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## 1. Introduction

New product development has been increasingly facing a fundamental challenge. Companies are under tremendous pressure to bring new products to market more quickly, and ensure that they address the needs of constantly changing and ever-narrower customer segments. These pressures are particularly acute in fast-paced, competitive markets for complex products requiring large investments, such as aeroplanes and microchips.

Over the past 15 years, most companies in the aerospace and semiconductor industries have significantly upgraded their new product development processes, with disciplined timelines, strict design reviews, ‘gates’ to decision making, and cross-functional collaboration. Nevertheless, some companies seem to outperform their industry peers in terms of time-to-market and meeting customer needs. This raises the question of how companies can achieve and sustain performance based on the new product development function.

A dominant framework in the strategic management literature addressing the question of why firms perform differently has been the resource-based view of the firm (Penrose 1959; Wernerfelt 1984; Mahoney and Pandian 1992; Amit and Schoemaker 1993). Though not unchallenged (e.g., Moskowsky and McKelvey 1997; Williamson 1999; Priem and Butler 2001), the resource-based view is still seen as a significant theoretical framework for understanding how performance within the internal organization of companies is achieved and sustained over time (Penrose 1959; Wernerfelt 1984; Prahalad and Hamel 1990; Barney 1991; Nelson 1991; Peteraf 1993; Teece, Pisano et al. 1997; Eisenhardt and Santos 2002). More recently, as regards the resource-based view of the firm, researchers have begun to acknowledge explicitly the importance of higher-order routine processes, or dynamic capabilities. Dynamic capabilities are signified by the ability to develop the ‘antecedent strategic routines’ by which the management exploits its resource base – acquires and sheds resources, integrates and recombines them - to generate new value-

creating strategies (Grant 1991, Winter 2003). These capabilities, which enable firm managers to “*integrate, build and reconfigure internal and external competences*” (Teece, Pisano et al. 1997, p. 516) are the drivers behind the realignment and reconfiguration of resources into new forms of competitive advantage (Henderson and Cockburn 1994; Teece, Pisano et al. 1997; Eisenhardt and Martin 2000).

Yet, while strategic management research has shed light on the characteristics of resources and capabilities as well as the market conditions that permit sustainable competitive advantage (e.g., Amit and Schoemaker, 1993; Barney 1991; Peteraf, 1993), little is known about the ways in which dynamic capabilities emerge. To date, only a few scholars have studied how higher-order routines develop. For example, Zollo and Winter (2002) suggest that dynamic capabilities are shaped by the co-evolution of various learning mechanisms. Taking a slightly different stance, Blyer and Coff (2003) highlight the importance of social capital in the development of higher-order routines. Other research has explored the managerial activities and processes associated with the evolution of dynamic capabilities (e.g., King and Tucci 2002; Kor and Mahoney 2005). These studies illustrate only some facets that play a role in shaping the evolvement of higher-order routines. Hence, there have been calls for further research to open up the ‘black box’ of precisely how such routines develop (Priem and Butler 2001; Cavusgil, Seggie et al. 2007). As Boccardelli and Magnusson (2006, p. 162) conclude:

*“Despite the apparent interest in the dynamics of firm resources, there is still limited empirical evidence for how the strategic matching of resources and market needs is actually done, particularly in more rapidly changing environments.”*

Thus the objective of my research is to contribute to the opening of this ‘black box’ tradition by investigating the mechanisms through which organizations develop capabilities in a dynamic sense (Teece, Pisano et al., 1997). Specifically, I am interested in the higher-order *integration* and *reconfiguration* routines underlying the new product development process. By focusing on the new product development process of the aerospace and semiconductor industries, I attempt to answer two related research questions: How can we explain the evolvement of different higher-order *integration* and *re-*

*configuration* routines in the new product development process? Which characteristics of these dynamic capabilities drive, rather than hinder, effective product development activities?

The following presents an overview of the relevant literature on new product development as well as the resource-based view. More specifically I will highlight the need for (i) a better understanding of new product development processes embedded in key new product development concepts and (ii) an increase in our understanding of the element of dynamic capabilities and its underlying processes such as learning mechanisms and path dependencies within the resource-based view. I argue that new product development literature has failed to understand the role of dynamic capabilities in the new product development process. Consequently, I suggest that research on dynamic capabilities in the new product development process is a relatively new area of study and that current knowledge is embryonic and not particularly well-grounded.

The case study-based approach, I argue in a second step, is the most appropriate design for dealing with complex social phenomena that are poorly understood, requiring a holistic, in-depth investigative approach. Furthermore, based on my presentation of the challenges involved in gathering data on social phenomena, most particularly the need to overcome subjectivity and reflexivity, I intend to increase the robustness of the findings by replicating the research in the aerospace and semiconductor industries. From each of these industries I selected two representative cases, albeit extreme, to illustrate the emergence of dynamic capabilities and to explore what dynamic capability characteristics drive, rather than hinder, new product development. While interview data is at the core of my research, it is supported by archival data on all key firms in each of the two industries and participant observation within the four in-depth cases.

In a third step, alongside presenting and interpreting the findings from my case studies, I argue that higher-order resource *integration* and *reconfiguration* routines are established idiosyncratically within new product development processes - not only within an industry but also across the observed in-

dustries. These idiosyncrasies can be best explained based on learning mechanisms guiding the evolvement of dynamic capabilities, which underlie path dependencies. Furthermore, my data suggests that within the same industry setting relatively simple, experiential and unstable routines coexist with rather detailed, analytical, and complicated higher-order routines on different organizational levels. The development of these different ‘layers’ of routines allows for a ‘stretch’ of resources as proposed by Edmondson et al. (2001) and Zott (2003). However despite the evolvement through unique paths and idiosyncratic processes (Teece, Pisano et al. 1997) it seems to be that dynamic capabilities do inherit commonalities across firms, which is often referred to as ‘best practices’. My empirical study’s data suggests that dynamic capabilities seem to follow either somewhat ‘defined’ or ‘flexible’ patterns (cf. Eisenhardt and Martin 2000). However, in building on Eisenhardt and Martin’s (2000) findings, it seems that both patterns can co-exist in the same type of market environment, i.e., in high-velocity markets such as aerospace or semiconductors.

Moreover my data suggests that relatively simple, experiential and unstable higher-order routines seem to be more effective for *reconfiguring* responsibilities and task sequences, something that makes it easier to adapt to environmental changes (cf. Wang and Ahmed 2007). Such ‘flexible’ patterns of dynamic capabilities are best shaped by a limited structure with clear priorities, guidelines and responsibilities (Eisenhardt and Brown 1997). On the other hand, detailed, analytical, and complicated higher-order routines were found to be more effective for *integrating* workforce, knowledge, and new technology and outsourced services. Such ‘defined’ dynamic capabilities are best shaped by the accumulation of experience, the development of collective competence with suppliers as well as knowledge codification in blueprints, spreadsheets, and decision support systems (King and Tucci 2002; Zollo and Winter 2002).

The structure of this thesis is as follows. Section *One* reviews the relevant literature, highlighting the need for further research on the association of new product development and the establishment of dynamic capabilities.

Section *Two* presents my research approach, design and methodology. Section *Three* presents the empirical study's data for each of the two industries; aerospace and semiconductors. Section *Four* discusses the empirical study's data by relating it to the research needs as developed in the second section. Patterns are then identified across these two industries, contributing to a synthesis of the findings. Finally, I discuss the limitations of the study and provide a summary of the discussion's findings and implications for practice and further research.



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## 2. Theoretical Background

### 2.1 Introduction

This section reviews and categorizes relevant literature on key concepts that are employed in this research attempt to better understand idiosyncrasies in new product development by using the resource-based view. More specifically, the second part reviews various attempts at gaining a better understanding of superior new product development and concludes that a fruitful approach seems to be to take a dynamic capabilities perspective. Furthermore I point out that research on dynamic capabilities in the new product development process is a relatively new area of study and that current knowledge is embryonic and not particularly well-grounded. In this respect, the consequential need is highlighted for (i) a better understanding of *new product development processes* embedded in *key new product development concepts* and (ii) an increase in our understanding of the element of *dynamic capabilities* and its *underlying processes* such as learning mechanisms and path dependencies within the *resource-based view*. The third part reviews the relevant literature in the *new product development* area, highlights its *constituting processes* and *common frameworks* and expands on the natural linkage of new product development and product innovation to outline how innovation is understood within this study. The fourth part reviews the relevant literature in the *resource-based view* area and specifically expands on the need for a better understanding of the element of *dynamic capabilities* and its *underlying processes*. Finally the fifth part links the literature from the *new product development* and *resource-based view* area and highlights the importance of *dynamic capabilities* and its *underlying processes* to explain idiosyncrasies within new product development.

## 2.2 Explaining idiosyncrasies in new product development

Most companies in the aerospace and semiconductor industries face increasing competition along the dimensions costs, time-to-market, and customer satisfaction. These pressures are particularly acute in competitive markets for complex products requiring large investments (e.g., Eisenhardt and Brown 1997; Katila and Ahuja 2002). New product development is commonly acknowledged as a key lever to achieve and sustain performance in those high-velocity industries, i.e. it plays a central role in business strategy (Cooper 2005; Kahn, Castellion et al. 2005; Atuahene-Gima and Murray 2006).

A benchmarking study by ‘American Productivity and Quality Control’ revealed that approximately 28 percent of firm sales consist of new products launched in the last five years (American Productivity & Quality Center 2003). This high rate highlights the importance of new products in today’s markets (Takeuchi and Nonaka 1984). Thus the greatest challenge is to achieve a high success rate of new product development projects. However 56 percent of those projects fail to achieve their financial goals and only 51 percent are launched on time according to the same study (American Productivity & Quality Center 2003). A recent study by the ‘Product Development & Management Association’ underlines these findings (Adams-Bigelow 2005). According to their data, sales from new products introduced in the last five years as a percentage of total sales account to approximately 30 percent. Hence the importance of new products has further increased in today’s markets. The study acknowledges an advance in success rates of new products but with an average success rate of 57 percent there is still room for improvement. Considering the strategic importance of new product development and facing those poor results it is not surprising that scholars have been eager to gain a better understanding of the nature of superior new product development processes.

Most importantly, the so-called ‘NewProd Study’ investigated 102 successful new product projects and 93 unsuccessful ones in 102 companies (Cooper 1979). Several further investigations followed as a result of its success (cf. Cooper 2001). Another major study was the ‘Stanford Innovation Project’, focused on high technology industry (Maidique and Zirger 1984) and the ‘Booz–Allen & Hamilton Investigation’, which identified common characteristics of successful product innovation in 700 firms (Booz-Allen & Hamilton 1982). The findings of these and further investigations (e.g., Larson and Gobeli 1988; Song, Montoya-Weiss et al. 1997) enabled scholars to filter critical success factors in new product development. For example, Cooper (2005) distinguishes various success factors at different levels, such as project level (e.g., strong market orientation, quality of execution, planning and resourcing the launch), people and environment level (e.g., organization of project teams, top management support) and strategic level (e.g., product innovation and technology strategy, leveraging core competences). While the identified success factors deepen our understanding of new product development, these studies have shortcomings with regard to a dynamic view of the problem, i.e. the processes required to be successful in new product development.

Only in the late 1990s did researchers begin to explicitly take a dynamic view of the problem and start to focus on the different processes underlying superior new product development. For example, Katila and Ahuja (2002) looked at organizational learning processes. More specifically the authors examined exploration and exploitation mechanisms (March 1991) in order to underline the importance of search or problem solving processes in enhancing new product development in the global robotics industry. Other researchers have highlighted the importance of knowledge creation and absorption processes in new product development (e.g., Ramesh and Tiwana 1999; Zahay, Griffin et al. 2004). Finally, path dependency has been regarded as a key approach for a better understanding of the need for knowledge acquisition processes in new product development (e.g., Schilling 1998; Tegarden, Hatfield et al. 1999).

More recently, a stream of research has started to recognize the fundamental role of resource and capability combinations in new product development. In doing so it attempts to integrate the previously mentioned approaches into various learning mechanisms and path dependency. Specifically, the literature points to the relevance of higher-order routines in the new product development process (e.g., Eisenhardt and Brown 1997; Danneels 2002; Verona and Ravasi 2003; Ettlie and Pavlou 2006). Although the importance of higher-order routines within new product development processes has been widely acknowledged by this stream of research, to date, there is limited empirical evidence to show how these dynamic capabilities evolve (e.g., Priem and Butler 2001; Zollo and Winter 2002; Kor and Mahoney 2005). Hence, there have been calls for further research to open up the ‘black box’ of precisely how such routines develop (Priem and Butler 2001; Cavusgil, Seggie et al. 2007).

The objective of my research is to contribute to the opening up of the ‘black box’ tradition. By focusing on the new product development process of the aerospace and semiconductor industries I attempt to answer two related research questions: How can we explain the evolvement of different dynamic capabilities in the new product development process? Which characteristics of such dynamic capabilities drive, rather than hinder, effective new product development processes?

In addressing this objective, my research chose the theoretical framework of the resource-based view (Penrose 1959; Wernerfelt 1984; Grant 1991; Mahoney and Pandian 1992; Amit and Schoemaker 1993). Though not unchallenged (e.g., Mosakowski and McKelvey 1997; Williamson 1999; Priem and Butler 2001), I will argue that the resource-based view is a significant theoretical framework for understanding how performance within the internal organization of firms is achieved and sustained over time (Penrose 1959; Wernerfelt 1984; Prahalad and Hamel 1990; Barney 1991; Nelson 1991; Peteraf 1993; Teece, Pisano et al. 1997; Eisenhardt and Martin 2000) and specifically, how dynamic capabilities are involved in this process (e.g., Verona and Ravasi 2003; Ettlie and Pavlou 2006). I argue that the new product