deliver to those requirements. The story and brand are what is going to drive the product*."
CoP_T "*We cannot have a plain product though*."
CoP_M "*yes, I agree. We need to have a lot of extras*."

CoP_T "*So what is the market worth*?"
CoP_M "*About [X] million with growth of [X]%*."
(CoP_T Pointed to the PowerPoint presentation)
CoP_T "*Do we have to use this brand for this project*?"
CoP_M "*We do not want to introduce any new brands as the firm only wants to support the [current] brands. It is a resource issue*."
CoP_T "*We now have only these brands to cover all our market segments*? *Can we do that*?"
CoP_M "*Yes, I think it is important to keep to the power brands*."
CoP_T "*Why did we use this brand in the first place*?"
CoP_M "*It was seen as a stop gap. We had to get it out there fast to keep market share*."
CoP_T "*Do you think it can work*?"
CoP_M "*I think it will work, but our whole approach will have to change*."
(CoP_T brought out a list of product formulations)
CoP_T "*Will these flavours still fit under the brand*?"
CoP_M "*My gut feel is no. I think we need to do some more work around this aspect. We will have to start thinking about product formulations that will fit into the brand. Maybe we only need to change the names*."
CoP_T "*I think we will have to come up with some new formulations that match the brand*."
CoP_M "*You are right we really do need to develop some new formulations*."
CoP_T "*Normal "me too" formulations are just not going to work*."
CoP_T "*In the concept document we need to know where the brand is going*."

6.2.1.3 Commentary on semi-racial concept brief

Members of the CoP_M and CoP_S were responsible for completing the project briefs with the assistance of the CoP_T, CoP_O and CoP_F. As can be seen from two sections above there were significant differences in how these were carried out. For incremental projects the concept brief was simply sent to all the concerned communities of practice who searched for supporting material and entered it into the documents. The main focus of the communities for incremental projects was on the numbers part of the document so while the communities of practice used the document as a boundary object, they also used numbers as a boundary object to communicate with each other concerning the project.

As for semi-radical projects, communities of practice met regularly to discuss important aspects of the project. The conversation reported in the previous section shows how the members of two communities of practice use the document, and to a lesser extent numbers

and models, in order to understand the issues they were facing. The documents used included a competitor's brochure, a draft of the product concept brief and a PowerPoint presentation which had been presented to the CoP_{EM}. The numbers referred to in the meeting were general non-financial indicators of market size and growth which were not used extensively in the discussions. Finally the communities of practice did talk about packaging models at the start of the discussion but I did not feel these were a major part of the discussions.

The CoP_T member and the CoP_M member seemed to be interested in different aspects of the project. This was because of their functional responsibilities. Members of the CoP_T were focused on the product specifications which included product formulations and packaging while members of the CoP_M were focused on the purpose, strategic intent and product attributes and benefits which included the market segment and branding. The differences that came to the surface as a result of the discussion were the differing views on what it took to launch a successful product. To do this the CoP_M, CoP_S and CoP_T had to make sure that the product's packaging, formulation, branding, and advertising all fitted together. To understand their differences these communities used boundary objects in the form of documents and, to a lesser extent, numbers and models.

The main focus of communities of practice during this activity, for both the incremental and semi-racial projects, was on reducing uncertainty about the market and scope of the project. The scope of the project in this context refers to project complexity, which communities of practice connected to the resources needed to carry out the project. Thus, the role of management control was to reduce uncertainty. The style in which management controls were used differed for each project type. For the incremental projects it was about

checking diagnostically to make sure that the project could meet certain financial expectations. For semi-radical projects the style of control was interactive as communities of practice engaged face-to-face to learn about their differences and to debate action plans about the best way forward.

6.2.2 Product formulations and packaging design

The CoP_{FMPD} and CoP_{FS} members of the CoP_T were responsible for product formulations and packaging design. Once all the CoP_{FM} had signed the product concept brief they would arrange for a CoP_T member to be allocated a block of time to start working on the product formulations and examining packaging solutions.

6.2.2.1 Product formulations

Members of the CoP_T were assigned the task of experimenting with different possible product formulations. CoP_T members first searched for materials to be used in the product. This required the assistance of ingredient suppliers to find the materials that would suit the product. Once materials had been sourced and delivered the functional specialists started making product formulations. The CoP_T members tested different ingredients and often made the product in the pilot plant to simulate production conditions. To source ingredients and test formulations for incremental and semi-radical projects was relatively straightforward as the CoP_T members knew the kinds of ingredients that were more likely to work and also knew what they would cost. The CoP_T members also produced documents listing ingredients that went into the formulation and summaries of the nutritional information which was sent to the CoP_{FMPD}.

For radical projects the product formulation process was much more extensive. CoP_T members developed charts that showed how different ingredients affected the product formulation in different ways. These charts were written into journals and analysed extensively within the CoP_T. At this stage ingredient costs were not seen as a major issue as ingredients could be substituted later if needed. During the formulation process for radical projects members of the CoP_{FM} and the CoP_{EM} would often visit the lab to taste product samples. According to a CoP_T member the reason for getting members of the CoP_{FM} and the CoP_{EM} to sample the products was that "*Getting buy-in of a wide range of people is very important at this stage of the process*." As members outside the CoP_T would not understand the product test results for radical products the only way for the CoP_T to communicate to these communities of practice was through product samples. For this reason product sample models of radical projects were used extensively during this activity.

6.2.2.2 Packaging design

Along with product formulations, the CoP_T was also responsible for the design of the packaging of new products. For incremental and semi-radical projects packaging solutions usually came from either the current product or from packaging already in use in the market. For incremental projects that consisted of new product varieties the current packaging was often used as the base for the new product. Semi-radical (business) projects that took existing products into new markets did not need extensive packaging design, although semi-radical (technical) projects that consisted of new technology usually required more innovative packaging solutions. In these cases members of the CoP_T would search for a packaging solution from something already in the market. This usually required some interactions with packaging suppliers who often came to *OpCo* to help with

the packaging design. For incremental projects the cost of the packaging was a critical factor as in most cases the firm could not get a large price premium from these product innovations. The members of the CoP_T did not have many face-to-face interactions with the CoP_{FM} during packaging design for these types of products as the packaging cost numbers were able to communicate all that they needed to know.

Semi-radical projects that required more packaging design work required greater involvement with packaging suppliers and with members of the CoP_{FMPD}. While packaging cost was also an issue for these projects other matters such as distribution costs and the cost of waste due to the packaging breaking were also issues. These issues were often entered into packaging documents and communicated to members of the CoP_{FMPD}.

Packaging was a critical part of both the radical projects I observed at *OpCo*. For these projects members of the CoP_T had to develop new packaging solutions which they did together with packaging suppliers. During radical projects members of the CoP_T would build and test new packaging samples in the technology lab. These packaging samples were used in a similar way to the product formulations and were used extensively to communicate with members of the CoP_{FMPD} and the CoP_{EM}.

6.2.2.3 Commentary on product formulation and packaging design

The CoP_{FMPD} and CoP_{FS} members of the CoP_T were responsible for product formulations and packaging design and communicated with the CoP_{FM} and CoP_{EM} during these activities. CoP_T members would start the activity by testing product formulations and packaging designs. For incremental projects communities of practice used numbers in the form of ingredient costs and packaging costs when communicating as these were sufficient

when there were few elements of novelty. For semi-radical projects communities of practice used boundary objects in the form of ingredient and packaging cost numbers but also used documents in the form of the product formulation (i.e. what ingredients went into the formulation) and a summary of the nutritional information when communicating with each other. This is because there were more novel elements for these projects. For radical projects, on the other hand, communities of practice used product models extensively as they consulted between themselves and with outside suppliers as there were many elements of novelty that they had to deal with.

As these activities revolved around creating and collecting information, the role in which management control was being used related to reducing uncertainty about the types of product formulations and packaging design necessary for the project. The style in which communities of practice used management controls was to diagnostically check incremental and semi-radical projects to make sure that they met their expected targets while it was used interactively for semi-radical and radical projects as communities of practice engaged to learn about how the product formulations and packaging options affected each community of practice.

6.2.3 Production feasibility

Another activity that took place during the product feasibility stage was an examination of production feasibility. This activity was organised by the CoP_{FMPD} and involved consultations between members of the CoP_T, CoP_M, CoP_S and the CoP_O. The activity began with a manufacturing process analysis carried out by members of the CoP_T and the CoP_O.

6.2.3.1 Production feasibility for incremental and semi-racial (business) projects

For semi-radical projects which were focused on launching an existing product into a new market there was seldom a need for this activity. For incremental and semi-racial (business) projects this was a straight forward process for the projects I observed. This was because these products required minimal changes to machines currently being used. When a change was needed it would only involve putting a new attachment onto an existing machine and thus the focus of discussions between the communities of practice for these projects was on the cost of the attachment and other manufacturing specifications.

6.2.3.2 Production feasibility for semi-radical (technical) projects

For radical projects and semi-radical projects which had new technical features there was often a need to either substantially change an existing machine or build/buy a new machine to produce the new product. As this required capital expenditure, members of the CoP_M or CoP_S would write up a capital expenditure application document which was presented to the members of the CoP_{EM} during the project review at Gate 3.

I observed discussions concerning production feasibility for these projects taking place in the technology laboratory. Matters discussed included critical product features and manufacturing equipment. One of the discussions I observed while in the technology laboratory one day took place between members of the CoP_T, CoP_M and CoP_O after they had sampled some new product formulations.

CoP_T "*Manufacturing is more difficult using this new ingredient so operations may not be happy about making it*."
CoP_T "*Waste could also be an issue*."

(The CoP_M member picked up a product formulation sample)

CoP_M "*So this product could be a problem*."
CoP_T "*That's just operations - we can overcome that*."
CoP_M "*The aim is for a [date] launch*."
CoP_O "*We might start with hand filling*."
CoP_O "*Hand filling is easy and will not take much capital - but to automate it will take substantial capital expenditure. The other machines are near production capacity anyway*."
CoP_O "*The [machine name] would need new plates, collators and other parts. [Machine name] could do it but it would then require major changes to other products*."
CoP_T "*[Machine name] will give us better quality*."
CoP_O "*We could also make it at [plant X]*."
CoP_M "*Executive managers want the product to be ready to launch in [date]*."
CoP_O "*We can only do hand fill in this time period or bring in another machine from somewhere*."
CoP_T "*The issue with the [plant X] is we have to ship materials down there and bring two thirds of the end product back here*."

In this case the communities of practice used the product formulation sample models to talk about the different production options open to them. They talked about different possible machines as well as manufacturing locations. By using the product formulation samples the CoP_O could understand how the product could fit into their environment. This product was radical enough for product formulation models to be necessary for understanding the effect the product would have current operations.

6.2.3.3 Commentary on production feasibility

The CoP_{FMPD} and the CoP_{FM} and CoP_{FS} members of the CoP_T, CoP_M, CoP_S and CoP_O were responsible for production feasibility and communicated with the CoP_{FM} and CoP_{EM} when necessary during these activities. For incremental and semi-radical (business) projects communities of practice used boundary objects in the form of numbers as they were sufficient to communicate when there were low levels of novelty. Communities of practice found it more difficult to talk about semi-radical (technical) and radical projects. While they still used boundary objects in the form of numbers (such as capital expenditure) they

also used documents related to manufacturing changes and models of new machines when discussing these projects as the elements of novelty were high.

The role of management control during this activity seemed to focus on reducing uncertainty about the changes necessary to the manufacturing process and the impact on project costs. While the style in which management controls were used focused on checking diagnostically critical performance measures for incremental and semi-radical (business) projects, communities of practice were seen to engage interactively using documents and models when dealing with radical and semi-radical (technical) projects.

6.2.4 Costings

The CoP_{FMPD} members were responsible for this activity and were supported by members of the CoP_T who computed the costs after the completion of the product formulation/packaging design and production feasibility activity. This was because it was necessary to know what ingredients, packaging and machines were going to be used before costings (numbers) could be calculated.

Indicative product costings (numbers) were calculated during the product feasibility stage for projects at *OpCo*. These costs were calculated using data from the various systems in use at *OpCo*. This was done using a product costing form which was filled in by communities of practice during the product development process. Product costings at *OpCo* were done on a full cost basis and thus included not only direct material costs such as ingredients, labour and machine costs but also a proportion of the firm's overhead costs.

6.2.4.1 Costings for incremental and semi-radical projects

The CoP_T carried out this activity with the support of the members of the CoP_{FMPD} for incremental and semi-radical projects. This took place after the product formulation, packaging design and production feasibility activities. This was because it was necessary to know what ingredients, packaging and machines were going to be used before costings could be calculated. After completing the costing sheet for incremental and semi-radical projects I observed members of the CoP_{FMPD} and CoP_T interacting with the CoP_F who checked the costings for accuracy. After costings had been checked they were communicated to members of the CoP_{FM} and CoP_{EM} and were used when these communities interacted with the CoP_{FMPD}.

6.2.4.2 Costings for radical projects

For radical projects the members of the CoP_{FMPD}, who were members of the CoP_T, CoP_M, and CoP_S would calculate indicative costings (numbers) during this stage. I observed the functional communities of practice using these numbers to discuss product features but not in relation to critical performance variables. This was because the product ingredients, packaging and manufacturing process were still changing and thus there was no point in trying to get an accurate cost at this stage. The CoP_{FMPD} did not use these costings when communicating with the CoP_{FM} or CoP_{EM} about the project at this stage.

6.2.4.3 Commentary on costings

The CoP_{FMPD} and CoP_{FS} members of the CoP_T were responsible for costings which were used by these communities of practice when they communicated with the CoP_{FM} and CoP_{EM}. For incremental and semi-racial projects communities of practice used these numbers as boundary objects when communicating with other communities. This is

because there were few elements of novelty. For radical projects functional communities of practice used numbers as boundary objects to discuss critical project features. The costings for radical projects were not very detailed but they helped the communities of practice examine important project issues. These costings, though, were not used by the CoP_{FMPD} when communicating with the CoP_{EM} as these numbers were not able to capture the elements of novelty these projects still faced.

As this activity revolved around creating and collecting costing information, the role in which management control was being used by communities of practice related to reducing uncertainty. The style in which communities of practice used management controls was to diagnostically check incremental and semi-radical projects to make sure that they met their expected cost targets, while it was used interactively for radical projects as communities of practice engaged to learn about how the costings affected each community of practice.

6.2.5 Summary and commentary on the product feasibility activities

A summary of the activities at the product feasibility stage is presented in Table 6 below. This table lists the communities involved, innovation types, boundary objects, and the roles and styles of management control. The CoP_{FMPD} took overall responsibility at this stage of the product development process at *OpCo*. During the activities at this stage they were joined by members of the CoP_T, CoP_M, CoP_S, and CoP_O as well as outside suppliers.

As the elements of novelty for each project type was different, communities of practice used different boundary objects when communicating with others about them. For incremental projects, which had only a few novel elements, communities of practice used numbers and occasionally documents. For semi-radical projects, which had more elements

of novelty, communities of practice used mainly documents. Finally, for radical projects, where there were many novel elements, communities of practice used models as well as the costing numbers (although these numbers were only used occasionally). Thus, as the level of novelty for each of these projects was different communities of practice needed different boundary objects to communicate with each other.

Table 6: Summary of Stage 3 - Product Feasibility

Product Development Activities	Communities Involved*	Innovation types and Boundary Objects	Control Role*	Control Style*
Concept brief	CoP_{FMPD} CoP_T, CoP_M, CoP_S	Incremental - Numbers/Documents Semi-radical - Numbers/Documents	RU RU	DC IC
Formulations and packaging	$CoP_{FMPD,}$ CoP_{EM}, CoP_{FM} CoP_T, CoP_M, CoP_S,Suppliers	Incremental - Numbers Semi-radical - Numbers/Documents Radical - Models	RU RU RU	DC DC & IC IC
Production feasibility	CoP_{FMPD}, $CoP_{FM,}$ CoP_{FS} CoP_T, CoP_M CoP_S, CoP_O	Incremental - Numbers/Documents Semi-radical – Numbers/Documents Models Radical – Numbers/Models	RU RU RU	DC DC & IC IC
Costings	CoP_T, CoP_F CoP_S	Incremental - Numbers Semi-radical - Numbers Radical - Numbers/Documents	RU RU RU	DC DC IC

*(CoP_{FMPD}: Functional manager product development community of practice, CoP_{FM}: Functional manager community of practice, CoP_{EM}: Executive manager community of practice, CoP_T: Technology community of practice, CoP_M: Marketing community of practice, CoP_S: Sales community of practice, CoP_O: Operations community of practice, CoP_F: Finance community of practice, RU: Reduce uncertainty, PGC: Promote goal congruence, IC: Interactive control, DC: Diagnostic control)

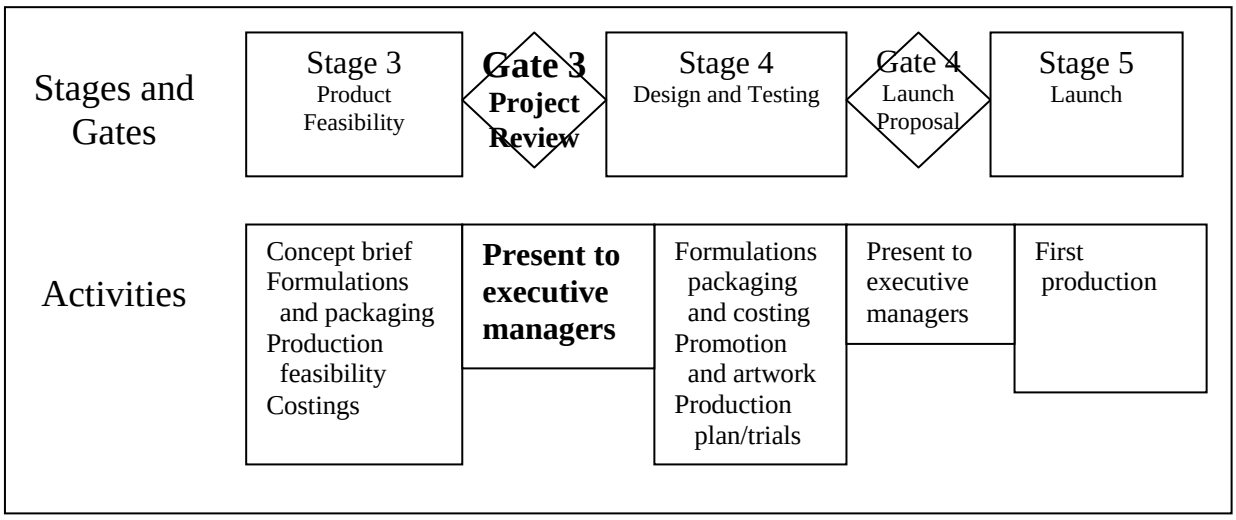
The role of management controls during this stage seemed to focus on reducing market and technical uncertainty. This can be seen in the report on practice when communities of practice collected information from different functional departments to better understand the projects they were working on.

The style in which management control was used seemed to be different for each project type. For incremental projects management controls were being used to check against expectations diagnostically. For semi-radical projects there was a mix of both diagnostic checks and communities of practice engaging interactively. This is because a part of these projects was incremental while the another part was radical. Finally, during radical projects communities of practice were seen to be engaging interactively using models as they met face-to-face to learn about the marketing and technical issues they faced while debating action plans about the best way forward.

6.3 Gate 3: Project review

At the completion of the product feasibility stage a member of the CoP_{FMPD} prepared a project presentation for the CoP_{EM} to obtain approval for proceeding to the design and testing stage of the product development process (see Figure 39).

Figure 39: The Product Development Process at *OpCo*: Gate 3 - Project Review



At this gate the CoP_{EM} voted on what to do with each project. They would either (1) approve the project moving to the design and testing stage (2) cancel the project permanently or (3) ask the CoP_{FMPD} to continue working on the project and present the project proposal again. Those projects that were successful at this stage would proceed onto the design and testing stage where the final product and manufacturing process was developed (stage 4).

Before doing a presentation the CoP_{FM} or CoP_{FMPD} member would usually show their notes to selected members of the CoP_{EM} to obtain preliminary feedback on the presentation, and buy-in for the project before it was formally evaluated by the whole CoP_{EM}.

The following sections present the project reviews I observed. Section 6.3.1 reports on a project review for an incremental project, Section 6.3.2, reports on a product review for a semi-radical project, while Section 6.3.3 reports on a project review for a radical project.

6.3.1 Incremental project review

Below is an example of an incremental product innovation project review I attended. The presentation was given by a member of the CoP_{FM} to the CoP_{EM} in the boardroom at *OpCo*. Also in attendance were other members of the CoP_{FM} who had been involved in the product feasibility stage of the project.

The presenter started with an overview of the market segment and the need for this type of product. Product cost details were then presented, which included the ingredient and packaging costs. Next the other financial numbers were presented which included contribution before marketing, contribution after marketing, cost of goods sold, and product discounts for retailers. This was followed by a discussion about the project.

CoP_{EM} "*If we do not have this new flavour we need to continue the status quo - we started the discount programme during the year at [X%]. Do we really want to cut it back to [Y%]*?"
CoP_{EM} "*That would affect contribution before marketing. But will the new flavour increase sales*?"
CoP_{EM} "*To get sales we need discounts. A lot of sales are on promo*."

> (The presenter put up a PowerPoint slide showing share sensitivity analysis which a member of the project team supported)

CoP_{EM} "*Why has the total cost not gone down with the increase in [this] cost*?"
CoP_{FM} "*We have been able to decrease prices in other areas*."
CoP_{EM} "*We need to check these numbers*."
CoP_{EM} "*Just put in the extra costs and see if our contribution before marketing would increase if we decreased discounts to [Y%]*."
CoP_{FM} "*It will cost [Z] million if we increase the discounts to [X]%*."
CoP_{EM} "*We need to examine our assumption. If we think that lowering the discount will help us that is fine, but I do not think that will happen as we will lose sales*."

CoP_{EM} "*There is no cap on that discount*."
CoP_{EM} "*This was not budgeted but it was needed to keep sales revenue at the current level*."
CoP_{EM} "*How do we find the optimum level of discounting*?"
CoP_{EM} "*You look at the marginal revenue gain*."
CoP_{EM} "*How much do we need to spend*? *And what is the strategy*?"
CoP_{EM} "*There is going to be a big difference between budget and forecast*."
CoP_{EM} "*Our strategy is to get [X]% of the market*."
CoP_{EM} "*We have not really been able to get there as we need [this project]*."
CoP_{EM} "*Yes that is a high number. We do need to tweak it and tighten it up. Our wholesale price is above the market and that spend is to get our price back to within [X]% of the market price*."
CoP_{EM} "*Another part is the effect on other suppliers*."
CoP_{EM} "*Not yet but there is some smoke*."
CoP_{EM} "*There are players under pressure with [competitor A] thinking about staying in the market and [competitor B] has certainly increased their activity*."
CoP_{EM} "*Could we check on the quality spend of the discount and the strategic value of the spend*? *Is this the best way of spending the $[X]*? *Or is there a better way to target any firm or region in particular and going hard at that area*."
CoP_{EM} "*Yes that is fair and we do need to look at this. What about timings*?"
CoP_{EM} "*We have this gap and we need to address it quickly as it is about to blow up soon. We will lose money on [flavour A], [flavour B] and [flavour C] but they will all lower our contribution before marketing*."

> (At this stage the presenter brought in samples of one of the new flavours that had been made during the product feasibility stage and handed it out the executive managers)

CoP_{EM} "*Why have we not had [this flavour] before*?"
CoP_{FM} (Presenter) "*The reason we did not have it in the range was the cost. The ingredients are a lot more expensive than others. We are hoping to launch it in a new [container] and increase the price to make a good margin. [CoP_T] is looking at more cost effective ways to make the product.*"

> (The project review ended with the CoP_{EM} signing a document to approve the project for development.)

6.3.2 Commentary on the incremental project review

The incremental project review was given by a member of the CoP_{FM} to the CoP_{EM} who were members of the functional CoP_T, CoP_M, CoP_S, CoP_F, and CoP_O. From the above discussion between the communities of practice the boundary objects they use included numbers; product cost, discounts, contribution before marketing, contribution after

marketing, cost of goods sold, market share as well as documents including; marketing reports.

From the above discussion it can be seen that the focus of the incremental project review was on numbers such as financial projections of contribution after marketing, contribution before marketing, cost of goods sold as well as non-financials such as discount percentage and market share. These numbers were used extensively during the presentation by the communities of practice as boundary objects as there were few elements of novelty for these projects. Although marketing report documents were presented they did not seem to have much influence on the discussions.

The role of management control during this activity seemed to focus on promoting goal congruence as communities of practice regularly referred to the firm's strategic and financial goals. The style of management control was interactive as communities of practice met face-to-face and debated information and challenged assumptions about the best way forward.

6.3.3 Semi-radical project review

Below is an example of a semi-radical product innovation project review I attended at *OpCo*. The presentation was given by a member of the CoP_{FM} to the CoP_{EM} in the boardroom at *OpCo*. Also in attendance were a few members of the CoP_{FM} who had assisted on the project. The project concerned a new product technology that the firm hoped could be used to add to its current product range.

The presenter started with a PowerPoint presentation concerning the recent developments that had taken place during the product feasibility stage. In addition to the PowerPoint slides the presenter also had brought some packaging samples to the project review. Following the presentation the executive managers had a discussion about the project.

CoP_{EM} "*This should be a short term project not a long term one*."
CoP_{EM} "*I think we should re-consider [another technology option]*."
CoP_{EM} "*We need more urgency on this*."
CoP_{EM} "*The problem is getting the time between getting the [technology] and having it up and running is 12 months*."
CoP_{FM} "*This [technology] would take 12 months*."
CoP_{EM} "*Now that we have got to this point we need to do something quick*."
CoP_{EM} "*The cost of getting [another technology] might not be worth it as the cost would be too high*."
CoP_{EM} "*We do not have time*"
CoP_{FM} "*Do we need [this technology] as we will also need [a new machine] which will cost [$]*."
CoP_{EM} "*No, we are not going to try to get [that technology] as soon as possible*."
CoP_{EM} "*Let's come back next week to discuss [the technology] issues*."

At the end of the discussion the members of the CoP_{EM} did not made a decision on which product technology option to pursue. Later that week I found out that the CoP_{EM} had decided to cancel the project. A few weeks later the CoP_{EM} decided to split the project into two parts, one with a short-term product focus and one with a long-term technology focus.

6.3.4 Commentary on the semi-radical project review

This project review was given by a member of the CoP_{FM} to the CoP_{EM} who were members of the functional CoP_T, CoP_M, CoP_S, CoP_F, and CoP_O. From the above discussion between the communities of practice the boundary objects used were a PowerPoint presentation document, and numbers. In the discussion the document was used to analyse the project in relation to the short-term and long-term strategy of the firm. Communities of practice also

used a machine cost and time numbers during their discussions. While aspects of the project required the use of documents because of the level of novelty, other aspects had lower levels of novelty and thus could be discussed using numbers. Thus, boundary objects in the form of documents and numbers were used by communities of practice to communicate with each other during semi-radical projects.

The role of management control was focused on achieving congruence with the firm's strategic goals. This can be seen in the decision to split the project into two parts as some new technology was necessary for the firm to reach its short-term goals while the more advanced technology was needed in the long term. Thus, the focus of this activity was on reducing goal divergence. The style of management control again was seen to be interactive as the communities of practice engaged face-to-face to debate and discuss action plans about the best way forward.

6.3.5 Radical project review

Below is an example of a radical project review I attended at *OpCo*. Before the meeting a project proposal had been circulated to the CoP_{EM} (I was also given a copy). The project review took place in the *OpCo* boardroom. There were three presenters who were all members of the CoP_{FM} and had been responsible for writing up the project proposal.

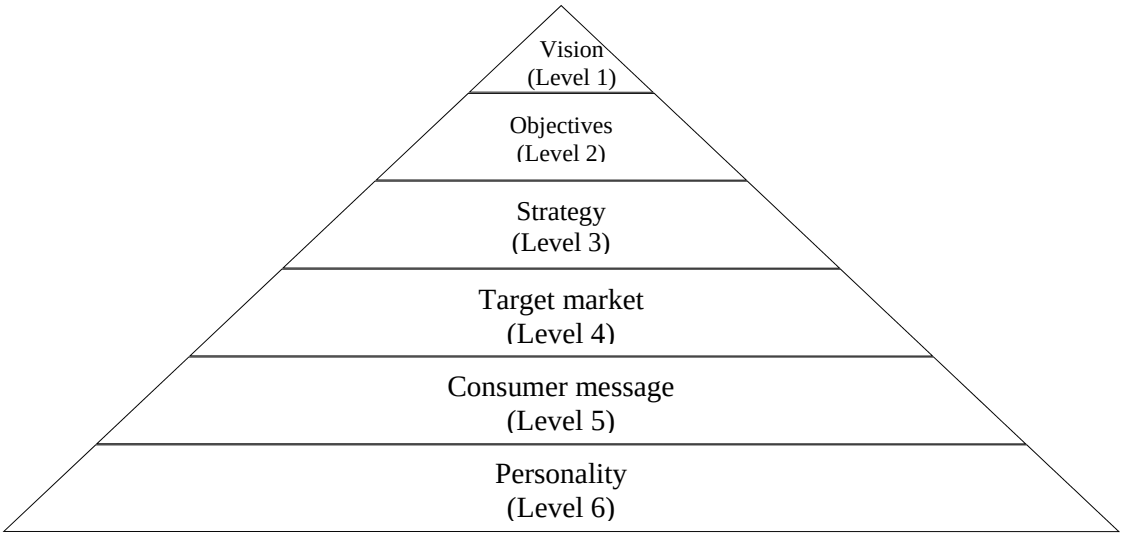
The CoP_{FM} members started off the presentation with a PowerPoint presentation. The first presenter introduced the CoP_{FM} members who had been involved in the project so far. The presenters then said they would "*bring in some samples later for you all to try*." The first few PowerPoint slides reviewed the background of the project and what funding would be needed to develop and launch the product. After this brief introduction the presenter talked

about the project's objective as well as some details about the product and packaging issues.

CoP_{EM} "*What degree of confidence do you have in successfully delivering the product*?"
CoP_{FM} "*Reasonably confident*."
(This member of the CoP_{EM} had been assisting the CoP_{FM} in developing possible packaging solutions added)
CoP_{EM} "*We have a solution from [one supplier] but only [another supplier] can deliver the solution. We have done some preliminary trials and it seems to deliver. We now just need to get the final models put together*."
CoP_{EM} "*Can they do it*?"
CoP_{EM} "*We are going to them today. Expect it to be solved*."

Another CoP_{FM} member then did an overview of the consumer proposition. This included a brand pyramid document (see Figure 40 below) that the CoP_{FM} had developed for the product.[36] The manager talked about the image the product was trying to portray, the market niche the product was aimed at, as well as the product message. The consumer research that had been done was also presented. This included both qualitative interviews and a more quantitative broad-based survey of consumers in the target market.

Figure 40: Project Brand Pyramid



[36] These brand pyramids were linked to the firm's strategy pyramid

At the top of the brand pyramid was *OpCo's* vision for the brand. The second layer of the pyramid contained the objectives that executive managers had set for the brand. The third layer was the strategy which briefly outlined what *OpCo* needed to do to reach the brand vision, and objectives. The strategy was also directly linked to the consumer message (level 5) keeping the focus on what consumers wanted. Level 4 was the target market for the brand which included the target demographic. The 5th level was the consumer message which was the message that *OpCo* wanted consumers to think about when they thought of the brand. Finally the last level was the personality of the brand. This level captured the words used to describe the brand and was linked to the other five levels in the brand pyramid.

Another CoP_{FM} member then presented the business plan. This focused on the operational advantages that retailers would get from the product. These advantages included fewer operating issues in a high turnover environment as the product came fully prepared. This would reduce variability and lower the risk of contamination. Finally, no cleaning would be required as the packaging would be fully disposable. At this stage the presenters sat down to take a break while product samples were brought in for the group to try. While the communities of practice were sampling the product some of the members of the CoP_{EM} and CoP_{FM} talked among themselves. Not all the members of the CoP_{EM} liked the product but they all seemed to agree that it could be a good product for the target market.

After the communities of practice sampled the product the members of the CoP_{FM} returned to the presentation. One of the CoP_{FM} members presented a distribution chart as well as a document which outlined how to build customer awareness. Next the members of the CoP_{FM} presented a document that summarised the capital expenditure that had been spent

and the amount needed to launch the product. This included the advertising that would be needed to launch the product.

CoP_{EM} "*This is a go to [design and testing], so we will need to be in full development phase by next month*."
CoP_{FM} "*Today we want to signal what resources we need - both in terms of money and people*."
CoP_{EM} "*We need to get people with local knowledge*."
CoP_{FM} "*Financial assumptions are[X]*."
CoP_{EM} "*You only get an [X]% margin at the moment which is very low. We need to get at least [Y]%. We are trying to get [Z]% on all our new projects. Can we ask [retailer] to take a lower margin*? *If we can't I will not be able to give you all the money you need*."
CoP_{FM} "*This is only a best guess. It could be much higher or a lot lower. Until we go to customers we will not know*."

> (The sessions concluded with all the executive managers summarising their points of view.)

CoP_{EM} "*Good commercial and technical plan. The biggest issue though is the margin*."
CoP_{EM} "*We really need to work hard to get the cost of the packaging down*."
CoP_{EM} "*This is a classical product development case. This project is hampered by the technical aspects at a price point. This project has pushed us into a new category. It is the learning that has been the most valuable part of the project*."
CoP_{EM} "*This project has come a long way but we still need to understand the costs better*."
CoP_{EM} "*We really need to get to [Y]% margin as we will not put a lot of resources into this project at that margin*."

The CoP_{EM} members all filled in a voting form to help them decide how to progress. The results of the voting showed that the CoP_{EM} perceived the project risk to be higher than the reward at this stage of the project but decided it was still worth proceeding to full product design and testing on the assumption that during the next stage a more robust packaging solution could be found and that the packaging costs could be decreased. If these could be achieved the CoP_{EM} thought that an acceptable margin could be achieved.

6.3.6 Commentary on the radical project review

At the start of the presentation the CoP_{FM} used a boundary objects in the form of a PowerPoint document to communicate where the project was and what they needed to continue the project. This also contained some numbers showing what resources had been used to get to this point and what would be needed should the project progress to development and launch. This was followed by the consumer research documents which included both qualitative and quantitative market research and the customer plan document.

The numbers and documents were used by the CoP_{FM} to talk about their knowledge of the new market category. Following the use of numbers and documents the CoP_{FM} used a model boundary object in the form of product samples (models) to communicate how the product would taste and how the product created a new market category. Also by presenting the product the CoP_{FM} members could get the CoP_{EM} thinking about the product and packaging issues that they had solved already and signalling what might be possible in the future.

"*Getting the right numbers*"[37] seemed to be the important thing for some members of the CoP_{EM}. Other members of the CoP_{EM} noted that the learning aspect alone had made this project valuable. There were no financials presented in the first part of the presentation but as soon as they came up they were referred to often. The financials, and in particular gross margin, were seen as critical to get the members of the CoP_{EM} to fund the project as they would not be able to defend money spent without it returning a significant margin to the firm, especially considering the risk involved.

[37] This statement was used by members of the CoP_{EM} in relation to certain financial performance measures.

Thus, the boundary objects used during this radical project review included numbers, documents and models. Some of the communities of practice concentrated on the numbers, while the presenters used documents about the market research and as well as the project proposal document. Models in the form of product samples were also used to show the potential the product had. Although numbers, document and models were all used during this presentation the models of the product samples were the most effective way of communicating the products potential. They were not sufficient, though, as members of the CoP_{EM} also needed to know the numbers so that they could defend their decisions.

The role of management control during this activity seemed to be on promoting goal congruence as it was focused on the firm's strategic and financial goals. The style of management control was seen to be interactive as the communities of practice engaged interactively, debating information and challenging assumptions about the best way forward.

6.3.7 Summary and commentary on the project review gate

Table 7 summarises the activities that took place during the project review gate and lists the communities involved, innovation types, boundary objects, and the roles and styles of management control. The project review gate was carried out by the members of the CoP_{EM} and CoP_{FM}. Project presentations were developed and presented by members of the CoP_{FM} who received assistance from other CoP_{FM} members who had been involved during the product feasibility stage.

Table 7: Summary of Gate 3 - Project Review

Product Development Activities	Communities Involved*	Product Innovation Types and Boundary Objects	Control Role*	Control Style*
Presentations to executive managers	CoP_{EM} CoP_{FM}	Incremental - Numbers Semi-radical - Numbers/Documents Radical - Models/Documents/ Numbers	PGC PGC PGC	IC IC IC

*(CoP_{EM}: Executive manager community of practice, CoP_{FM}: Functional manager community of practice, PGC: Promote goal congruence, IC: Interactive control)

The aim of these presentations was to obtain resources for the project to proceed to the design and testing stage (Stage 4). To do this the CoP_{FM} had to show how the project fitted into the firm's strategic and financial goals. The CoP_{EM} had to decide if the project would help the firm reach the financial and strategic goals that they had set. Thus the role of management control in all cases was about reducing goal divergence between what the project being presented could deliver and the goals of the firm.

The use of boundary objects at the project review gate seems to be related to the type of product innovation being presented. For incremental projects numbers were main boundary objects used as the CoP_{FM} knew that the CoP_{EM} was familiar with the technology and market and thus they had to show why developing a new product variety would add value to the firm.

For semi-radical projects numbers and documents were used. The CoP_{FM} used documents to highlight the different technologies or markets and to communicate to the CoP_{EM} how the firm should develop a product line for a certain market segment.

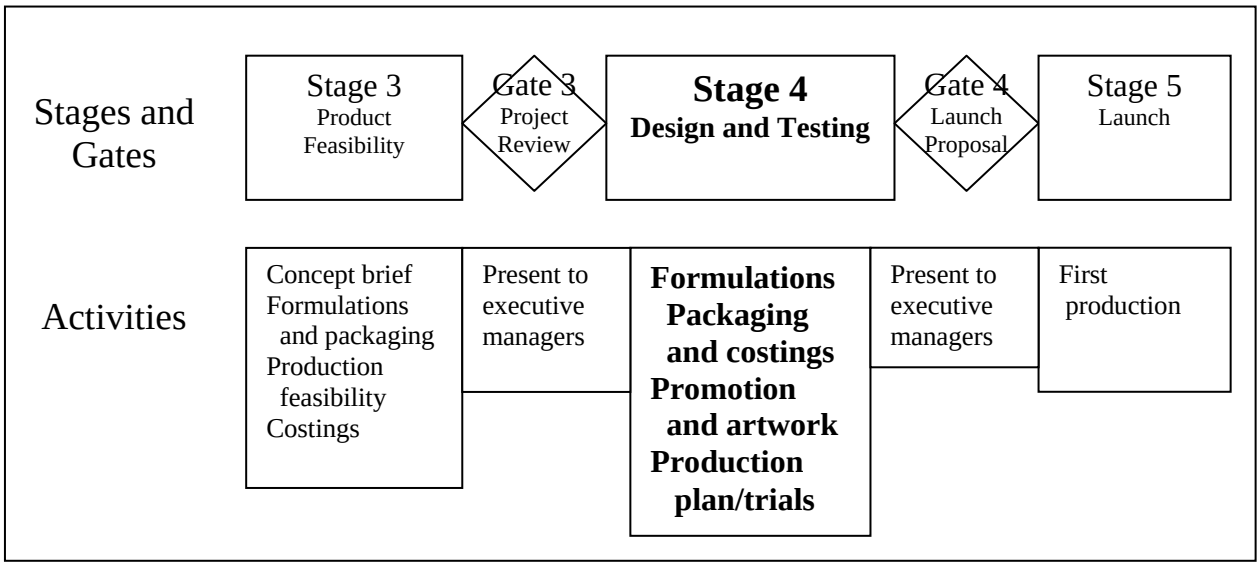
Finally for radical projects, documents and models were all used when presenting product developments to the CoP_{EM}. The CoP_{FM} used models to show what the product was, how it worked and how it fitted with *OpCo's* capabilities. The CoP_{FM} used documents to show their understanding of the market from the consumer and customer points of view. The CoP_{FM} used numbers to bring the whole radical product innovation story together and show what it had taken to get to that point and what would be needed to progress to development and launch. The numbers also showed what the new product would bring to the firm and the risks it entailed. Thus, different boundary objects were seen to be used by communities of practice for different types of product innovation.

The role of management control during this activity seemed to focus on promoting goal congruence as communities of practice regularly referred to the firm's strategic and financial goals. The style of management control was interactive as communities of practice met face-to-face and debated information and challenged assumptions about the best way forward.

6.4 Stage 4: Design and testing

Once a project had been approved by the CoP_{EM} at a project review meeting (Gate 3) a project team (CoP_{PT}) was formed to design and test the product (see Figure 41).

Figure 41: The Product Development Process at *OpCo*: Stage 4 - Design and Testing



During my field work at *OpCo* I observed eight project teams (CoP_{PT}) which were made up of members of the CoP_{FS} and the CoP_{FM}. These CoP_{PT} held weekly meetings, run by a project leader.[38] This community of practice worked closely, with most projects lasting from three to nine months.

Organisation members were chosen for a CoP_{PT} based on their knowledge and past experience working in specific market segments.[39] The CoP_{PT} members were chosen by

[38] It should be noted that this section does not report directly on the project team meetings (functional interactions). Instead the focus is on the hierarchal interactions that took place during the stage.
[39] *OpCo* divided its operations into various market segments with functional managers and specialists each assigned to a particular segment.

the CoP_{FM} to be members of the team. In addition to members from $CoP_{T,}$ CoP_{M} and CoP_{S}, project members also came from CoP_{O} and CoP_{F} and were assigned based on their role in the organisation and their knowledge of the project's target market segment.

At the first project meeting the CoP_{PT} leader, who was usually a CoP_{FS} or CoP_{FM} from the CoP_{M}, CoPs or CoP_{T}, would invite a member of the CoP_{FMPD} to talk to the CoP_{PT} about the overall purpose of the project and its importance to the firm.

An example of one of those interactions is given below.

CoP_{FMPD} "*This is a top 10 project in a new category with international potential. The aim is to first launch in [country] and [country]. As this product could be copied by [competitor] or [competitor] when we launch we will launch very fast. Speed to market is the key as protecting [IP] will be difficult.*"

(The CoP_{FMPD} member followed the introduction with an overview of the critical aspects of the project.)

CoP_{FMPD} "*When [packaging supplier] does mock-ups we can test them. We are only supplying the product with [X] and will supply the [Y] separately. We need to prove to the [retailers] that it works. From our perspective we really want a realistic outcome and not one driven by gimmicks. [CoP$_T$ members] will provide a demonstration to show the rest of the team how [a key product feature] works.*"

(This set the scene for drawing up a critical path so that all communities of practice were aware of the activities and tasks that had to be done to keep the project on track.)

CoP_{PT} Leader "*I sent out a list to everyone. I need to understand lead times so I can do a critical path.*"

An expected launch date was given to the CoP_{PT} by the CoP_{EM} when a project was approved. The project team then worked backwards from the expected launch date to

figure out how they could meet the date. If time pressures were high the CoP_{PT} had to decide what could be dropped from the critical path without increasing the risk of the project to an unacceptable level. For example all projects did not need the same number of production trials. If these could be cut, the product could move from design and testing to launch in a shorter period of time. This would only be done if there was enough knowledge of the expected outcomes to mitigate the potential risk, although even that was sometimes not enough and on some occasions problems came up during first production. The decision to skip an activity or task was signalled to members of the CoP_{FMPD} and CoP_{EM} who were responsible for making the final decision about what activities and tasks could be cut from the product development process.

At the second CoP_{PT} meeting the project leader would present a critical path diagram to all the communities of practice outlining the activities and tasks that had to be done during the project to achieve the expected launch date. The major activities included product formulations/packaging/costing, promotion/artwork, and production plan/trials. Weekly project meetings were then held so that the CoP_{PT} could review the achievements and examine issues from the previous week. Progress was then mapped against the project's critical path to see if there needed to be any changes. A list of tasks was then presented along with a list of who was responsible for each task. The CoP_{PT} used a PMO (project management office) document to organise these tasks (see Figure 42 below).

Figure 42: PMO Project Progress Report

1. PROGRESS REPORT DETAILS

COMPILED BY	Project manager		
DATE		**REPORT NUMBER**	
FOR PERIOD			
MEETING ATTENDEES			
Other Attendees			
CIRCULATION	Project team		

2. PROJECT DETAILS

POW ID	
PROJECT NAME	

3. OVERALL STATUS

Green: All on target, no major issues
Amber: Several minor issues but a mitigation strategy in place
Red: Major issues

4. ACHIEVEMENTS

Task Performed	**Person Responsible**	**Planned Completion Date**	**Actual Completion Date**

5. ISSUES

Issues	**Action Required**	**Person Responsible**	**Action By Date**

These weekly meetings were a valuable time for the members of the CoP_{PT} to discuss how the product development was progressing. This is also where functional differences were brought to the foreground. CoP_{FS} members on project teams brought their knowledge and expertise in specific areas as well as their own priorities. Some CoP_{FS} members from CoP_{M}, CoP_{S} and CoP_{T} were allocated 50% or more of their time to product development projects while for some of the other departmental communities such as CoP_{O} and CoP_{F} working on product development projects was a small part of their job.

At this stage of the product development process the CoP_{PT} worked on delivering the project concept into a deliverable product. This consisted of three main activities at *OpCo* and included the final product and packaging development (reported in Section 6.4.1), which was the responsibility of the technology (CoP_T) members on the CoP_{PT}. The second activity was the design of packaging artwork which was the responsibility of the marketing (CoP_M) and sales (CoP_S) members on the CoP_{PT} (reported on in Section 6.4.2). The third and final activity was the development and trial of a production plan (reported on in Section 6.4.3), the responsibility of the technology (CoP_T) and operations (CoP_O) members on the CoP_{PT}.

6.4.1 Formulations, packaging and costings

During the design and testing stage I observed the CoP_T members of the CoP_{PT} making product formulation samples, examining packaging options and computing costings. These activities were done to ensure the product met the expected specifications.

Final product formulations were made in the technology laboratory by the members of the CoP_T on the CoP_{PT}. While these formulations were similar to the ones made during the product feasibility stage the level of detail required at this stage was much higher. This is because it was difficult to change the product formulations once the product had been launched as a change in ingredients would affect the nutritional information on the packaging and a change in packaging was expensive to make because of minimum order quantities. As the ingredients affected the nutritional information the packaging was another important part of this activity and was also carried out by members of CoP_T on the CoP_{PT}. This activity also required extensive consultations with packaging suppliers who were often included as a member of the CoP_{PT}.

While product formulations and packaging options were being developed the members of the CoP_T were also involved with determining the cost of the product. The costing took into account the ingredients that would be used in the product formulation, the packaging used, the machine the product would be produced on and how many factory staff were needed to pack the product. The product costings were an important part of the product development stage as this information was critical for decision-making for many products. While the initial costing activity took place at the product feasibility stage of the product development process the product costing activity done at this stage was more detailed. It was combined with forecast sales data to show the estimated contribution after marketing and estimated earnings before interest and tax for the product. The product costings were used actively by the CoP_{PT} to compare possible product formulations and packaging solutions and communicated to members of the CoP_{EM}. Also during this activity the CoP_M or CoP_S member of the CoP_{PT} would collect market research to better understand the product formulations and packaging options. These would be reported to members of the CoP_{FM} and CoP_{EM} in the form of market research documents.

The sections below outline product formulation, packaging and costing issues for different types of product innovation during the design and testing stage.

6.4.1.1 Incremental projects

As incremental projects were aimed at markets that were known to the firm using technology that all the communities of practice were familiar with, many of the interactions between the members of the CoP_{PT} and the CoP_{FM} were about the numbers. These numbers included the cost of the ingredients and packaging, the final sales price and,

of key importance for the firm, a forecast of the gross margin and the earnings before interest and tax the product would deliver for the firm.

During the formulation, packaging and costing activities members of the CoP_{PT} would talk about the effect that the cost of a particular ingredient or packaging option would have on the total product costs with members of the CoP_{FM}. These project discussions were framed in terms of the effect that product costs have on the firm's gross margin.

During these projects models, in the form of product samples, were made but were not used extensively when communicating outside the CoP_{PT}. While documents were used during project meetings involving the CoP_{PT} they were also not often used during interactions with the members of the CoP_{FM} as these communities of practice were familiar with the current product range and these incremental projects were very close to these products. Also, since documents had been used during the product feasibility stage to communicate with the CoP_{FM} they were not seen as necessary during the design and testing stage.

6.4.1.2 Semi-radical projects

During semi-radical projects the PMO project progress report (Figure 42, on page 190) was usually used during interactions between the members of the CoP_{PT} and members of the CoP_{FMPD}. The CoP_{PT} leader updated the PMO progress report every week after consulting with the other members of the CoP_{PT}. A brief example of a product formulation-/packaging/costing discussion using a PMO progress report is given below.

CoP_{PT} leader "*Some sample [packaging] has been made. Two should arrive today. [The supplier] was to have made the [packaging] tool today but that has been put on hold. We*

may need to do a redesign when we have tested how the [packaging] can be stacked. There needs to be more research here as [X] is a problem. Can we do [Y] on all our products? *What will be the cost*? *[The CoP_T member] is working on this. All these are interrelated. I will present back on this next week.*"

CoP_{FM} "*Can we take these decisions off the critical path and do some more research on this later*?"

CoP_{FM} "*We need to understand what pressures are going to be placed on the [packaging] when stacked against each other*."

CoP_{PT} leader "*Costing for this is being done by [the CoP_F member]. I need someone in marketing to do the descriptors. I also need [an ingredient list] by [this date]*."

Usually one of the issues in the progress report had to do with costings so numbers were sometimes talked about, but the numbers did not play the same role as they did for incremental projects. Also while models in the form of product formulations and packaging were often mentioned they were seldom used during interactions. For these projects the documents were the main boundary objects used.

6.4.1.3 Radical projects

For radical projects the PMO project report document and product and packaging models were both used extensively. This does not mean that numbers were not used at all, but they did not seem to be used as much as for other types of projects. During these projects the CoP_{PT} leader would write-up a PMO project report weekly after talking with all the members of the CoP_{PT}. These PMO project reports were then presented to the CoP_{EM} during their weekly meetings to update project progress. During the design and testing of radical products the product and packaging models were also used when CoP_{PT} interacted with members of the CoP_{FM} and CoP_{EM}. During the design and testing stage, members of the CoP_{FM} and CoP_{EM} would often visit the technology laboratory to sample the product and discuss project issues.

6.4.1.4 Commentary on the formulation, packaging and costing activities

During the formulation, packaging and costing activities the members of the CoP_{PT} interacted with members of the CoP_{FM} and CoP_{EM} using numbers, documents and models. For incremental projects communities of practice used mainly numbers while for semi-radical projects they used numbers and documents and finally for radical projects they used numbers, documents and models.

When members of the CoP_{FM} and CoP_{EM} interacted with the members of the CoP_{PT} during these activities the role of management control seemed to be focused on reducing technical and marketing uncertainty associated with product formulation options, packaging design options and product costings. For incremental projects the CoP_{PT} collected and analysed information in the form of ingredient and packaging cost lists, project updates and project samples and used these boundary objects during interactions with the CoP_{FM}. For semi-radical projects members of the CoP_{PT} collected and analysed information and used the PMO document during communications with the CoP_{FM} and CoP_{EM}. During radical projects the CoP_{PT} would use the PMO document when communicating with the CoP_{EM}.

As the members of the CoP_{FM} and CoP_{EM} interacted with the members of the CoP_{PT} the style of management control changed for each product type. For incremental projects the style of management control was to check cost expectations diagnostically as the focus was on well-understood cost expectations. During radical projects communities of practice engaged more interactively using models as they met face-to-face to learn about the marketing and technical issues they were facing and debated action plans about the best way forward. Finally as semi-radical projects were a mix of both incremental and radical the style included a mix of both diagnostic checks and engaging interactively.

6.4.2 Packaging artwork and product promotion activities

At the same time that members of the CoP_T worked on designing and testing the product and packaging and computing the costings, the members of the CoP_M from the CoP_{PT} designed the artwork for the packaging and worked with advertising companies on the promotional material. When the member of the CoP_M on the CoP_{PT} received artwork templates and promotion samples from the advertising agency they met with members of the CoP_{FM} and CoP_{EM} to get their feedback on the selection of the best option, as getting the approval of members of the CoP_{FM} and CoP_{EM} was necessary to get approval to proceed with one of the options. The input of managers was important because the promotional material and the artwork on the product's packaging were the main ways for *OpCo* to accomplish their brand strategy. The firm believed that the promotional material and packaging artwork influenced how consumers viewed the brand in the market and thus it was seen as an important strategic tool.

The first part of the activity was the design of a creative brief. This was written up by the member of the CoP_M on the CoP_{PT} and sent to an advertising agency to develop. The advertising agency would then develop artwork templates and promotion samples for the firm to choose from.

The following sections outline the differences between promotion and artwork for each of the project types at *OpCo*.

6.4.2.1 Incremental projects

The packaging artwork and promotion activity for incremental projects at *OpCo* was relatively straightforward because the artwork and promotional material for these projects

had to be consistent with current products. Thus, the main focus for these projects was on consistency with the current offerings and the cost (numbers) of the packaging artwork and promotions.

While this activity was usually carried out by the CoP_M member of the CoP_{PT} all final packaging artwork and promotional material decisions were made by members of the CoP_{FM} in consultation with members of the CoP_{EM}. During this activity the CoP_M member of the CoP_{PT} sent packaging artwork and promotional models supplied by an advertising agency to the members of the CoP_{FM}. When the members of the CoP_{FM} were satisfied with the results they would send the packaging artwork and promotion models to members of the CoP_{EM} for final approval.

6.4.2.2 Semi-radical projects

For semi-radical projects the packaging artwork and promotion activity was more complicated with members of the CoP_{FM} and CoP_{EM} playing a larger role than for incremental projects. This was because these products were new in some way to the market and thus required a new concept. These breadth of these concepts was limited though as they had to fit in with other products offered by the firm in that category. Thus the base of the packaging artwork and promotional material was the current products in the category. But, unlike the incremental projects, there was a greater range of options to be considered.

During one semi-radical project in particular I observed the CoP_{PT} leader (who was a member of the CoP_{FM}) meet with members of the CoP_{EM} weekly to discuss the packaging artwork and promotional material being proposed and to get approval at every stage of the

process. At these meetings the CoP_{PT} leader used the new packaging artwork and promotion models as well as the packaging and promotion costings when discussing these projects with members of the CoP_{EM}.

6.4.2.3 Radical projects

The packaging artwork and promotional activity was the most complex for radical projects. This was because these projects required totally new concepts to be developed from scratch. As these products were not going to be launched in *OpCo's* current market the CoP_{PT} did not have any constraints about what the packaging artwork or promotional material should look like. Thus the packaging artwork and promotion material was seen as critical for consumers to understand the new product.

At the start of the development stage of radical product innovations I observed a large number of packaging artwork and promotion models being produced by members of the CoP_{PT} and discussed with members of the CoP_{EM}. This is because it was important for the CoP_{PT} to examine many different packaging artwork and promotion options. These models were then used to interact extensively with the members of the CoP_{FM} and CoP_{EM} to discuss the options and to decide which ones had the most potential.

6.4.2.4 Commentary on the packaging artwork and product promotion activities

The packaging artwork that was produced during this activity was used to communicate how the CoP_{PT} saw the product positioning to members of the CoP_{FM} and CoP_{EM}. Sometimes these packaging artwork models were combined with costings (numbers) so that members of the CoP_{FM} and CoP_{EM} could see what the artwork would look like and to understand how the cost affected the financial performance of the product.

The packaging artwork was also a part of the PMO project report (Figure 42 on page 190 above) and was updated at weekly project meetings. While packaging artwork and promotion models were used in all types of projects they were used more extensively in semi-radical and radical projects. The development of packaging artwork and promotion material was critical because of the time needed to develop them. This made packaging artwork and promotion material a central part of the critical path for most projects and involved reducing market uncertainty.

The style of management control was different for each product type. For incremental projects management controls were used to check cost expectations diagnostically as the focus was on well-understood product artwork and cost expectations. For semi-radical projects there was a mix of both diagnostic checks and engaging interactively. This is because these projects had to fit into a current product category and so the product artwork and promotion material had to fit with other products in the category. Finally, during radical projects communities of practice engaged interactively using models as they met face-to-face to learn about the market issues they were facing and debated action plans about the best product artwork and promotion material.

6.4.3 Production plan and trials

Along with the product formulation/packaging/costing and the packaging artwork/ promotion activities the members of the CoP_{PT} were also in charge of carrying out production trials and developing a production plan to manufacture the product. To do this the CoP_T and CoP_O members of the CoP_{PT} examined various machines to determine which one would be the most suitable. The CoP_{PT} also examined different locations where the firm had manufacturing operations and took into consideration capacity, line speed, and

distribution costs as part of their calculations. This is because production cost was an important part of a product's total cost. As with the other activities at the development stage members of the CoP_{FM} and CoP_{EM} were consulted to varying degrees while the activity was being carried out.

After a production plan had been agreed to, through consultation with members of the CoP_{FM} and CoP_{EM}, most products went through one or more production trials. This was to make sure that everything in the factory actually worked the way it was expected to. The production trial was run by the CoP_{T} member on the $CoP_{PT.}$ The CoP_{O} member on the CoP_{PT} and other factory staff assisted with the production trial. One CoP_{PT} leader stated that "*While the whole manufacturing process may look fine on paper it is not until you actually do it that you realise that theory does not always work in practice*." After production trials some projects would also be tested in distribution and market trials.

The following sections report on the production plan and trial activity in relation to incremental, semi-radical and radical product innovations at *OpCo*.

6.4.3.1 Incremental projects

For incremental projects the production plan was usually straightforward as the firm already produced products that were similar to the new product. Also for incremental projects a production trial was not usually seen as critical as they had the production numbers from similar products. The CoP_{PT} would use the numbers from these other products when consulting with the members of the CoP_{FM} and CoP_{EM} to see if they thought a production trial was necessary. To make this decision the members of the CoP_{PT} would write a production report outlining the important aspects of the production for CoP_{FM} and

CoP_{EM}. This would include an overview of the machine they proposed to use as well as the line speed (numbers) and other operational numbers. When the members of the CoP_{FM} and CoP_{EM} were satisfied with the production plan they would authorise the project team to prepare a launch proposal.

6.4.3.2 Semi-radical projects

In the case of semi-radical projects production planning and results of trials were more critical. The CoP_T and CoP_O members of the CoP_{PT} would first prepare a document outlining some possible production plans. The CoP_{PT} would then discuss the alternatives with members of the CoP_{FM} and CoP_{EM}. Once a production plan had been agreed, the CoP_T would organise a production trial. Once a trial had been run the CoP_T member of the CoP_{PT} would report the trial results to members of the CoP_{FM} and CoP_{EM}. These managers would discuss the trial results with the members of the CoP_{PT} and decide if another trial was needed. If the members of the CoP_{FM} and CoP_{EM} did not think that the trial had answered all their questions then they would ask the CoP_{PT} to organise another trial to answer specific issues. If the members of the CoP_{FM} and CoP_{EM} were happy with the trial results they would either authorise the CoP_{PT} to prepare a launch proposal or ask the CoP_{PT} to organise a distribution trial.

A distribution trial was usually required to test the durability of a new product during transportation. When the members of the CoP_{FM} and CoP_{EM} were satisfied with the production plan, production trial and distribution trial they would authorise the project team to prepare a launch proposal.

6.4.3.3 Radical projects

For radical projects the production plan and trials took on a greater significance as the CoP_{PT} needed to prove that the product could be manufactured to the required specifications. Production planning was thus far more interactive during radical projects with members of the CoP_{PT} working closely with members of the CoP_{FM} and CoP_{EM} to develop possible production plans using numbers, documents and models. When a production plan had been agreed the CoP_{PT} organised production trials. These production trials often involved new manufacturing equipment. For radical projects members of the CoP_{FM} and CoP_{EM} would often attend the trial to see first-hand the products.

For radical products which involved new packaging material the CoP_{PT} would consult with members of the CoP_{FM} and CoP_{EM} to see if it was necessary to carry out a distribution trial following the production trial. This was done to gather information on the stability of the packaging and the product during transportation.

Finally, radical projects would undergo a market trial to see how the concept worked under actual market conditions. The aim of these trials was to gather information to reduce uncertainty and to confirm that the product concept was robust enough to launch onto the market. When the members of the CoP_{FM} and CoP_{EM} were satisfied with the production plan, production trial, distribution trial and marketing trial they would authorise the project team to prepare a launch proposal.

6.4.3.4 Commentary on the production plan and trial activities

The aim of the production plan and trials was to reduce the uncertainty surrounding the manufacturability of the new product and when necessary, to trial the product's

distribution and saleability in the market. While members of the CoP_{PT} organised the production plan and trials the members of the CoP_{FM} and CoP_{EM} actively checked the plans and results to make sure that they met expectations.

For incremental projects the managers were interested in the numbers such as manufacturing cost. This is because production plans for incremental projects were just a confirmation of expectations. Thus, numbers were sufficient during the development of these products. For semi-radical projects they focused on wider issues of project planning. This is because for semi-radical projects the production plan and product trials brought new issues that the communities of practice had to find solutions to. Thus, communities of practice used documents and models during the development of these products. Finally, for radical projects communities of practice focused on the manufacturability of the product. These production plans and product trials were far more extensive for radical projects. This is because the firm had to understand both new technology and a new market. Thus, during the development of radical products communities of practice used numbers, documents and models.

During the interactions between the CoP_{PT}, CoP_{FM} and the CoP_{EM} the focus of all the communities of practice was on reducing the technical manufacturing and distribution uncertainty and for radical projects to reduce market uncertainty through the use of market trials.

The style of management control was different for each product type. For incremental projects management controls were used to check cost expectations diagnostically as the focus was on well-understood production expectations. For semi-radical projects there was

a mix of both diagnostic checks and engaging interactively. This is because these projects had to use slightly modified current machines which required more planning. Finally during radical projects communities of practice engaged interactively using numbers, documents and models as they met face-to-face to learn about the production issues they were facing and debated action plans about the best production options.

6.4.4 Summary and commentary on the design and testing stage

In summary the three activities that took place at *OpCo* during the design and testing stage consisted of product formulation/packaging/costing, packaging artwork/product promotion and production plan/trials. These activities are summarised below in Table 8 in relation to the communities of practice involved, the innovation type, the boundary objects used, the role of management control and the style of management control.

Table 8: Summary of Stage 4 - Design and Testing

PD Activities	Communities Involved*	Innovation Types and Boundary Objects	Control Role*	Control Style*
Formulations packaging and costings	CoP_{PT} CoP_{FM} CoP_{EM}	Incremental - Numbers Semi-radical - Documents/Models Radical - Models/Documents	RU RU RU	DC DC & IC IC
Packaging artwork and product promotion	CoP_{PT} CoP_{FM} CoP_{EM}	Incremental - Numbers/Models Semi-radical - Numbers/Models Radical - Models	RU RU RU	DC DC & IC IC
Production plan/trials	CoP_{PT} CoP_{FM} CoP_{EM}	Incremental - Numbers/Documents Semi-radical - Documents Radical - Models/Documents/Numbers	RU RU RU	DC DC & IC IC

*(CoP_{EM}: Executive manager community of practice, CoP_{FM}: Functional manager community of practice, CoP_{FS}: Functional specialist community of practice, CoP_{PT}: Project team community of practice, RU: Reduce uncertainty, IC: Interactive control, DC: Diagnostic control)

These activities were carried out by the CoP_{PT} who interacted with members of the CoP_{FM} and CoP_{EM} when necessary. Communities of practice used numbers as boundary objects to communicate during incremental projects. This is because these projects had few elements of novelty and thus numbers were able to be used to understand the important aspects of the formulations, packaging, artwork and promotion, and production.

Communities of practice used documents to communicate during semi-radical projects. This was because these projects had more novel elements. Thus documents were necessary for them to understand different options related to these projects.

Finally communities of practice used boundary objects in the form of numbers, documents and models to communicate during radical projects. These were all necessary as these projects had many elements of novelty. Because of the level of novelty it was difficult for communities of practice to talk about the project and thus they needed different boundary objects to discuss and debate and learn about the formulations, artwork and promotions, and production aspects of these projects.

In summary, as the elements of novelty increased the boundary objects, the communities of practice used changed. For incremental products, numbers were sufficient to communicate during the initial formulations, packaging and costings but some documents and models were used during the packaging artwork, product promotion and production plan/trial activities. For semi-radical projects documents and models were used more while for radical projects the use of models increased but at times documents were also used.

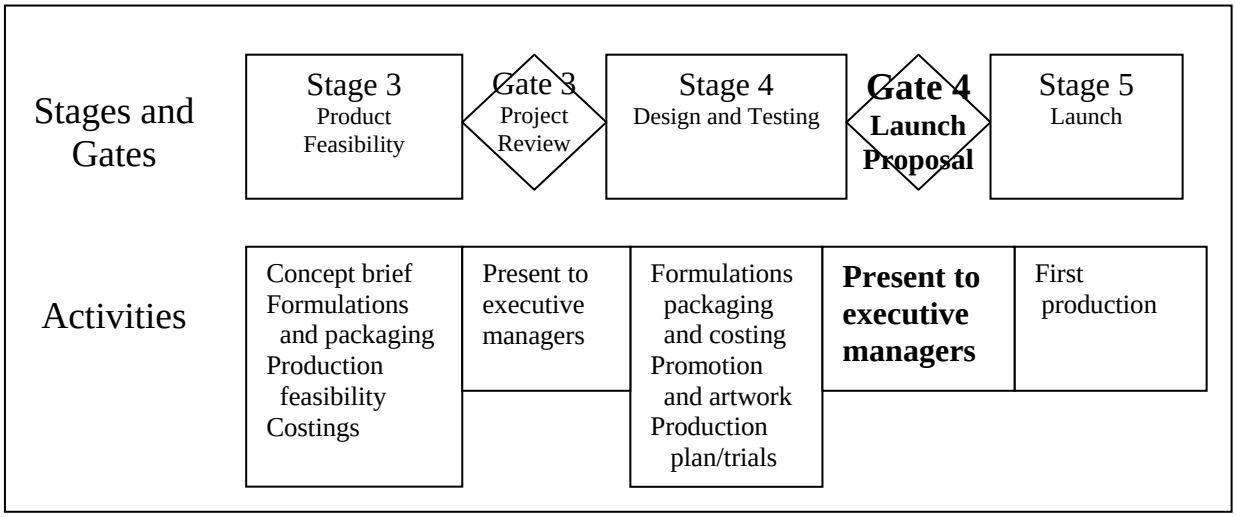
The role of management controls during this stage was to reduce market and technical uncertainty. To do this, communities of practice used numbers, documents and models. For incremental projects which had only a few novel elements the communities of practice used numbers and occasionally documents. During semi-radical projects the communities of practice used mainly documents. While for radical projects where there were a significant number of novel elements the communities of practice used models as well as numbers and documents.

The style in which management control was used was different for each product type during this stage. For incremental projects management controls were used to check formulation, artwork and production expectations diagnostically as the focus was on well-understood expectations in current markets. For semi-radical projects there was a mix of both diagnostic checks and engaging interactively. Diagnostic checks were important for these projects as they were to be launched into existing markets and thus they needed to be consistent with the current product range. Each of these projects, though, had some novel elements. To better understand these elements communities of practice engaged interactively. Finally during radical projects communities of practice engaged interactively using models as well as numbers and documents as they met face-to-face to learn about the market, technology and production issues they were facing and debated action plans about the best way forward.

6.5 Gate 4: Launch proposal

When the CoP_{PT} had proved to members of the CoP_{FM} and CoP_{EM} that the new product was robust the CoP_{PT} sought permission to do a launch proposal (Gate 4 in Figure 43).

Figure 43: The Product Development Process at *OpCo*: Gate 4 - Launch Proposal



This involved the CoP_{PT} working with members of the CoP_{FM} to write up a launch proposal document (see Figure 44 below) which was presented to the CoP_{EM} by a member of the CoP_{FM}. While preparing the launch proposal members of the CoP_{PT} would meet with members of the CoP_{FM} to talk about the proposal. While in the technology lab one day I overhead a member of the CoP_{FM} talking to members of a CoP_{PT} about a launch proposal they were preparing. The member of the CoP_{FM} said "*I am doing a presentation for the launch proposal tomorrow. I will go see [CoP_{EM} members] before the meeting to get their buy-in.*" This shows that before presenting to the whole CoP_{EM} members of the CoP_{FM} would check with key members of the CoP_{EM} to make sure there was enough support for the project. Members of the CoP_{FM} often commented that without the support of some key members of the CoP_{EM} they would not present a launch proposal.

Figure 44: Launch Proposal Document

PROJECT NAME:
PROJECT DESCRIPTION:
BACKGROUND AND RATIONALE TO LAUNCH:
EXPECTED LAUNCH DATE:
TARGET MARKET:
ATTACHMENTS

Production sign off and feasibility
Finance draft costings
Recommended selling price
Forecast volume
Cashflow
Estimated product lifecycle

SIGNED

Project sponsor
Technology manager
Marketing manager

APPROVED

GM Marketing
GM Technology
GM Sales
GM Operations
GM Human resources
CFO
CEO

The launch proposal document included the project name, a description of the project, background and rationale to launch, target market and expected launch date. This document also had some financial numbers such as the recommended selling price, forecast volumes, a three year cashflow and estimated project lifecycle. Before being presented to the CoP_{EM} it had to be signed by the project sponsor and the technology and marketing members of the $CoP_{FM.}$

At this gate the CoP_{EM} was focused on how the new product helped the firm achieve its financial and strategic goals. Members of the CoP_{EM} asked the launch proposal presenter, who was always a member of the CoP_{FM}, how the product would fit into the current

product range and what value it would add to the firm. As all the launch proposal presentations for each of the different project types were similar I will only present one example in the following section.

6.5.1 Launch proposal presentation

This section presents an example of a launch proposal presentation. These presentations were held in the boardroom at *OpCo* and included the presenter who was a member of the CoP_{FM} and six members of the CoP_{EM}. After all the members of the CoP_{EM} were seated a member of the CoP_{EM} stated the meeting.

CoP_{EM} "*[CoP_{FM}] would still like to launch this product even though it will not make much money for the firm. This is because [*CoP_{FM} *] main performance measure is market share and this product is important to get market share*."
CoP_{FM} "*At the moment our segment plan calls for new products in [month] and [month]. This product is needed to keep up with the competition*."

> (The presenter showed the effect that launching the product would have on the *OpCo's* other products. The presenter emphasised how this new product would not cannibalise *OpCo's* existing products and as such would be more likely to hurt the competition. The presenter then showed some numbers including the product cost, contribution before marketing and market share (and share cannibalisation). The risk assessment showed that project risk was low.)
>
> (At the end of the presentation there was a discussion about the launch proposal.)

CoP_{EM} "*The question for the group is do we go for share or is it busy fools for no money*."
CoP_{EM} "*[CoP_{FM}] needs [X]% share for her key performance indicator. I think we need to protect our market share with minimal resource. Do we give this the final go-ahead*?"
CoP_{EM} "*Why do we push one of our [major] brands for very little money*?"
CoP_{EM} "*We still want to hit the competition and without this product we will not look to be very innovative*."
CoP_{EM} "*[Competitors products are] not really new in themselves as they have been around for a while*."
CoP_{EM} "*Why are people buying*?"
CoP_{EM} "*What makes me nervous is that if the competition does really well and we have no reply. Our options are to spend some money here or put most of our money behind the [month] product launch*."
CoP_{EM} "*[The last product launch] was a huge success but it did not add much to the bottom line*."

(This was because it took share away from other *OpCo* products.)

CoP_{EM} "*We have some real issues about launching too many products and that was an issue last year. We cannot add too many products willy nilly into the market*."
CoP_{EM} "*Next year we are deleting seven products and will launch only three products. We are also going to promote our key products more*."
CoP_{EM} "*We really need to cut down on our projects*."
CoP_{EM} "*We usually only look at one side of the equation [market share]. We really need to concentrate on products that make money*."

(The conversation then came back to the launch decision.)

CoP_{EM} "*What if this product is a big hit*?"
CoP_{EM} "*We should launch this product. But we need to change our thinking in future and only launch products under our [major] brands that will make money*."

At the end of the discussion the members of the CoP_{EM} took a vote to decide whether to proceed to launch. The vote was 4 to 3 in favour and the presenter was told to prepare the product for launch.

6.5.2 Summary and commentary on the launch proposal gate

Table 9 summarises the activities that took place at the launch proposal gate in relation to the communities of practice involved, the innovation type, the boundary objects, the role of management control and the style of management control.

Table 9: Summary of Gate 4 - Launch Proposal

Product Development Activities	Communities Involved*	Innovation Types and Boundary Objects	Control Role*	Control Style*
Presentations to executive managers	CoP_{FM} CoP_{EM}	Incremental - Numbers/Documents Semi-radical - Numbers/Documents Radical - Numbers/Documents	PGC PGC	DC DC DC

*(CoP_{EM}: Executive manager community of practice, CoP_{FMPD}: Functional manager product development community of practice, PGC: Promote goal congruence, IC: Interactive control, DC: Diagnostic control)

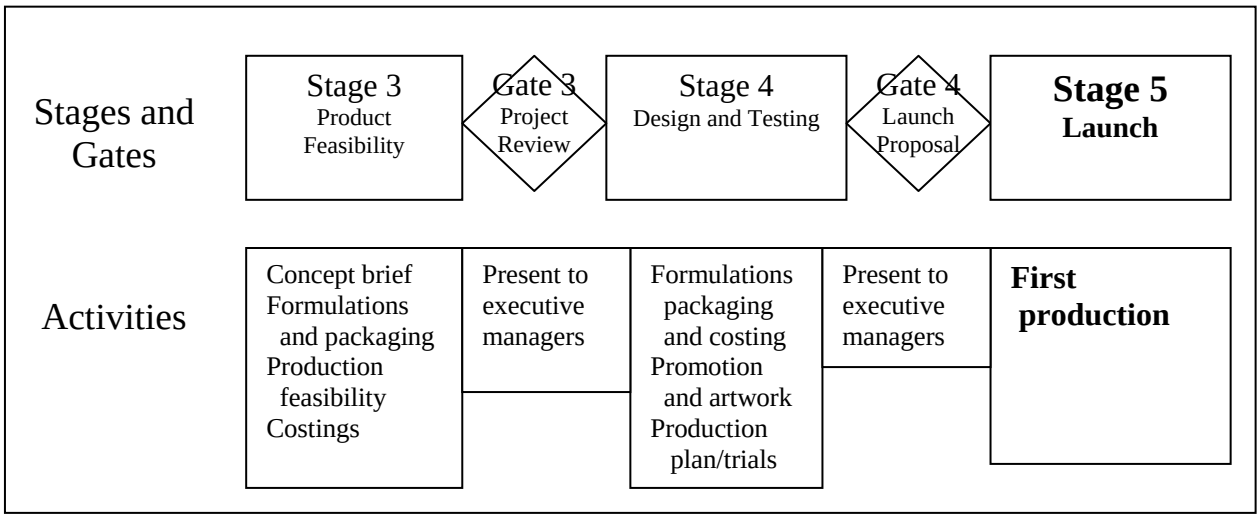
At all the launch proposal presentations that I observed the communities of practice used numbers such as market share, contribution after marketing, profit and documents, the presentation Power Point slides and market research reports with the aim of promoting goal congruence. One major difference between the CoP_{FM} and the CoP_{EM} that came to the surface during the launch proposal presentation was the different performance measures that they were aiming to achieve. While the CoP_{FM} was evaluated on market share which was a strategic goal of the firm, the CoP_{EM} was aiming to increase profits, which was a financial goal.

The communities of practice involved in this stage were the CoP_{FM} and CoP_{EM}. These communities used numbers and documents to communicate. By the time that projects reached this gate there were few differences between the different project types. During this activity the focus for all projects was to promote goal congruence by making sure that they would help the organisation achieve its strategic and financial goals. The management control style used during this stage was diagnostic as the communities of practice focused on the market share and profitability.

6.6 Stage 5: Launch

Once a project had passed through the launch proposal in Gate 4 the CoP_{PT} prepared the product for launch onto the market (see Figure 45).

Figure 45: The Product Development Process at *OpCo*: Stage 5 - Launch



The CoP_{PT} was responsible for the project all the way to the end of the first production run.[40] For export projects the project team would be responsible for projects all the way to the shipment of the product to the customer. After the production and shipment of new products members of the CoP_T, CoP_M and CoP_S would follow up on issues related to the product but these activities were outside the scope of this study.

6.6.1 First production

After the CoP_{EM} approved the launch proposal the CoP_{PT} had to organise the first production run for the new product. To do this the CoP_{PT} worked closely with members of

[40] I only observed projects to the end of first production although I did receive the sales forecasts and actual sales updates from the sales department following the launch of new products.

the CoP_O. Usually a member of the CoP_{PT} was present in the factory during the first production run to make sure that there were no problems. If a problem did occur members of the CoP_{PT} consulted with members of the CoP_{FMPD} to see what they should do. While the first production run for most new products usually went smoothly there was always a chance for things to go wrong at this stage of the process. This section reports on two examples of first production runs where issues came to the surface.

6.6.1.1 First production: example one

While I was observing a first production run for an incremental product with a member of the CoP_{PT} we noticed that the product did not look right. The CoP_{PT} member was not sure what to do and decided to call a member of the CoP_{FMPD} to come to the factory to have a look at the product as it came off the production line. They agreed that the product looked different than expected so they took some product sample models back to the technology laboratory to analyse. The CoP_{FMPD} member was not sure if the customer would accept the product so decided to take some digital photos of the product and email them to the customer to see what they thought. Even though the customer agreed to accept the product the CoP_{PT} and the CoP_{FMPD} continued to examine the product and the manufacturing process with other members of the CoP_{PT} to find out what had caused the problem and how it could be overcome for future production runs. As the communities of practice knew the production process well they could use numbers to talk about the issues. So while a product sample model was used to determine there was a problem the communities of practice could then use numbers such as machine settings, line speed and temperature to discuss why the problem occurred.

6.6.1.2 First production: example two

On another occasion there was a problem with a new semi-radical product which was discovered after the first production run. When the problem was discovered the CoP_{PT} carried out some analysis on the new product. The CoP_{PT} tested one box from each of the pallets and found problems with the products sampled in each box. The results were written into a document which was taken to a meeting with members of the CoP_{FMPD} and CoP_{EM}. At the meeting the members of the CoP_{FMPD} and CoP_{EM} used the production plan document and trial documentation to examine what might have caused the problem. The packaging was also checked to see if it had an effect on the product. One member of the CoP_{EM} commented that "*This is what happens when you take shortcuts and do not do enough trials*." Later on I talked to a member of the CoP_{PT} who said "*There was no expectation that there would be a problem as we have made [this type of] product before without any problems*." After examining the test results the CoP_{EM} decided that the product needed more trials. After some more production and distribution trials the problems were solved and the new product was successful launched.

6.6.2 Summary and commentary on the launch stage

In summary (see Table 10) the communities of practice involved in the launch stage consisted of the CoP_{PT}, CoP_{FM}, and CoP_{EM}. For successful first production runs the results were communicated to members of the CoP_{FM} through post-production documents. When problems came up models were first used for all project types, but to solve these problems communities of practice used numbers to reduce technical uncertainty. The numbers in example one related to the machine settings, line speed and temperature which were important variables in the production process, while the in example two some documents were also used.

Table 10: Summary of Stage 5 - Launch

Product Development Activities	Communities Involved*	Innovation Types and Boundary Objects	Control Role*	Control Style*
First production	CoP_{PT} CoP_{FMPD} CoP_{EM}	Incremental - Models/Documents/Numbers Semi-radical - Models/Documents/Numbers Radical - Models/Documents/Numbers	RU RU RU	DC DC DC

*(CoP_{PT}: Project team community of practice, CoP_{FMPD}: Functional manager product development community of practice, CoP_{EM}: Executive manager community of practice, RU: Reduce uncertainty, DC: Diagnostic control)

At the launch stage I observed that numbers, documents and models were used by communities of practice in practice. By the time that projects reached this stage there were few differences between the various project types. The numbers the communities of practice used were operational numbers such as line speed, temperature and machine setting; documents, such as the production plan and trial reports; and models such as product samples with the aim of reducing uncertainty about the issues that had come up during the first production run. The management control style used during this stage was diagnostic as the communities of practice focused on making sure that products were produced according to the specifications.

6.7 Conclusion

This chapter has reported on the activities that took place at *OpCo* during the stages and gates that made up the second half of the product development process. It also commented on how and why boundary objects were used for different types of product innovations and

categorised the way in which communities of practice used management control in relation its role and style.

At the start of each section a report on the details of the activity and how it took place in practice was given. This was followed by a commentary on how and why boundary objects were used by communities of practice for different product innovation types and the role and style of management control. Finally a summary and commentary of each activity was given which showed the interactions that took place between communities of practice during the activity, the boundary objects used for each product innovation type, and the role and style of management control.

This section concludes with an analysis of the findings in relation to the role of management control (Section 6.7.1), the style of management control (Section 6.7.2) and how communities of practice accomplished management control in practice (Section 6.7.3).

6.7.1 The role of management control during the second half of the product development process

During the second half of the product development process the role of management control seemed to change between the stages and gates. This is consistent with what happened in the first half of the process where the focus was on uncertainty reduction during the stages of the process the promotion of goal congruence was a feature of the gates. As in the first half of the process this could be related to the level in the hierarchy of the communities of practice who took part in the activities during the stages and gates.

As can be seen from the summary information reported in each section the communities of practice at the stages were mainly from the CoP_{FM} and CoP_{FS} while the communities of practice at the gates were members of the CoP_{FM} and CoP_{EM}. The members of the CoP_{EM} promoted goal congruence in relation the market share, revenue, gross margin and profit during the gates. On the other hand, reducing uncertainty seemed to be the focus of control when members of the CoP_{FM} and CoP_{FS} were present at an activity. This is because the CoP_{FM} was focused on implementing the strategy and managing the product development process. The CoP_{FM} had to communicate the firm's strategy and connect it to the practices of the CoP_{FS} through their understanding of the market and technology. Finally the CoP_{FS} concentrated on the issues that would affect their function and the kind of work that would be required while undertaking a product development project.

6.7.2 The style of management control during the second half of the product development process

The style in which communities of practice used management controls changed from the first half to the second half of the product development process. While the style of management control was mainly interactive during the first half of the process it changed during the second half in relation to the type of product development project. This can be seen at product feasibility (Stage 3) and Design and testing (Stage 4) where a diagnostic style of management control was used for incremental projects, diagnostic and interactive styles were used for semi-radical projects and interactive controls were used for radical projects.

At project review (Gate 3) the style of control seemed to revert back to an interactive style for all the project types. A reason for this could be that a financial evaluation projects had

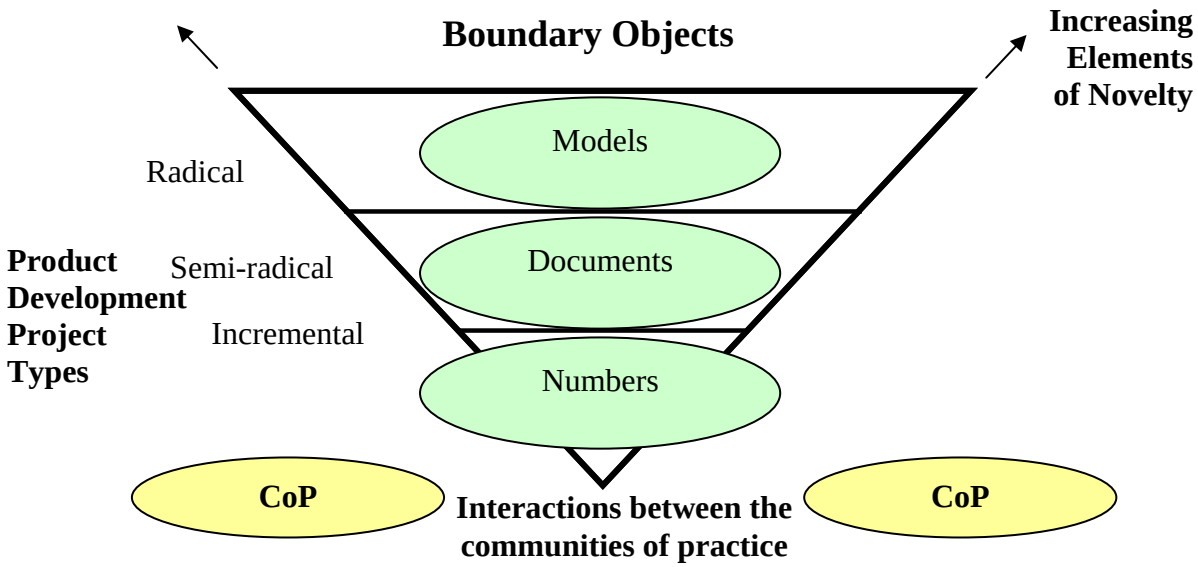
already carried out at project screen (Gate 2) and so communities of practice concentrated on learning more about the market and technology by discussing and debating how to progress products and challenged assumptions about the best way forward.

Diagnostic control was the feature of the launch proposal (Gate 4) and product launch (Stage 5). By the time that projects reached this stage they were all evaluated in a similar way. These diagnostic checks were important for all project types as the firm did not want to launch new products that were not consistent with its strategic and financial goals.

6.7.3 How communities of practice used boundary objects during the second half of the product development process

During the second half of the product development process at *OpCo* I observed communities of practice using different boundary objects depending on the level of product innovation they had to deal with (see Figure 46).

Figure 46: Boundary Objects and Project Types



Developed from Carlile's 3-T Framework (2002)

While the figure shows that communities of practice should be able to interact during incremental projects using numbers, semi-radical projects using documents and radical project using models that is not exactly what I found during the second half of the product development process at *OpCo*. I found that for incremental project communities of practice do mainly use numbers, although occasionally documents and models were needed. As such, numbers are able to deal with the low levels of novelty and enables communities of practice to communicate. As for semi-radical projects, communities of practice did use documents extensively, as expected, but occasionally used numbers and model. This could be explained by these projects being half incremental and half radical (see Figure 1, on page 9), thus, the use of numbers and models should be expected.

While communities of practice used models exclusively during the first half of the product development process for radical projects this changed during the second half as communities of practice started to use more documents and even numbers. An explanation for this could be that as these projects progressed, the level of novelty decreased making it easier for the communities of practice to interact using documents and numbers.

6.7.4 Differences between the communities of practice during the second half of the product development process

Differences between communities of practice related to the issues they had to face in their daily work. For members of the CoP_{EM} this revolved around issues of strategic and financial goals. During the second half of the product develop process the CoP_{EM} members tried to make sure that they only launched new products that would help the firm reach these strategic and financial goals.

Members of the CoP_{FS} on the other hand, were involved with more operational issues on a daily basis. During the product feasibility, development and launch stages members of the CoP_{FS} dealt with product formulation, packaging, production, branding, advertising, promotion, supplier, and customer-related issues.

Members of the CoP_{FM} had to interact with the CoP_{EM} regarding the both strategic and financial goals of *OpCo* as well as with the CoP_{FS} concerning the day-to-day activities of the firm. They played a key role in communicating the outcomes of the activities which the CoP_{FS} carried out and communicating the decisions of the CoP_{EM} members to the CoP_{FS} members.

Chapter 7: Summary and Conclusion

7.1 Introduction

The aim of this thesis is to provide empirical insight into the use of management controls during product development through an understanding of the creation and use of boundary objects. The thesis reports and comments on a nine-month longitudinal field study of *OpCo*, a subsidiary of a multinational Australasian food company (AusFood) investigating the following two research questions set out in Chapters 1, 2, and 3.

1) How do communities of practice use management controls during product development?
    a. What are the role(s) of management control during product development?
    b. Which management control styles are used during product development?

2) How do communities of practice accomplish management control through the use of boundary objects during product development?

The focus of the report on practice in Chapters 5 and 6 was on the boundary objects (numbers, documents and models) communities of practice used to accomplish management control and the role and style in which management controls were used in relation to different types of product innovation.

This thesis concludes by discussing the finding related to how communities of practice accomplish management control though the use of boundary objects for each of the three

product innovation types (Section 7.2). Next, Section 7.3 discusses the finding on the role of management controls at *OpCo* and compares them with the findings of Davila (2000). The next three sections discuss the findings in relation to each of the hierarchal communities of practice; Section 7.4 on the executive manager community of practice, Section 7.5 on the functional specialist community of practice and Section 7.6 on the functional manager community of practice. Section 7.7 then discusses the findings on the style (Simons, 1995a, 1995b) in which management controls were used at *OpCo* and compares them with the findings of Bisbe and Otley (2004)(2004) and Bonner et al. (2002). The chapter concludes (Section 7.8) by outlining the contributions the thesis makes to management control research, sets out limitations and suggests areas for future research.

7.2 Boundary objects

Research question 2 is concerned with how communities of practice accomplish management control through the use of boundary objects during product development for different types of projects. This section examines the boundary objects used by communities of practice during the different stages and gates and how they were used to promote goal congruence or reduce uncertainty.

7.2.1 The use of numbers

The report on practice in this thesis shows how communities of practice used numbers during the product development process to accomplish management control (i.e. to promote goal congruence or reduce uncertainty). These boundary objects were used by communities of practice at times when there were only a few elements of novelty. Communities of practice started to use numbers to reduce uncertainty during project

planning (Stage 2) for incremental and (incremental aspects of) semi-radical projects. One reason that communities of practice may not have used numbers during the first stage to reduce uncertainty and at the first gate to promote goal congruence is that the generation of new ideas (Stage 1) idea screening (Gate 1) involve elements of novelty that numbers could not deal with.

Following project planning (Stage 2) communities of practice used numbers during almost every activity to reduce uncertainty for incremental projects. There were only a few activities for which numbers were not used. One of these was the concept brief (Stage 3). During this activity communities of practice used the concept document instead of numbers to reduce uncertainty. This could be because of the relatively high number of novel elements communities had to deal with.

Communities of practice used numbers extensively for semi-radical projects during the gates of the process to promote goal congruence but did not use numbers as often during the stages to reduce uncertainty. While communities of practice used numbers to reduce uncertainty during project planning (Stage 2) these communities did not use numbers to reduce uncertainty during product feasibility (Stage 3) or design and testing (Stage 4). This could have been due to the increasing elements of novelty that communities of practice had to deal with during these stages in the process. Communities of practice did use numbers to promote goal congruence during the project review (Gate 3), launch proposal (Gate 4) and to reduce uncertainty during project launch (Stage 5). By the time that a semi-radical project got to the final stage they needed numbers to support their entry into the normal operations of the firm, thus, numbers were critical to reduce uncertainty by this stage of the process.

Communities of practice used numbers more for incremental and semi-radical projects than they did for radical projects. They first used numbers for these projects to reduce uncertainty during the costing activity of project feasibility (Stage 3). During the project review (Gate 3) communities of practice used costings to promote goal congruence and these numbers formed an important part of their discussions. As radical projects have the most elements of novelty communities of practice used numbers to promote goal congruence and reduce uncertainty only when they were sure that others would understand the context. Thus, the use of numbers for these projects always followed the use of other boundary objects.

7.2.2 The use of documents

The report on practice in this thesis shows how communities of practice used documents during the product development process to accomplish management control (i.e. to promote goal congruence or reduce uncertainty). Communities of practice used these boundary objects at times when there were more elements of novelty. Documents were used extensively from idea generation (Stage 1) and were used for all three project innovation types further on in the process.

Communities of practice used documents during almost every activity for incremental projects to either promote goal congruence or reduce uncertainty. There were only a few activities for which documents were not used. One of these was the project review (Gate 3). During these activities communities of practice used only numbers to promote goal congruence. Communities of practice may have used numbers to promote goal congruence during this activity because there were only a few elements and thus every understood the numbers. The high use of documents by communities of practice to promote goal

congruence and reduce uncertainty is surprising for these projects. It should be noted, though, that these documents were used in conjunction with numbers and thus they may have had another purpose.

Communities of practice used documents to promote goal congruence or to reduce uncertainty during almost every stage and activity for semi-radical projects. There were only a few activities when documents were not used. One of these was the costing activity (Stage 3) where communities of practice used numbers to reduce uncertainty. During the packaging artwork activity (Stage 4) communities of practice used models to reduce uncertainty as documents were not able to capture the important aspects of this activity. The extensive use of documents by communities of practice helped them promote goal congruence and reduce uncertainty for semi-radical projects.

Communities of practice used many different documents to promote goal congruence and reduce uncertainty for radical projects. While communities of practice did not seem to be able to use documents to reduce uncertainty during idea generation (Stage 1) they did use them from project feasibility (Stage 3) to product launch (Stage 5). Communities of practice may not have used documents to reduce uncertainty during the first few stages or promote goal congruence at the first few gates of the product development process owing to the high number of novel elements. For radical projects communities of practice often used documents in conjunction with models as documents alone were not able to capture all the elements of novelty for these projects.

7.2.3 The use of models

The report on practice in this thesis shows how communities of practice used models during the product development process to accomplish management control (i.e. to promote goal congruence of reduce uncertainty). These boundary objects were not used extensively for most projects until design and testing (Stage 4). For incremental projects communities of practice seldom used models to accomplish management control. This was because these projects were related closely to existing products and as such communities of practice could easily use documents and numbers to promote goal congruence and reduce uncertainty for these projects.

Communities of practice used models to accomplish management control more for semi-radical projects than incremental projects. During some of the activities during the project screen (Gate 2) organisation members used models to promote goal congruence. Models were also used to reduce uncertainty during activities in product feasibility (Stage 3). During testing and design (Stage 4) and product launch (Stage 5) communities of practice used models extensively to reduce uncertainty. In general it was shown in the report on practice that as the elements of novelty increased beyond what documents could deal with communities of practice used models to promote goal congruence and reduce uncertainty.

Communities of practice used models extensively to accomplish management control for radical projects. This started in the laboratory activities which took place during idea generation (Stage 1) to reduce uncertainty and continued on to the use of models to reduce uncertainty during product launch (Stage 5). A reason why communities of practice used models to reduce uncertainty from the start of the product development process for these

projects may be because of the high number of novel elements that organisation members had to deal with when working on these types of projects.

7.3 The role of management control

Research question 1a sought to understand the role of management control during each of the stages and gates during the product development process. As presented in Chapter 2, the role of management control has traditionally been understood in terms of promoting goal congruence. Davila (2000:386), instead "*assumes that the main role of management control systems in product development is to supply information required to reduce uncertainty rather than to reduce goal divergence problems.*" He examines the uncertainty reduction role of management control during one stage, "*product design*" (Davila, 2000:395) of the product development process. The unit of analysis in Davila's (2000) study was the "*project manager*" (Davila, 2000:404). As discussed in Chapter 2, Davila finds that the focus of project managers during this stage was to reduce uncertainty.

The aim of this thesis is to provide an holistic examination of the role of management control during product development. Instead of assuming that the role of control is to reduce uncertainty I sought to observe how communities of practice used management controls in practice with a view to distinguishing between promoting goal congruence and reducing uncertainty. This was done by examining the activities that different communities of practice carried out during each of the stages and gates of the product development process. The unit of analysis in this study was the innovation project (divided by type – incremental, semi-radical and radical). The communities of practice examined consisted of hierarchal communities of executive managers (CoP_{EM}), functional managers dealing with product development (CoP_{FMPD}), functional managers (CoP_{FM}) and

functional specialists (CoP_{FS}) and functional communities consisting of a technology community of practice (CoP_T), a marketing community of practice (CoP_M), a sales community of practice (CoP_S) a finance community of practice (CoP_F) and an operations community or practice (CoP_O).

The report on practice in Chapters 5 and 6 indicates that the role of management control use changes during the product development process. While management controls are used to reduce uncertainty during the stages of the product development process they are used to promote goal congruence during the gates or decision points of the product development process.

This finding is partially consistent with Davila (2000) in that it does support Davila's finding that project managers (in my study the CoP_{FM}) concentrate on collecting information to reduce uncertainty during product design (Stage 4). My report on practice in Chapters 5 and 6, though, shows that while the role of management control was to reduce uncertainty during the stages, the focus during the gates was on promoting goal congruence.

The report shows that only once during the product development process did a community of practice attempt to promote organisation goals during one of the stages. This occurred at the ideation activity during idea generation (Stage 1) when two members of the CoP_{EM} talked about the strategic and financial goals of the organisation. The reason for such a split could be related to the presence of members from specific communities of practice at the activities that took place during the product development process. The following

sections discuss these three main hierarchal communities of practice in relation to the activities they carried out during the product development process.

7.4 Executive manager community of practice (CoP_{EM})

The members of the CoP_{EM} took part in activities which focused on setting and monitoring the firm's strategic and financial goals. This community of practice was concerned with the financial return a new product would make to the firm. This can be seen by the discussions in the report on practice in Chapters 5 and 6 which took place during executive meetings and interactions.

At executive meetings members of the CoP_{EM} focused on project performance indicators such as contribution before and after marketing, earnings before interest and tax and market share. This led CoP_{EM} members to focus on resources[41] allocated to different projects in an attempt to maximise the return for the firm. Thus, this community of practice focused on promoting goal congruence (see Figure 47, on page 232).

Members of the CoP_{EM} also took part in the activities during the first half of the product development process reported in Chapter 5. They took part in the idea ranking activity (Gate 1) and were in charge of evaluating the initial project presentations (Gate 2). During the second half of the product development process reported in Chapter 6 the CoP_{EM} was in charge of the project review (Gate 3) and the launch proposal (Gate 4). They were also involved during the design and testing (Stage 4) activities. This shows that most of the interaction between the CoP_{EM} and other communities of practice took place at the gates during the product development process. Only during one stage – Design testing Stage 2 –

[41] Resources usually related to the time that functional managers and specialists could spend on projects

did members of this community become involved. A reason for this could be that CoP_{EM} members wanted to make sure that projects would help the firm meet its goals and this was best done at the gates.

7.5 Functional specialist community of practice (CoP_{FS})

Members of the CoP_{FS} reported to a member of the CoP_{FM} in their department. The members of the CoP_{FS} were involved in many of the activities that took place during the stages of the product development process reported on in Chapters 5 and 6. They carried out the activities that took place at the stages during the second half of the product development process: product feasibility (Stage 3), design and testing (Stage 4) and launch (Stage 5).

The main focus of this community of practice during the product development process was on carrying out product development activities and gathering information on the market and technology (see Figure 47, on page 232). In order to manage technical uncertainty the technology and operations members of the CoP_{FS} carried out ingredient, product formulation, packaging and engineering activities during product feasibility (Stage 3) and design and testing (Stage 4). The marketing and sales members of the CoP_{FS} carried out activities which included research on general product and consumer trends which were used during idea generation (Stage 1) and project planning (Stage 2) to target market opportunities.

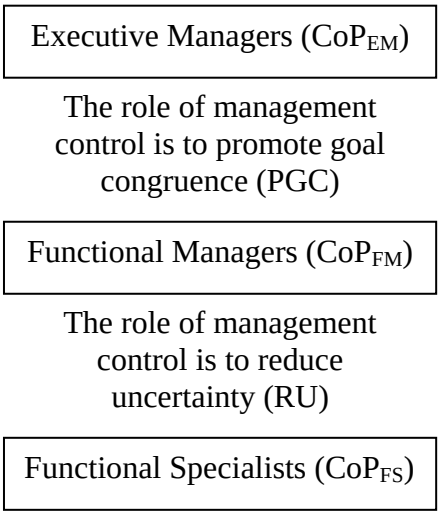
7.6 Functional manager community of practice (CoP_{FM})

Members of the CoP_{FM} reported to a member of the CoP_{EM} and were in charge of the work of a number of members of the CoP_{FS}. This made them an important part of the product development process as they took part in the activities of the CoP_{EM} and the CoP_{FS}. For this reason the members of the CoP_{FM} had to have a different management control focus when dealing with each group. When they dealt with members of the CoP_{FS} their main focus was on understanding how the functional activities they were taking part in and the information they were gathering could be used to reduce uncertainty. They did this by reviewing the project activities that the members of the CoP_{FS} carried out. Uncertainty included technical uncertainty with the product and packaging as well as market uncertainty which included the different markets and market segments in which *OpCo* operated (see Figure 47, on page 232).

In addition to their involvement in the product development activities that took place during the stages the members of the CoP_{FM} were also involved during the gates of the product development process. During the first half of the product development process they were responsible for all the activities, although they were supported by some members of the CoP_{EM} during the gates. During the second half of the product development process the members of the CoP_{FM} presented project reviews (Gate 3) and launch proposals (Gate 4) to the CoP_{EM}. Thus, during the stages the members of the CoP_{FM} focused on reducing uncertainty through their interactions with members of the CoP_{FS}. At the gates of the product development process the members of the CoP_{FM} knew they had to focus on goal congruence issues as they interacted with members of the CoP_{EM} (see Figure 47). Thus, the members of the CoP_{FM} played a key role in linking the promotion of goal congruence

activities led by the CoP_{EM} with the uncertainty reduction activities of the CoP_{FS} during the product development process.

Figure 47: The Role of Management Control in Practice at *OpCo*



7.7 The style of management controls

Research question 1b is concerned with the style in which management controls were used during the product development process at *OpCo*. This section first discusses the findings of the report on practice on the style in which communities of practice used management controls during the stages and gates. It then examines these findings in relation to the findings of Bisbe and Otley (2004) and Bonner et al (2002) which use control constructs based on Simons' (1995a; 1995b) levers of control. As shown in Chapter 2 the findings of Bonner et al (2002) and Bisbe and Otley (2004) are not consistent. Thus section 7.7.1 aims to addresses these issues in relation to the findings of this thesis.

The report on practice in Chapters 5 and 6 indicates that the style in which management controls were used by communities of practice changes both at different times during the product development process and in relation to the different types of product development projects.

During the first marketing activity and brainstorming activity (Stage 1), at the start of the product development process, the style in which communities of practice used management control for incremental and semi-radical projects was focused on setting boundaries. Following these activities the style changed to an interactive one as communities of practice engaged face-to-face to learn, discuss and debate assumptions about new project ideas. There were also times during Stage 1 when the CoP_{EM} felt it was important to influence the beliefs of the other communities of practice. They did this by using their "strategy pyramid" and linking the firms' vision to product development. Following this short period during which the CoP_{EM} members influenced the beliefs of the other communities of practice, the style in which communities of practice used management control reverted back to an interactive style for the idea screen (Gate 1) and the project planning (Stage 2).

At the project screen (Gate 2) communities of practice used both an interactive and a diagnostic style of management control as they sought to examine critical project performance variables as well as debating and challenging important project issues. During product feasibility (Stage 3) and the design and test (Stage 4) the communities of practice used a different style of management control for each type of product development project.

For incremental projects communities of practice used management controls to check cost expectations diagnostically as the focus was on well-understood cost expectations. For semi-radical projects communities of practice used a mix of both diagnostic checks and interactive engagement. This is because a part of these projects was incremental while the other part was radical. Finally during radical projects communities of practice engaged interactively using documents and models as they met face-to-face to learn about the marketing and technical issues they were facing and debated action plans about the best way forward.

The style of management control reverted back to a consistent form for all the types of projects in the project review (Gate 3) as the communities of practice used an interactive style of management control. This can be seen in the report on practice as the communities of practice met face-to-face and debated information and challenged assumptions about the product development projects. At the launch proposal (Gate 4), and at the launch (Stage 5), though, the style of management control became totally diagnostic as communities of practice focused on market share, revenue and profitability expectations.

The evidence from the field report suggests that the style in which communities of practice used management controls was connected in some way to both the type of project and to the stage or gate in the product development process. It can be seen from this discussion that the styles in which management controls can be used includes; setting boundaries, influencing beliefs, checking diagnostic or engaging interactively depending on what communities of practice need to achieve in a particular context.

7.7.1 Bisbe and Otley (2004) and Bonner et al (2002)

As presented in Chapter 2, the style of management control during product development has traditionally been understood in terms of diagnostic control (Bisbe & Otley, 2004; Bonner et al., 2002). These two papers question this style of management control in managing product development. Bisbe and Otley (2004) show that firms use interactive controls while Bonner et al. (2002) show that while interactive control is useful during the first half of the product development process it can be harmful during the second half of the process. This section reviews these two studies and analyses the results in relation to the findings of this thesis.

Bisbe and Otley (2004) argue, based on Simons (1995a; 1995b) research, that studies that interpret the style of management control in relation to diagnostic controls have found that management controls hinder product development and show the focus should be on an interactive style of management control in this context. They examine the style of management control in relation to three management control mechanisms; project management systems, budgets and balanced scorecards (Bisbe & Otley, 2004:717). The unit of analysis in Bisbe and Otley's (2004:715) study was the "*CEO*". Bisbe and Otley (2004) find that interactive control is the style of management control used during product development.

Bonner et al (2002:236) examine formal process and output (diagnostic) controls as well as interactive controls. Bonner et al (2002:239) survey "*product development professionals.*" They find that formal diagnostic controls harmed product innovation and that interactive control was only beneficial during the first half of the product development process.

My finding are not consistent with either Bisbe and Otley (2004) or Bonner et al (2002). The report on practice in Chapters 5 and 6 indicate that all four styles of management control are important for product development. While the setting of boundaries and influencing belief styles of management control were not common during product development they were used during two key activities, market analysis for boundary setting, and ideation for belief influencing. A reason that more of these styles of management control were not seen during product development could have been because they were used during functional activities unrelated to product development. I attended all the functional activities of the Technology department at *OpCo* and found that boundary setting and belief influencing styles of management control were pervasive.

Both diagnostic and interactive styles of management control were used extensively during product development. The report on practice indicates that the style in which communities of practice use management controls changes both during the product development process and in relation to different types of product development projects. While the style in which communities of practice used management controls was more interactive during the first half of the product development process, the style became more diagnostic during the stages and gates during the second half. This could be because communities of practice had better expectations about the results of the project. While these expectations were facilitated by the use of interactive controls early in the product development process, communities of practice needed to make decisions about which projects to progress in the later stages.

During product feasibility (Stage 3) and product design and testing (Stage 4) the style of management control was different for each type of product development project. This could be because of the characteristics of the each product development project types.

7.8 Conclusion

This final section concludes the thesis by outlining the contributions this thesis makes to management control research. It concludes with the limitations of the thesis and suggested areas for future research.

7.8.1 Contribution to management control research

This thesis makes a number of contributions, namely; on the role of management control and the styles in which communities of practice use management controls during product development, introducing an ethnomethodology practice theory perspective, the participant observer method, and finally by showing how management control is accomplished in practice through the use of boundary objects.

This thesis extends past research on the role of management control (Davila, 1997, 2000) and the style in which management controls are used (Bisbe & Otley, 2004; Bonner et al., 2002) within an organisation during product development. It shows that both roles and all four styles of management control are used in practice during product development.

As my research revealed no field studies in the management accounting literature that are explicitly based on ethnomethodology I also contribute to the literature by presenting and using this theoretical perspective. Because of this I took Jönsson and Macintosh's (1997:367) advice and used ethnomethodology to understand how management control

works in an "*actual organizational setting*" and commented on how the empirical material from the setting might be connected to "*current theoretical discourses*" in management control. This was an ambitious agenda as one cannot hope to capture all the interactions between communities of practice during product development. It did, though, provide in-depth insights into the practice of product development from different hierarchal and functional perspectives. I acknowledge that this thesis contains only one possible report of the activities that took place at *OpCo*. It is, thus, not the only "*correct, indefensible*" report on practice but one that is "*good enough to count as adequate*" regarding what I was reporting on (Laurier, 2003:1522).

The participant observation method was well suited to the ethnomethodology perspective and as such is helps contribute to management accounting research as it enabled me to collect rich empirical material. Participant observation allowed me to enter the world of different practitioners at different levels within the organisation. This **"**immersion" helped me become part of the scene so as to learn the methods of the different communities of practice. Being a **"**peripheral member" of many communities was critical to this as it enabled me to see interactions that I would not otherwise have seen. An example of this was when I was helping a project team make product samples. While we were working an executive manager came in to talk to the project leader about a critical project issue. If I had not been assisting the project team building models I would have missed an important informal interaction between an executive manager and the project team leader. This interaction led to a formal meeting later that day concerning the project, which I also attended.

Another important part of this thesis was the use of the "boundary object" (Star 1989) concept. While other management accounting researchers have used this concept (see for example, Briers & Chua, 2001) I use it in a slightly different way to show how communities of practice use boundary objects during their day-to-day activities to accomplish management control in practice. This is because boundary objects are able to span organisation boundaries and thus can mediate between two or more communities of practice. This thesis shows how boundary objects are a key resource and a critical integrating mechanism between communities of practice. The boundary object concept helps see beyond the existence of management controls in an organisation by showing how management control is accomplished by communities of practice during their daily activities.

7.8.2 Limitations

As with all research this thesis has limitations. A major limitation that I faced doing this study was the difficulty in observing all the interactions that took place throughout the organisation at all three hierarchal levels and across the different functions. Although I was able to attend most meetings that were held regularly and planned in advance, I was not able to attend meetings that tool place on short notice. This limitation was more pronounced for informal interactions which took place throughout the organisation but were never planned. In order to mitigate this limitation I had to be proactive and immerse myself as much as possible in the activities taking place throughout the organisation.

Even though I had access to all hierarchal levels within the organisation I had a closer relationship to the CoP_{FM} and the CoP_{FS} members than with the CoP_{EM} members. This could be because I had a desk in the same office as the CoP_{FM} and the CoP_{FS} and interacted

with them on a daily basis. Although I talked to the members of the CoP_{EM} regularly and attended their meetings, my relationship with them was different. Because the first half of the product development process was run by the CoP_{FMPD} I had good access to both the formal activities and informal interactions during these stages and gates.

The product feasibility to launch stages of the product development process, though, were complicated and thus more difficult to observe. Although I had good access to the formal activities during these stages, there were times when I felt that I was missing information on certain projects as many decisions were being made through informal interactions between members of the CoP_{FM} and CoP_{EM}. To mitigate this problem I often asked CoP_{FM} members about specific projects and how decisions were being made.

Another possible limitation is the use of only three boundary objects through which the empirical data is analysed. Another boundary object that could have been examined was people, in particular the functional manager communities CoP_{FM} and CoP_{PDFM} who often mediated between the CoP_{EM} who were focused on goal congruence issues and the CoP_{FS} who were focused on reducing uncertainty.

7.8.3 Areas for future research

Future research could inform how communities of practice use other boundary objects in relation to the role and style in which management controls are used in practice. Also, while this thesis has examined different roles and styles of management control it has not explicitly examined how these management control concepts may be connected or how they may influence each other.

While this thesis has taken a broad view of all the stages and gates of the product development process, future research could select a few of the stages and/or gates and study how communities of practice accomplish management control in more detail. One way of doing this would be by dividing the product development process into its two natural parts and either examining the project selection part or the product feasibility to launch part. Other ways of dividing the product development process could be by looking at just the stages or gates or even individual stages and gates that take place during the product development process.

Future research could also look at different management control structures such as budgeting or could even take a departmental view by examining how communities of practice accomplish management control within a function (such as technology or marketing) during the product development process. This would match a budgeting management control structure as the budgeting process I felt was related to departments but not the product development process.

Future research could also take ethnomethodology practice theory a step further than I did in this thesis. This would require the researcher becoming a "complete member" (see Adler & Adler, 1987) by obtaining a full-time position in an organisation so that they could be involved more directly in the product development process. The ideal would be for a researcher to obtain a functional manager-project manager position so that they could be in a position to view the interactions between both the functional specialists and executive managers. There are a couple of limitations, though, to being a "complete member." The first is the time it would take to do the job, thus, leaving little time to write up field notes. Another limitation is that it would be difficult to study opposing

viewpoints. The advantage of the "peripheral member" was that I could be open to different points of view.

7.8.4 Conclusion

This thesis has examined the boundary objects organisation members at *OpCo* used to accomplish different roles and styles of management control in practice. It has shown, through the use of an ethnomethodology informed field study, that the role of management control changes during the stages and gates of the product development process. It has also shown that the style of management control differs for each type of product development project with organisation members using more diagnostic control for incremental projects and interactive controls for more radical projects. These styles of management control were accomplished using mostly documents and then numbers for incremental projects, documents and then models for semi-radical projects and models, documents and then numbers for radical projects.

Appendix 1

DRIVING INNOVATION AT [AUSFOOD]
View based on reviews of best practice in new product development

Executive Summary

Best practice in new product development (NPD) is best defined by, superior products that consistently meet business objectives where the NPD effort is profitable and time efficient. [AusFood] has a NPD process, that while procedurally correct, is too rational and does not formally link into our business objectives. It is recommended that we develop across our categories and operating company's portfolio management systems integrating strategic project balancing, product pipeline management and an innovation applications group to achieve best practice in NPD.

Recent NPD benchmarking studies show that for the top 20% of companies who follow best practice 38% of sales and 42% of profits are derived from products launched in the past three years. For [AusFood] to achieve best practice we need to evolve our category and NPD management processes. Initially, we should focus on our categories to enable them to achieve excellence in new product delivery via a revision of the NPD process, upskilling of staff with formal project management skills, and the establishment of NPD committees within each operating company. When excellence has been achieved in these functions [AusFood] will be well enabled to establish formal portfolio management systems and tools supporting project balancing with strategy and product pipeline management supported by a global cross-functional innovation applications group.

Finally, NPD benchmarking studies show that leadership from the senior management group is critical to the innovation process. For [AusFood] this means that senior management needs to be engaged in the design of both the NPD process and portfolio management system so that management can play an effective role in leading the firm towards its strategic objectives.

Introduction

One of our objectives for this year is to review the NPD process. Isolating the NPD process from the broader innovation process is impossible from a best practice perspective, in fact, one could say that this is possibly the biggest fault of many companies – "we have an NPD process therefore we are innovative."

Looking initially at our NPD process, which is based directly on Cooper's stage-gate (1993) approach, it is clear that the procedure is correct; however, it is too rational and does not link NPD directly into the business. From our experience, users do not necessarily understand what the development stage constitutes or understand the purpose of the gates. There is also a propensity to treat the process as a check-box system rather than a set of guiding principles to think about. The net result is the tendency to lose active project management and active risk assessment. As the NPD process is applied to individual product development projects it does not link all projects into an end-to-end strategy setting and review process which does not allow for easy business project review. These comments also reflect the major recent criticism of the stage-gate process that several best practice reviewers, including Cooper himself, have made and is the reason behind looking beyond the NPD process when reviewing the NPD process.

In reviewing NPD best practice over the past two months, we have looked at recent best practice reports and have thought long and hard about how it relates to [AusFood] as a company and our recent changes. We believe that we have the framework to build better practice than our current practice. And we also think that we do not need to change our basic structure but we will need to adjust our interactions and build our categories and operating companies to allow for effective portfolio management, strategic balancing and pipeline management over a reasonable time horizon. These changes are evolutionary and to achieve them we need to design a roadmap with people from our business operations to allow us to arrive at best practice in the shortest possible time.

What is best practice?

Best practice in NPD is best defined by, superior products that consistently meet business objectives where the NPD effort is profitable and time efficient. Independent reviews of companies and their achievement of "best practice" are few and far between. However, there are several very recent benchmarking studies that indicate metrics for best practice. Kraft has been well reported as an example of best practice and provides a good example for us to consider (there is information from other companies such as Unilever and Proctor and Gamble, while interesting, the information does not seem to be as thoroughly reviewed as that of Kraft). In his study of NPD best practice Cooper (2004a, b) found that the top 20% of companies had 38% of sales revenue derived from products launched in the past three years with 42.4% of their profits coming from these products over the same time period. "Average" companies achieved 27.5% and 26.4% respectively on these same metrics.

While some companies may not be displaying best practice in NPD it is not to say that they are not innovative. One example of a company that is seen as innovative but may not have displayed best practice in their NPD effort is Gillette. In the late 1990's and very early 2000's, Gillette's profits and sales were not stunning. While they may be well know as a company that is ahead of the curve in technology some of their practices were not

complementing this. An example of this is the development of their new razor the Mach3 which cost the company nearly US$1 billion to develop and design (Caminiti, 2003). While Kraft on the other hand is not instantly thought of as an innovative company, it was viewed by Cooper (2003) as displaying best practice in NPD. Cooper's NPD best practice study consisted of a survey and a series of in-depth case studies (including a case study of Kraft carried out in June 2002) with the assistance of the American Productivity and Quality Centre, Houston, Texas. It is interesting to note that early in 2001, Gillette employed Jim Kilts (2 weeks retired from Kraft) to help Gillette turnaround by focusing on discipline and business basics (Caminiti 2003). It will be interesting to watch Gillette and see how they turn around especially if they are able to harness NPD best practice along with their high level of innovation.

What are the best practices and what do they deliver?

Reviewers of best practice discuss similar processes, tools and behaviours in NPD. One paper by the Performance Management Group (2002) seems to encapsulate all these ideas very clearly and provides some sensible stages to grow product development capability, the descriptions below are mostly derived from this reference. These authors note that when effective portfolio management practices and a dedicated innovation group are utilized companies deliver a much higher level of profits from new products (3 year period) compared to sales whereas average performing companies are delivering a similar level of profits to their level of sales. They can also expect to have a 90% project success rate. Table 1 describes the identified best practices in NPD and Table 2 illustrates the outcomes of achieving best practice in NPD as reported in recent literature.

Table 1: Description of Best Practices in NPD

Best Practices	Reference	Description
Strategic Balancing	(Performance Management Group, 2002)	The alignment of the product portfolio with business strategy and balancing investments in new product development among short-term requirements, long-term goals, and other critical imperatives, including the decision on whether to extend existing platforms or develop new ones
Pipeline Management	(Performance Management Group, 2002)	Managing the flow of projects, with an emphasis on resource management. Specific processes include project staging and prioritization, resource allocation and assignment, and resources supply/demand balancing
Portfolio Process	(Performance Management Group, 2002)	Optimising the development project portfolio to maximize value and manage risk. Specific processes include project selection, decision making, and portfolio reviews
Information Technology	(Performance Management Group, 2002)	Tools and systems required to manage the portfolio and pipeline on an enterprise wide basis. Such systems enable project data to be used directly for managing portfolios and resources across the organization without Herculean, manual data collection efforts

Innovation Group (dedicated)	Cooper et al, 2004. Benchmarking Best NPD Practices II.	Description via example: Kraft Foods uses a dedicated group called Innovative Applications (IA) that drives much of the new product development. The IA group is a multiple-discipline group designed to help R&D successfully innovate and work with business teams to build and expand growth opportunities and leverage technical knowledge and expertise within R&D. This group has 10 or more people who are focused full time on providing this support to NPD and the organisation and work primarily on the pre-development end of the process

Table 2: Performance measurements

Measurement	**The best**	**Average**	**The worst**
Products new to the world (%)	15.89	10.23	7.42
Products new to the business (%)	24.11	24.16	20.00
Major product revisions (%)	25.00	21.97	19.15
Incremental product improvements and changes (%)	28.21	32.74	40.42
Promotional developments and changes (%)	5.89	9.45	12.31
% sales from new products in past 3 years	38.0	27.5	20.0
% profits from new products in past 3 years	42.4	25.4	9.1

Metrics (PDMA Visions July 2004: North American Companies)	**The best**	**The rest**
% sales from new products in past 5 years	47.6	21.4
% profits from new products in past 5 years	49.1	21.2

Metrics in NPD measurement

Metrics are raised as an initial comment in best practice and are fairly well reported in the literature as a measurement separating best, average and worst performers in NPD. There seems to be a trend away from the more traditional measures to metrics that align to profit and consumer satisfaction. The most popular current metric is percentage of sales revenue derived from new products. The top 20% of companies reviewed by Cooper (2004a.b) (according to the best practice definition above) displayed 38% of sales revenue derived from products launched in the past three years with 42.4% of their profits coming from these products over the same time period. "Average" companies achieved 27.5% and 26.4% respectively on these metrics.

Reporters, though, strongly suggest that the primary metric for measuring NPD performance should not be percentage of sales revenue from new products as this primary driver may not direct best practice performance. This metric on its own will drive sales and not necessarily profits. It will often lead to a focus on short-term products and could potentially cause unnecessary product churn. Best practice companies showed two key metric dimensions: overall NPD success and profitability and opening windows of opportunity. There is considerable discussion around performance measurements and in our view these ideas should be presented to our businesses and discussed and adapted according to portfolio needs.

Moving [AusFood] to Best Practice in NPD.

[AusFood] can move towards achieving best practice via an evolutionary approach. As a company we have good skills in several areas, however, rather than just pulling the current "good bits" together, we should take time to review and upgrade them and roll them out across the business. We recommend assembling a "reference team" or expand the [AusFood] innovation project to review global best practices, prepare a model for [AusFood] and to lead the implementation across the company.

In our opinion, and as yet un-debated, we need to implement product pipeline, strategic balancing and portfolio management systems with associated supporting technologies over a mapped out time horizon. Within our company at the moment categories could be regarded as beginning to move towards best practice portfolio management as described by Holmes and Campbell (2004), however, we need to extend these upwards to a global portfolio and locally to all operating companies where categories are matrixed across operating companies (see Diagrams 1 and 2).

Associated with portfolios we need to further develop our pipeline management process. Ideation as an activity is beginning to occur but it will need to be integrated into the portfolio system through strategic balancing (a new and possibly more "rugged" term for prioritisation). The final piece to the improvement would be the overlaying of an innovation applications group based on the Kraft model tasked with leading innovation processes in [AusFood]. The group would be cross-functional and support activities within categories, operating companies and managing research and development providers especially at the pre-development phase.

[AusFood] has the basis for portfolio management across our brands. The three categories are currently defined in three different ways [details of the three categories]. Our view is that while these categories may not be ideal, they do not need to be changed for us to make a step-change in performance which will first come from achieving excellence in project

delivery. Project excellence constitutes an integrated concept to market processes across functions and supported by focused, cross-functional teams and business driven decision-making. The categories will also be able to develop an intimate understanding of customer needs allowing teams to develop targeted, winning products.

Once project excellence has been achieved we can more towards portfolio excellence where there is an active translation of business strategy into robust market, product and technology strategies via a formalised process where senior management regularly assesses and refines portfolio balance. New opportunities are rapidly identified and selected and projects are staffed and executed based on strategic merit. Collaborative development excellence is finally achieved once portfolio management is in place so that effective processes are in place to facilitate full utilisation of cross-enterprise R&D competencies through effective partner and relationship management. The Performance Measurement Group (2002) strongly recommends stepping through the phases one at a time so as to achieve excellence at each step, companies that attempt to implement portfolio and pipeline management systems without project excellence tend to struggle to deliver against business objectives.

Diagram 1: The portfolio

Where the management decision authority is a cross-functional team of approximately 4 – 6 people (finance, general manager, operations, R&D and marketing)

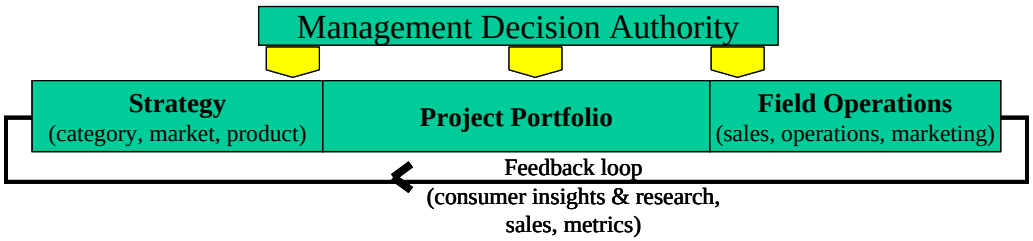


Diagram 2: Portfolio interactions: *(portfolios will matrix across the business)*

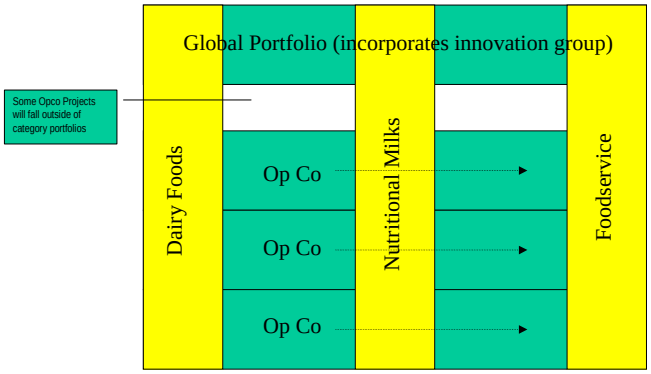


Table 3: Suggested approach moving [AusFood] to best practice in NPD

Stage	Output	Support required
Assemble reference team and review work to date on best practice	A roadmap for implementation	
Proposed approach (not reviewed)		
2005: [AusFood] categories to continue work in progress (categories seen as precursors to portfolios)	Achieve project excellence within current categories (teams developing targeted and winning products through intimate customer understanding)	1. Revision of phase-gate process to a more intuitive process and training of all staff (especially senior management) 2. Thorough training of people identified as project managers
2005: Operating Companies to implement NPD committees 2005: Preparation of IT systems	Precursor of an Operating Company portfolio Selection of an IT tool to facilitate NPD portfolio management	1. Identification of effective metrics 2. Appointment of an "innovation champion" for each committee to drive the team (GM or marketing director would be accountable) 3. Global IT group to support portfolio system tool review
2006: Establish portfolio management within the global group and the categories	Business strategy constantly balanced with market needs and resource availability	1. Implement IT systems capable of project and portfolio management 2. Move categories to portfolio management processes 3. Roll into operating companies
2006 – 2007: Implement an Innovation Champion Group (Kraft model)	Development chain fully configured to utilize core competencies and R&D capability by leveraging development partners (internal and external). Will manage partnerships and ensure efficient interaction across all portfolios	1. Require a global marketing/innovation director

The people side of NPD

While this report has predominantly focused on NPD best practice it should not be forgotten that it is the people within the organization that make NPD work. Without the knowledge and skills that everyone in the organisation brings to NPD a firm would not be able to develop successful new products no matter how good their NPD process was. This of course needs to start from the top with senior management being involved in the design of the NPD process as the development of new products is of strategic importance to the firm. As mentioned above, the support of senior management was shown to be a critical factor in the development of successful new products at Kraft (Cooper 2003). When this key person left Kraft she took with her all the tacit knowledge about the organization which she had built up over the years. This proved to be a big loss for the firm and had a substantial impact on their performance. The lesson to learn from this is the importance of keeping key people in the firm as it is difficult to replace their knowledge.

When senior management understands the importance of NPD they will then provide access to a range of support mechanisms to enable NPD **organisation members** to enhance their skills and thus contribute more to the NPD effort. This not only includes skills relating to functional expertise but also to cross-functional team building as collaboration among people from different functions is difficult, uncertain, and suffers from too little mutual understanding. Team-building is therefore an area which requires conscious effort if it is to lead to successful NPD. Finally Cooper (2003) has outlined three lessons for NPD success 1) hire the best people and develop their skills 2) get a strong commitment from senior management for NPD and 3) develop and sustain a culture that breeds success.

Summary

The ideas expressed in this document will serve as a foundation for building further ideas. From a best practice, it was important to try and discover what best practice in NPD was. Discussing specific ideas from the NPD literature and case studies with a group derived from business operators may yield a roadmap based on new thinking. Implementing a fully managed portfolio system will allow us to better interact within the company and also utilise research and development providers far more effectively. Coupled with pipeline management we may be able to complement good NPD practices and deliver real innovation. Last, but not least, we need systems in place to develop our people as they make the biggest difference to our NPD effort.

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