

The rise and fall of product innovation strategy: a simulation model

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Note that this paper is work-in-progress. Most notably, a full working model is still under active development and thus (regrettably) omitted from this submission. This implies that especially the second half of the paper is still under construction (including experimentation, simulation findings, and conclusions). Nevertheless, the paper so far will give a good impression of the potential of the inquiry, as well as what can be expected in the near future.

1 Abstract

The benefits of a strategically balanced product portfolio, as a key driver of long-term business success, are well documented. In this respect, many firms have been unable to achieve a balanced product portfolio. An important cause is the failure to develop dynamic capabilities, that is, the capabilities to reconfigure internal and external competences to address dynamic business environments. In times of environmental instability and financial decay, top managers are facing difficulties in adapting their strategy to changes in market and competitive conditions. Firms can thus become seriously trapped in a reinforcing negative loop, where the changing environment is counteracted with inadequate strategic actions, which in turn results in further decreasing financial performance. This so-called suppression mechanism serves to explain why so many firms fail at building dynamic

capabilities. We draw on system dynamics modeling to build and simulate a model of the causes, consequences, and potential solutions of the suppression mechanism. This model is derived from the literature on dynamic capability and, more broadly, strategy and innovation studies. The main contribution of this paper to the literature on dynamic capabilities is the definition and codification of the suppression mechanism.

Key words: dynamic capabilities, suppression mechanism, balancing exploitation and exploration, innovation management, strategic management, strategic change.

2 Introduction

In today's economy, the life cycles of products are getting increasingly shorter while their complexity increases. In many industries, this has resulted in a fierce competitive landscape where business success, or even survival, largely depends on the organizational ability to innovate and change. Subsequently, organizations increasingly adopt a product innovation strategy to cope with market and competitive dynamics. According to many authors, such a strategy should combine exploitation with exploration (e.g. March 1991; Gupta et al. 2006; O'Reilly III and Tushman 2008). Creating and keeping the right balance between radical and incremental innovations in the product innovation portfolio is therefore often mentioned to be a key competitive advantage (Christensen and Bower 1996; Gupta et al. 2006; Chao and Kavadias 2008).

Therefore, creating a competitive advantage depends on the firm's ability to continually learn new systems and unlearn obsolete routines (Moenaert and Souder 1996), in order to keep the product portfolio at a competitive balance. This relates closely to the notion of dynamic capabilities which represents the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments (Teece et al. 1997). According to a study by Adams and Boike (2004), however, a large majority of firms tends to overemphasize incremental innovation efforts. To make matters worse, many

innovative initiatives do not go beyond mere imitation (Burgelman et al. 2004).

Dynamic capability theory emphasizes the key role of top management to orchestrate and integrate both new and existing assets to develop and learn new routines (O'Reilly III and Tushman 2008). However, more often than not, strategic plans and agendas will reveal more about today's problems than tomorrow's opportunities (Winter 2000; Burgelman et al. 2004). The former, inherent to its short-term focus, will result in a focus on exploitation and incremental improvements only, lacking any desirable long-term ends (beyond shareholder satisfaction). Empirical findings illustrate that even when top management is faced with a changing organizational context they will continue directing the business towards even more exploitation as it is perceived to be the right direction (Christensen et al. 1998). Here a self-reinforcing phenomenon can be observed as the failure to adapt to changing environments (exploration) will ruin any attempt to bring or sustain a long-term competitive equilibrium in the product portfolio. This subsequently results in a diminishing portfolio value, which top management tries to compensate for with a larger focus on exploitation.

Although everybody, practitioners and scholars alike, seem to agree that a strategically sound product portfolio is essential for long-term performance, many firms still get in trouble. From this, an interesting question can be distilled. The question pertains to the reason how so many firms get trapped in this vicious circle thereby seriously compromising their long-term existence. Using theoretical arguments, case study findings, and systems thinking and modeling, we will model and simulate the underlying mechanism of why so many firms fail at developing dynamic capabilities. Subsequently, by deductive reasoning, we will explore what is necessary to get out of this reinforcing negative loop – the so-called suppression mechanism.

To study the causes, consequences, and potential solutions of the suppression mechanism, this study will adopt a dynamic simulation model. Simulation has become an

important methodology for theory development, especially if the research question is one that unfolds over time and is non-linear in nature (Sterman 2000; Davis et al. 2007). Davis et al. (2007) place simulations as the sweet-spot between theory creating research and theory testing research. It allows for the elaboration on emerging theories by deductive logic and empirical evidence. Although the biases of the modeler might be included in the model, the latter can clearly reveal the outcomes of interactions between multiple underlying organizational and strategic processes by experimentation (Repenning 2002).

The next section will present a review of the literature which will form the basis of the model. Subsequently, the most important aspects of the model will be described where after the simulation results will be presented. We will conclude with theoretical interpretations, findings for future empirical inquiry, and implications for practice of this theory building discussion.

3 Theoretical background

It widely known that firms tend to fail if they effectively reject superior new products (Christensen et al. 1998; Woodside and Biemans 2005). Nevertheless, many incumbent firms remain ignorant to this threat based on the often false believe that their current products will prevail, which in turn allows their core competencies to become core rigidities (Leonard-Barton 1992). In that sense, most successful companies suffer from their success and fail to cannibalize their own products (Schumpeter 1942). On the contrary, firms that are able to adapt to the changing environment by purposefully creating, extending, and modifying its resource base are said to posses a dynamic capability (Helfat et al. 2007). Although developing dynamic capabilities implies a long-term commitment to specialized resources (e.g. exploration), it can create a sustainable competitive advantage. Indeed, one of the key ingredients of dynamic capabilities is directing the business towards learning and innovation (Helfat et al. 2007).

The concept was first introduced by (Teece et al. 1997) to explain why some firms create a competitive advantage over other firms. In their view, dynamic capabilities reside in the high-performance routines operating inside the firm and are shaped by distinctive organizational processes, asset positions, and evolutionary paths. This implies that a firm can build its competitive advantage by reshaping and creating tangible and intangible resources and capabilities. Eisenhardt and Martin (2000, 1107) provide the following definition of dynamic capability: “The firm's processes that use resources [...] to match and even create market change”. This implies that dynamic capabilities are related to market dynamism and are idiosyncratic in nature.

Thus, dynamic capabilities reside for a large part in top management¹ by sensing market dynamism and translating them into opportunities by creating new combinations (build, integrate, and reconfigure) of resources and competences (Christensen and Bower 1996; O'Reilly III and Tushman 2008). Many studies have confirmed the influence of top management on performance, reporting large and statistically significant effects of corporate decision making on overall profitability (Adner and Helfat 2003). For instance, Christensen and Bower (1996) demonstrate that managers can effectively change the strategic course of their firms in order to achieve sustaining innovations. This capability is also referred to as 'dynamic managerial capability' (Adner and Helfat 2003; Helfat et al. 2007). Here, learning occurs by observing what happens as a result of a strategic change (Sengupta et al. 2008). Indeed, dynamic capabilities arise from this type of learning (variation, selection, replication, and retention) (Zollo and Winter 2002). Concerning dynamic managerial capability, this implies that the purpose and effectiveness of the resource base should be questioned time over time as the market shapes the firm and the firm shapes the market (Zollo and Winter 2002; Helfat et al. 2007).

¹ But are impacted by the organizational processes, systems, and structures of the firm (Teece et al. 1997).

The corporate strategy reflects the perceived direction needed over time. The perceived need is based on the mental model of top management which consists largely of assumptions about cause-and-effect relationships in the firm's environment (Sengupta et al. 2008). The mental models constitute simplified representations of the world that facilitate the processing of information. Mental models serve as the basis for management to ground decisions making (strategic direction) and are shaped and based on prior experience (Tripsas and Gavetti 2000). In sum, this suggests that cognition, based on historical experience as opposed to current knowledge, influences organizational performance to a great degree.

In this respect, there often is a mismatch between intentions build into the strategic plans and the actual (long-term) results. An important cause for this phenomenon is the time lag between cause (strategy change) and effect which degrades learning (Argyris 1989). Moreover, longer feedback times result in a stronger bias towards the prevailing mental model – at the cost of newly emerging models (Argyris 1989; Sengupta et al. 2008). Next to this, managers often experience difficulties to move beyond their existing mental models, even if information is available that indicates the necessity of change. Tripsas and Gavetti (2000) labeled this the 'dominant logic' that senior management develops over time. This historical influence, which relates closely to the notion of organizational culture² (Hofstede et al. 1990), reinforces the current mental model of top management thereby seriously limiting the adaptability of firms (Eisenhardt and Brown 1998). An example here would be that the firm's prior history tends to be premised on local processes of search, thereby limiting its future behavior.

Environmental instability arising from for example competence-destroying changes that redefine an industry (Tushman and Anderson 1986), periodic shift in the market preferences (Christensen et al. 1998), or new emerging dominant designs which changes the competitive

2 It is about assumptions that worked well in the past and are for this reason accepted as truth.

dimensions (Henderson and Clark 1990) can cause a fast decreasing value of the product portfolio. The evolution of industry brings along environmental instability which can result in fast decreasing financial performance. Subsequently, decreasing financial performance increases the need for financial performance on the short-term. An effect which is likely initiated (and amplified) by the pressure from shareholders (Burgelman et al. 2004). This will result in a strategic direction which focuses on the exploitation capabilities of the firm. Indeed, the mental model prevailing among top managers supports the idea that investing in incremental improvements is more likely to bring revenue and less risky, than exploring radical innovation during times of financial decay.

Radical new products constitute the main cause of the above mentioned disruptions. Although they have the potential of superior performance over the existing product, they are generally underperforming at the moment of market introduction (Burgelman et al. 2004). In addition, even if the new product is superior at the moment of introduction, the performance increase of the new technology tends to start slow (as technological progress has been shown to follow a S-curve (Burgelman et al. 2004)) implying that 'old' technologies may (temporary) outperform the new. An increased focus on incremental opportunities thus very likely results in increasing financial performance on the short term. This then constitutes a second cause for the reinforcement of the current mental model of top management.

This phenomenon can be observed at many incumbent enterprises that favor incremental improvements over radical innovation (Teece et al. 1997; Helfat et al. 2007). This gives rise to a dangerous trap: If a firm finds itself in a changing organizational context, top management will most likely direct the business towards incremental improvements, lacking any desirable long-term ends (beyond shareholder satisfaction). Although the incremental improvements may bring short-term revenue, they will undermine the firm's dynamic capability and any attempt to bring or sustain a long-term competitive equilibrium in the

product portfolio between exploitation and exploration. The resulting decrease of portfolio value can then cause firms to become seriously trapped in a reinforcing negative loop (Sterman 2000), where bad performance is counteracted by mere incremental improvements since the latter are expected to bring the necessary revenue to survive. The more effective intervention, sacrificing short-term profits for long-term performance by investing into exploration, is delayed by the (at first increasing) biased mental model of top management. Thus, top management is not likely to engage in continually learning new systems and strategies and unlearning established routines that are becoming obsolete. The key issue is here the firms disability to correctly change the strategy (cf. Christensen and Bower 1996). This pattern of forces is coined the *suppression mechanism* and serves to explain why so many firms fail at building dynamic capabilities. Figure 1 provides an overview of the argument made thusfar, in the form of a causal loop diagram (Sterman 2000).

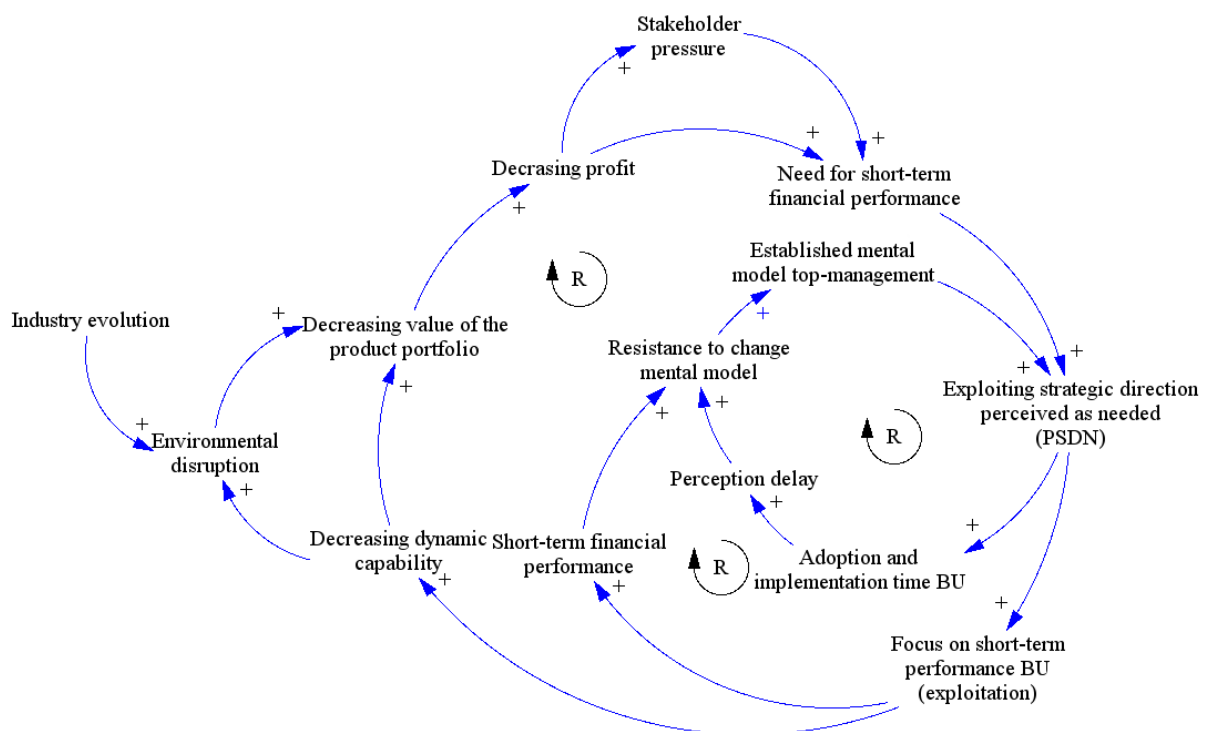


Figure 1: Causal loop diagram of the suppression mechanism.

Next to this, it should be noted that the formulation and implementation of a strategy that serves to cope with today's competitive landscape constitutes an intangible asset which takes

a long time to develop, but is easily damaged through accident, carelessness, or ignorance. In this respect, intangible sources take a long time to build-up and accumulate, but are destroyed rapidly (Warren 2002). For example, the perceived safety of a particular airliner may take many years to develop, but can be destroyed in seconds by an accident. The same idea may apply to the development and adoption of a new product development strategy. Although the adoption of a new strategy might seem to be a decision by top management, the benefits will only become apparent after months or even years. During this (long) dialectic process of building up these capabilities (cf. Van de Ven 2007), top management can rapidly fall back into its old mental model because of delayed results.

The next section will provide the model structure of the suppression mechanism. This approach serves to explore how the established mental model of top managers influences the strategic decision between exploitation and exploration. More specifically, the model serves to explain why so many firms fail at building dynamic capabilities.

4 Model structure

We draw on system dynamics modeling to build and simulate a model of the causes, consequences, and potential solutions of the suppression mechanism. This model is derived from the literature on dynamic capability and, more broadly, strategy and innovation studies. The model was developed by using *Vensim DSS* software. In order to focus on the research questions, the model will assume that all firms are “technically fit” (Helfat et al. 2007), and thus able to develop the necessary technology in their field. Next to this, development funding is also considered to be available. This assumption is not unreasonable considering the findings of Christensen and Bower (1996) that established firms were successful at developing technologies (which does not equal innovation) of every sort.

This section is still under construction and the model description is to be added in the near future.

5 Simulation findings and experimentation

This article adopts system dynamics modeling to inform theory and to prescribe executive action with regard to the suppression mechanism. For this, experimentations will be conducted. Experimentation is a key strength of simulation and a primary source of theoretical insight (Davis et al. 2007). They often reveal non-intuitive findings which are difficult to grasp by using “armchair thought processes” alone (Davis et al. 2007).

This section is still under construction and findings of the simulation model why so many firms fail at building dynamic capabilities and how firms could prevent themselves from getting into the suppression mechanism are to be added in the near future. As well as findings of how to get out of the mechanism, if firms are already located inside the vicious circle.

6 Conclusions and future research

The main contribution of this paper to the literature on dynamic capabilities is the definition and codification of the suppression mechanism. Managerial action, in the form of design principles (Romme 2003), will be formulated and contribute to the managerial implications of this paper. More detailed conclusions will be added in the near future.

Dynamic capabilities is a topic that has been frequently discussed in the theoretical debate (e.g. Teece et al. 1997; Eisenhardt and Martin 2000). Previous studies have observed and defined two strategies that will allow firms to develop dynamic capabilities and thus escape the suppression mechanism. Ambidexterity (Tushman and O'Reilly III 1999) and punctuated equilibrium (Brown and Eisenhardt 1997). Future research (e.g. by extending our model) could address the fundamental question of when to strategically pursue ambidexterity versus punctuated equilibrium. Both strategies may be viable ways to create dynamic capabilities, meaning sustained survival by balancing exploitation with exploration, and there is an ongoing debate when which strategy is best deployed. This is also referred to as the

simultaneous/ sequential question (Gupta et al. 2006; O'Reilly III and Tushman 2008). The former refers to synchronous pursuit of both incremental and radical innovation via dedicated subunits or individuals. The latter is about iterating between exploration and exploitation rather than organizational differentiation. Although both strategic approaches indeed serve the same goal, it is clear that the mechanisms are radically different and will likely have different outcomes when considering different exogenous and endogenous factors.

This article attempted to contribute to theory and prescribe executive action by explaining why so many firms fail at building dynamic capabilities. By understanding the causes and effects of the suppression mechanism, top management can be enabled to set sound strategic directions and prevent their firms from getting trapped.

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