Exploring the role of management control anchor practices in new product development

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Abstract

This paper shows how certain management controls become more guiding than others in the management of new product development (NPD). We detail how the opportunity space within which managers maneuver NPD can be underpinned by a hierarchically arranged management control infrastructure governed by management control anchor practices that enable ‘anchored prioritizations’ through which some concerns become ‘more important’ than others. As the anchor practice in our case was an integrative liaison device, we also contribute to research that emphasizes the use of social controls in NPD settings. As management control anchor practice, integrative liaison devices can go beyond the ‘pure’ sharing and integration of knowledge and play a crucial role in framing accountability-induced conflicts and negotiations. We also contribute to the notion of management control anchor practices by considering the dynamics between a constitutive rule and the strategies used to enact it. Management control anchor practices play a crucial role in the light of ‘conservative dynamism’ where strategies through which a constitutive rule is enacted are constantly adjusted. A key role of a management control anchor practice hereby is to avoid the emergence of a state of excessive proliferation where strategies are formed merely based on opportunism or short-term contingencies.

Keywords: New product development, management control anchor practices, integrative liaison devices, anchored prioritizations
1. Introduction

New product development (NPD) provides a complex setting where concurrent projects are often intertwined and compete for resources (see Yaghootkar & Gil, 2012). It is also a critical activity in making it possible for companies to successfully compete and grow since a significant amount of the total product cost is determined during this stage and cannot be changed when the product reaches production (Davila, 2000). The literature shows that management control practices, for instance, can enable NPD activities by supplying information to reduce uncertainty (Davila, 2000), integrating different sources of knowledge (Ditillo, 2004), generating dynamic tensions (Curtis & Sweeney, 2017; Simons, 1995), and mediating between NPD activities and wider organizational concerns (Christner & Strömsten, 2015; Davila & Ditillo, 2017; Jørgensen & Messner, 2009, 2010; Mouritsen, Hansen, & Hansen, 2009). The literature shows that a multiplicity of various control practices is usually employed in these settings and interact with the NPD activities as well with each other at particular points in time (Davila & Ditillo, 2017; Jørgensen & Messner, 2009, 2010; Van der Meer-Kooistra & Scapens, 2015) as well as over time (Christner & Strömsten, 2015; Revellino & Mouritsen, 2015).

This relationship between NPD activities and the various management control practices is often recursive in the sense that they influence and (re-)shape each other (Revellino & Mouritsen, 2009, 2015). This creates, as noted by Mouritsen et al. (2009), a situation where a set of sometimes competing information emanating from the various control practices provides different directions for the numerous NPD activities entertained by an organization. The authors show that the various controls that mediate between an organization’s NPD activities and wider organizational concerns frame “considerations about the value of innovation to the firm strategically differently” (p. 738). In other words, management control practices used in NPD settings provide different and sometimes competing perspectives on ongoing projects. These practices thus not merely reduce but rather contribute to the complexity of NPD activities as – through the way they frame certain projects – they point to or even create different ‘strategic’ directions that managers can head off (see also Jørgensen & Messner, 2009, 2010). Or, as argued by Revellino and Mouritsen (2009), “[r]ather than responding primarily to the strategic context and the uncertainties around the innovation, controls are involved more in trials around specific challenges to the development of innovation.” (p. 341). This perspective emphasizes that the multiplicity of management controls employed in NPD contributes to the creation of possibilities and opportunities rather than per se narrowing them.

But how do firms then decide which direction to take? This was not the focus in Mouritsen et al. (2009), nor in other works on management control and NPD. From a conceptual point of
view, the literature tends to treat the various control practices employed in NPD settings as equal. Prior research has thus tended to sidestep the question of management control practice hierarchies in favor of emphasizing the fluidity and temporariness of these practices. Problematizing this ‘analytical egality’ of controls, we argue that in complex NPD settings, there is a hierarchy of control practices. This means that some practices can be expected to be superior to others when it comes to controlling NPD activities. Even in dynamic organizational settings like NPD that are often depicted as being in a constant state of flux, we can assume that there is some stability and structure that serves more long-term organizational characteristics. Therefore, some control practices can be more important than others in the management of NPD activities if they enact something ‘bigger’ and relate to ‘grand’ organizational concerns.

To develop this argument, we draw on the theoretical notion of ‘anchor practices’ recently introduced to the management accounting and control literature by Ahrens (2018). From this perspective, control practices form hierarchies in which some practices control others in pursuit of more stable and long-term organizational concerns. Such ‘management control anchor practices’ provide structure by enacting an organization’s ‘constitutive rule’ and in this manner govern other (subordinate) practices. A constitutive rule characterizes the nature of an organization which relates to, for instance, its identity and “great and enduring” organizational concerns (Ahrens, 2018; Swidler, 2001, p. 79). Exploring such issues in an NPD context where multiple control practices are employed, we pose the following research question: How are management control anchor practices implicated in the management of complex NPD activities?

Our paper is based on a case study of ABB Robotics (Robotics) where we analyzed the NPD of industrial robot systems. Industrial robot systems are complex high technology systems which are developed in several parallel and interdependent projects. In such a setting, parallel NPD projects both share and compete for resources and – from a strategic point of view – are intended to deliver benefits which would be impossible if the projects were managed independently. We encountered situations of the kind Mouritsen et al. (2009) refer to where various management control practices provided managers with different perspectives on ongoing NPD projects. This was mainly because individual projects and related interests needed to be aligned with an overall portfolio perspective. This required coordination and at times led to conflict-laden situations that needed to be resolved.

Our case is informative for analyzing and discussing how management control anchor practices are implicated in the management of complex NPD activities. As Moll (2015, p. 9) concluded in her review, “[m]any studies have focused on project level accounting, ignoring
the role of accounting when NPD processes involve a portfolio of products…. Understanding the interactions between control elements operating at different levels is likely to require the development of new theoretical explanations.” In this vein, we mobilize the notion of management control anchor practices to theorize our empirical material and offer the following contributions to the accounting literature.

First, we contribute to the literature on management control in NPD settings by demonstrating that the ‘opportunity space’ within which managers maneuver complex NPD activities can be underpinned by a hierarchically arranged management control infrastructure governed by so-called management control anchor practices (Ahrens, 2018; Swidler, 2001). An anchor practice enacts an organization’s constitutive rule and hence long-lasting organizational characteristics, which in the case of Robotics was a strong commitment to be a technology leader. Management control anchor practices are in this sense more determinative in discussions about NPD activities and how the latter are framed with respect to wider organizational concerns and implications for the company (Jørgensen & Messner, 2009, 2010; Mouritsen et al., 2009). In this context, we illustrate how management control anchor practices frame certain concerns as more important than others during NPD and how this enables ‘anchored prioritizations’ in multi-project NPD settings.

The anchor practice in our case was an integrative liaison device (Abernethy & Lillis, 1995; Miller, 1988). Analyzing the functioning of this management control practice thus allows us to expand on prior studies that emphasize the importance of social controls in NPD settings (Bürkland, Zachariassen, & Oliveira, 2019; Feeney & Pierce, 2018; Van der Meer-Kooistra & Scapens, 2015). Integrative liaison devices play an important role as they support knowledge sharing and integration (Abernethy & Lillis, 1995, p. 167; Bürkland et al., 2019; Ditillo, 2004, 2012; Morris & Empson, 1998). However, if used as a management control anchor practice that enacts an organization’s constitutive rule and frames accountability-induced conflicts and negotiations in a highly visible way (Ahrens, 2018; Swidler, 2001), integrative liaison devices can have a controlling role in the creation of ‘anchored prioritizations’.

Furthermore, we contribute to the theoretical concept of management control anchor practices (Ahrens, 2018; Swidler, 2001) by specifying the analytical link between an organization’s constitutive rule and the strategies through which this rule is enacted. We illustrate that although an organization’s constitutive rule is relatively stable over time, it can be expressed through different strategies and hence enacted in various ways. Considering the dynamics between a long-lasting constitutive rule and more dynamic and adaptive strategies used to enact this rule, we argue that management control anchor practices play a crucial role
in avoiding situations where strategies are formed merely based on opportunism or short-term contingencies. Through their specific characteristics, they force managers to constantly go back to common structures (Ahrens, 2018, p. 66; Swidler, 2001, p. 85) and in doing so instill practice hierarchies with a spirit of “dynamic conservatism” (Ansell, Boin, & Farjoun, 2015) that prevents constitutive rules from collapsing. Management control anchor practices can in this vein enable a coexistence of stability and change in organizational practices such as NPD.

The paper is organized as follows: The next section reviews the literature on management control and NPD and explains the concept of management control anchor practices (Ahrens, 2018; Swidler, 2001) that – as we propose and illustrate in the present paper – can serve as a useful sensitizing device for researchers to identify and analyze interesting dynamics and tensions in complex NPD settings. The subsequent section describes our research methods. Finally, we present our case study of Robotics, followed by a concluding discussion.

2. Theoretical background

2.1 Management control practices and NPD – previous research

The role of management controls in NPD settings is a relatively young research domain (see Lukka & Vinnari, 2014) that emerged in the 1980s (Brownell, 1985; Rockness & Shields, 1984, 1988) and started to flourish in the late 1990s (see Davila, Foster, & Oyon, 2009). While early studies argued that financial control practices constrain NPD activities (Abernethy & Brownell, 1999; Abernethy & Lillic, 1995; Birnberg, 1988; Brownell, 1985; Hayes, 1977; Rockness & Shields, 1984), more recent reviews talk about a ‘new paradigm’ in terms of understanding the role of management control in NPD as rather enabling than constraining (Adler & Chen, 2011; Barros & Ferreira, forthcoming; Chenhall & Moers, 2015; Davila et al., 2009; Moll, 2015). This enabling role of management control practices in NPD settings has been illustrated through studies conducted in various contexts and on different hierarchical levels (Berhausen & Thrane, 2018; Curtis & Sweeney, 2017; Davila, 2000; Davila & Ditillo, 2017; Jørgensen & Messner, 2009; Miller & O’Leary, 2007; Revellino & Mouritsen, 2009).

A common theme in this paradigm is that the enabling function stems from the use of multiple control practices, ranging from a budget for development projects and financial measures, to non-financial measures, NPD stage gate models, project team composition guidelines and so-called integrative liaison devices such as cross-functional meetings (Bürkland et al., 2019; Davila, 2000; Henri & Wouters, in press; Revellino & Mouritsen, 2009, 2015).
Studies hence demonstrate that various types of technical and social controls co-exist and are made use of in the management of new product development projects. This multiplicity of controls has been studied through, for instance, the Simons (1995) levers of control framework (Bedford, 2015; Bisbe & Malagueño, 2009; Bisbe & Otley, 2004; Curtis & Sweeney, 2017), the notion of directional and inspirational systems (Davila & Ditillo, 2017), minimal structures (Feeney & Pierce, 2018; Van der Meer-Kooistra & Scapens, 2015) and mediating instruments (Carlsson-Wall & Kraus, 2015; Christner & Strömsten, 2015; Miller & O’Leary, 2007). Some studies analyze how management control practices change over time to maintain the enabling role in NPD activities (Christner & Strömsten, 2015; Revellino & Mouritsen, 2009, 2015) while others emphasize the combined use of different control practices at specific points in time (e.g. ‘at the gates’ in the state-gate process) when decisions need to be made (Jørgensen & Messner, 2009, 2010; Mouritsen et al., 2009).

The latter type of studies is of particular interest for this paper as it highlights situations where a set of sometimes competing information emanating from the various management controls employed provide different (potential) directions for NPD activities. As Mouritsen et al. (2009, p. 739) explain: “[management controls] challenge each other and develop organisational tensions and dialogues beyond innovation activities”. In their case, some control practices directed NPD activities to include a limited range of complex, sometimes exotic and expensive components, while others, in contrast, provided information that supported reducing complexity of components and the use of standard software packages (Mouritsen et al., 2009). Prior research hence demonstrates that the multiplicity of control practices used in NPD processes contributes to the complexity of this setting because they link these activities to and highlight different organizational concerns (such as complex and expensive components vs. standardized and less expensive components in Mouritsen et al. (2009), or modularization or not in Jørgensen and Messner (2009, 2010)). What previous research on management control and NPD hence demonstrates is that management control is “complexly intertwined with strategizing and other organizational practices” and “that the intertwining of organization and MCS contributes to shaping the future” (Ahrens, 2018, p. 63) of an organization’s NPD function.

But considering that the multiplicity of management controls opens for various potential futures and thus constantly “creates new space for management” (Mouritsen, Hansen, & Hansen, 2001, p. 221), the question arises how these practices render NPD a productive resource for the company and which NPD direction should be taken at a particular point in time? Here management control practices can also play an important role, yet previous research
has been relatively silent on this issue. Going back to Mouritsen et al. (2009), it can be asked which of the different strategies for NPD fashioned through the mediating role of the various management controls used should be prioritized? Should the company pursue an innovation strategy of tight customization through liberal use of externally sourced special and customized components (supported by certain management control practices) or should the company focus more on programmable standard components and software (supported by other management control practices)? In other words, while previous work has shown that multiple and competing management control practices open for various directions and ‘potential futures’ and in doing so create tensions in NPD, we know less about how priorities are formed in such situations. How do certain organizational concerns and related management control practices become more important and more guiding for managers than others?

With this particular focus, this paper sets out to add to the management control and NPD literature by exploring the above-mentioned issue both empirically and theoretically. From an empirical point of view, in a complex NPD setting such as the one for industrial robot systems, we can expect frequent tensions of the kind Mouritsen et al. (2009) as well as Jørgensen and Messner (2009, 2010) highlight. Some management control practices are likely to provide information that is used to find ‘optimal’ solutions for individual project’s requirements, while other practices (or combinations of practices) will supply information that can be utilized to establish prioritizations on a portfolio level and thus, ideally, satisfy most projects’ essential requirements. This implies that evaluation of each individual project, at times, becomes relative rather than absolute, as there are usually no clear-cut lines between success and failure of individual projects. Theoretically, we argue that when such priorities are formed and decisions about which NPD strategy to pursue are made, there is a hierarchy of control practices underpinning these processes and some practices can be expected to be more central than others in shaping how NPD decisions are made. These “more central, more controlling, more determinative” (Swidler, 2001, p. 81) control practices enable NPD activities by enacting more stable and long-term organizational concerns and thereby provide directions for how to prioritize between the competing NPD strategies. To develop this theoretical argument, we draw on Ahrens’ (2018) concept of management control anchor practices, discussed below, and position it in the NPD context.

2.2 Management control anchor practices and NPD – theoretical development

“Are all practices equal, or are some more equal than others” (Swidler, 2001, p. 79)? As mentioned above, organizations usually use different types of technical and social controls to
maneuver their NPD activities in uncertain and dynamic environments. These controls in different ways mediate between NPD activities and wider organizational concerns. Linking this observation to the opening quote by Swidler, one can ask whether the management control practices that organizations perform in NPD are all equally important or if there is some kind of structure that underpins the formation of priorities. Although not focusing on management control in NPD, a recent analysis of the structuring of multiple controls by Ahrens (2018) provides a fruitful analytical framing for this question. To explore such hierarchies of practices, Ahrens draws on the notion of anchor practices coined by Swidler (2001) and an in-depth study of “R”, a German retail bank. Based on an analysis of the interplay between R’s cost management and other control practices such as EFQM (European Foundation for Quality Management), he suggests that some management control practices are indeed more central than others and hence structure, control or ‘anchor’ (therefore their name) subsidiary control practices. In Ahrens’ study, R’s cost management turned out to be such an anchor practice and used “HR/IR1 practices for its ends, such as maintaining orderly industrial relations, preparing employees for the worst, and filtering out employees who were uninterested in R’s quality management practices” (p. 79).

But what renders these so-called anchor practices central and thus more determinative than others? Ahrens (2018) states that anchor practices provide structure and hence control subsidiary practices by enacting the constitutive rule of an organization. The constitutive rule “define[s] an entity’s nature as well as the identities of its members by constituting key social relationships” (Ahrens, 2018, p. 64). An organization’s constitutive rule is hence an expression of an enduring and relatively stable social structure that characterizes an organization and underpins its activities. Those management control practices that enact these constitutive rules can hence structure other practices. As management control anchor practices, they – in a disciplinary way – link subsidiary control practices to the organization’s constitutive rule. From this perspective, it can be expected that an organization’s NPD practices are structured by certain enduring and more long-term rules. Analyzing management control practices and NPD, researchers thus need to identify what this constitutive rule is in the organization they are studying and how it affects the forming of priorities. For instance, an early-mover organization that is constituted based on the notion of being a technology leader in a specific segment or industry that constantly pushes the boundaries of what is technically possible can be expected to organize and control its NPD activities accordingly; and differently from an organization that

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has a different self-understanding with respect to its position in its organizational field. Management control practices that enact this constitutive rule can thus be expected to be more central and determinative than others (Swidler, 2001, p. 81) in the management of NPD activities. Considering the mediating role of management control practices in NPD settings (Mouritsen et al. 2009), it can be argued that management control anchor practices contribute to the shaping of prioritized futures that are in line with an organization’s (long-lasting and relatively stable) constitutive rule and do not merely respond to shorter-term contingencies. This view adds to prior work on management control and NPD which has tended to sidestep theoretically and empirically the question of management control practice hierarchies in favor of emphasizing the fluidity and temporariness of control practices (Christner & Strömsten, 2015; Jørgensen & Messner, 2009, 2010; Mouritsen et al., 2009; Revellino & Mouritsen, 2009, 2015).

Ahrens (2018) further demonstrates how important antagonistic relationships are for the enactment of an organization’s constitutive rule through management control anchor practices. Anchor practices contribute to the formation of “common structures” to which negotiating parties return in order to engage one another” (Ahrens, 2018; Swidler, 2001, p. 85). Management control practices in this respect can help to make prioritizations in situations of competing NPD strategies since they bring together different actors and force them to “return to common structures” (Swidler, 2001, p. 85). What is crucial is that anchor practices are enacted in highly visible ways which contributes to their organization-wide acceptance. Ahrens (2018) illustrates that visibility can be ensured in different ways, for example, through certain events like annual congresses or particular organizational acts such as the sell-off of important technologies to competitors (p. 66). Looking at complex NPD settings with concurrent projects, such as our Robotics case, antagonism and visibility seem crucial aspects in controlling these activities. Managers usually have individual interests and accountabilities and can be expected to focus primarily on their own NPD projects. An important role of a management control anchor practices would thus be to ‘tame’ and align these different interests in a way that enables selecting directions that are in line with the organization’s constitutive rule. Visibility can support the acceptance of the anchor practice among the managers involved in the NPD process. It can also facilitate acceptance that these practices sometimes lead to outcomes that – although serving a ‘greater purpose’ for the organization – individual managers would perceive as suboptimal for themselves. Our theoretical approach thereby problematizes the ‘analytical egality’ of management control practices in prior studies on NPD and emphasizes the need for
stability and structure that serve more long-term organizational characteristics in complex NPD activities.

In his analysis, Ahrens (2018) furthermore discusses and illustrates the relationship between management control anchor practices and subsidiary practices. Subsidiary management control practices are structured and controlled by anchor practices, but they also flesh out these practices and with this also the functioning of the constitutive rule (Ahrens, 2018, p. 68). By looking at NPD settings and the multiplicity of management controls used, it can thus be argued that subsidiary management control practices, though disciplined and structured by a management control anchor practice, do not simply execute pre-defined scripts determined by the anchor practice (Ahrens, 2018, p. 66). Rather, subsidiary practices interact with the management control anchor practice in a way that enables the enactment of the latter and eventually the organization’s constitutive rule. As already mentioned, previous literature has demonstrated that various types of technical and social controls are made use of, ranging from NPD budgets, cost targets and sales measures to non-financial measures, NPD stage gate models, project team composition guidelines and so-called integrative liaison devices such as cross-functional meetings (Bürkland et al., 2019; Davila, 2000; Henri & Wouters, in press; Revellino & Mouritsen, 2009, 2015). As noted by Ahrens (2018), one cannot identify an organization’s constitutive rule and management control anchor practice before entering the field. In what follows, a case study of management control practices and complex NPD activities of industrial robot systems in Robotics is analyzed to explore these issues and demonstrate how they play out empirically. But first, the research methods are presented.

3. Research methods

The empirical focus of the paper is Robotics, a business unit within the ABB Group, which develops, manufactures, and sells industrial robot systems. At the time of our data collection, Robotics employed 600 people and was one of the world’s largest robot manufacturers, with an annual turnover of about 250 million €. All major functions of Robotics were located in Västerås, Sweden and the annual sales volume varied between 8,000-10,000 robots. Generous long-term access was granted which enabled us to, in an abductive manner (Ahrens & Chapman, 2006; Lukka & Modell, 2010), iterate between theoretical development, data collection and data analysis. In addition, an important criterion in selecting the case was the ability to study NPD conducted in several concurrent projects. An industrial robot system is comprised of three main parts, a robot (NPD project called Voyager), which performs the activities, a steering cabinet (NPD project called Endeavour), which steers and controls the
The case study is based on data gathered as part of a broader research study (including 88 semi-structured interviews) into the role of management control practices in Robotics’ intra- and inter-organizational NPD. This paper draws mainly on 49 of these interviews. Interviews were typically conducted in company offices, mostly tape-recorded and then transcribed and analyzed. In total, 35 people were interviewed, many several times, normally for one hour.

As shown in the appendix, interviews were conducted with employees at all levels in the company, including the top management and people working within purchasing, development, quality assurance, logistics, production, accounting, and sales. Each interview began with an introduction by the informant in which he/she clarified his or her current role and explained what he/she had been doing in his/her previous positions within Robotics. This introduction was followed by somewhat specific questions related to the role of management control practices and new product development and to the nature of the concurrent projects and the project portfolio. Finally, the informants were asked to recount other experiences that they deemed relevant to issues raised during the interview.

The interviews were supplemented with direct observations and archival studies. One researcher was given a desk in Robotics’ NPD department office. Here he could interact with engineers, purchasers, and quality and production personal. In addition, he shadowed a project manager, and participated in NPD meetings. In total, 22 days were spent at Robotics. Access to Robotics’ intranet meant it was possible to study project documentation in the form of power point slides, organization charts, minutes from meetings and process descriptions. These documents were used as complementary sources of information; for example, an interviewee...
might have talked about “the big order from customer X” and then the internal documents could confirm more specific time periods.

The data collection took place between 2002 and 2005. The long collection period was necessary because of the complexity of the setting and because we wanted to explore management control practices and NPD over time. Initially, data collection concentrated on securing a general understanding of the complexities of developing, manufacturing and selling industrial robots; here the importance of concurrent projects and the resulting challenges for management control were evident. We then followed the VEGA project portfolio, which was very important to Robotics, and later the focus shifted to the project level, more specifically the Endeavour project. Endeavour was the project name for the new steering cabinet that Robotics developed between 2001 and 2004, so we were able to follow some of the NPD processes in real time. We also followed the concurrent NPD projects Voyager (a robot project), and Apollo (a software project).4

The nature of the research process was similar to what Ahrens and Chapman (2006, p. 836) described when they argued that “[p]roblem, theory and data influence each other throughout the research process. The process is one of iteratively seeking to generate a plausible fit between problem, theory and data.” When collecting the empirical material, we were guided by a broad interest in management control practices and new product development. No formal coding program was used for the data analysis. First, each interview transcript and pertinent documents were read by the researchers. Then empirical data was arranged chronologically and common themes (project vs. portfolio tensions, management control practices such as Product Development Forum and Stage Gate Models) were identified. This first analysis indicated that we needed additional analytical concepts to interpret our data. Here the concepts of constitutive rule and management control anchor practices were employed; our analysis of field material in relation to the theoretical concepts took place entirely after the data was collected (see Ahrens, 2018, p. 67; or Ahrens & Chapman, 2004, pp. 284-285 for a similar discussion). As Ahrens and Chapman (2006, p. 836) put it: “Theory helps the author structure the masses of data and communicate its significance at the same time as it helps construct that significance.” Empirical material was related to the theoretical concepts of the study to draw unique insights. We re-organized the material around key events (e.g., launching the VEGA project portfolio, starting

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4 It is important to note that Endeavour is part of a new generation steering cabinets, which is very different from the previous generation. With a modularization design Endeavour is considered a new product category in Robotics. Voyager is a new type of advanced robot, which can lift 500 kg. It was in fact the first robot in the world that was designed to lift above 500 kg. Voyager was the start of a new product category for extreme heavy lifting robots (previous robot generations could lift 250-300 kg).
Endeavour, closing down Endeavour) and significant theoretical issues (constitutive rule, management control anchor practices, subordinate control practices, anchored prioritizations). Finally, the case analysis was written up where the emerging findings were compared to and contrasted with previous research to determine the insights unique to our investigation.

4. Case analysis

4.1 Developing robots that change the world – technology leadership as the constitutive rule

The construction of the robot was a white paper. It became an electrical robot with one of Sweden’s first microprocessors (Björn Weichbrodt, former CEO of ABB Robotics)

A central part of Robotics’ identity has always been about what they refer to as “technology leadership”. The company was formed in 1973 and in 1974, Robotics managed to develop the first electronically steered robot in the world. From a technology leadership perspective, this achievement is nowadays comparable to Tesla’s development of electrical cars. Previous robots had been controlled with mechanical steering, which was good for simpler tasks such as lifting, but with electrical steering, precision could be dramatically improved and enabled more difficult tasks such as welding. All our respondents made it clear that being a technology leader was not simply a slogan within Robotics. Rather, it was (and still is) an integral part of its organizational identity and – from a theoretical point of view – represents the constitutive rule (Ahrens, 2018; Swidler, 2001) that characterizes the nature of Robotics. The notion of being a technology leader also provided a specific identity for not only Robotics as such but also individual actors within the company. In the early stages of the company, the constitutive rule was enacted primarily by recruiting entrepreneurially minded engineers and socializing them into a “nothing is impossible” type of mentality (see Abernethy & Brownell, 1997; Collier, 2005). Personnel controls (see Merchant & Van-der-Stede, 2012, p. 88) thus traditionally played an important role within Robotic as it enabled the company to ensure that employees contributed to the enactment of the constitutive rule of being a technology leader. The company’s NPD strategy was basically to rely on the employees’ creativity and innovation skills and sell robots to those customers who wanted to experiment with robot automation and could afford to pay for them.

In the late 1980s however, the robot market started to change. European and North American automotive companies began to invest heavily in robot automation to prevail against their Japanese competitors such as Toyota and Nissan. To maintain their technology leadership,
Robotics changed NPD strategy and increased intimacy with specific automotive customer such as Volvo, BMW, General Motors and Ford. In this way, being a technology leader included paying close attention to the market size of the customer base(s) that showed interest in Robotics’ cutting-edge technology. Describing this new focus, one sales manager said:

We decided that we should start listening to the [automotive] customer. Up until that point, we had tried to sell what we had come up with ourselves. From 1991-92 we said, let’s do what the automotive customers ask us to. That was a really, really, big change…But it was a necessary move in order to stay at the technological forefront as we needed to combine our skills and knowledge with the knowledge of the leading automotive customers.

Being a technology leader was still what characterized the company’s identity and structured all their different practices. Hence, the constitutive rule remained stable. But the NPD strategy for enacting this rule changed. Being “the technology leader” by interacting closely with the automotive industry meant having a more customer-driven and cost-conscious new product development process. At this time, Robotics used what the Technology Director referred to as the “standard [management] control practices for new product development” such as Target Costing and Stage Gate Models. For instance, to meet cost pressures from automotive customers, a very ambitious cost reduction program called P25, which aimed at reducing product cost by 25% was launched. Remembering the situation, one R&D manager recounted:

Yes, that’s when the big cost-hunt started, the P25 program. The background was that Stelio Demark [CEO of Robotics in the early 1990s] saw the market development. I remember he had a favorite picture [chart] with the price development in the different parts of the world. He concluded that prices would be harmonized and that we had to cut costs by 25% to stay competitive.

Initially, the new NPD strategy was successful. Robotics managed to secure large orders from General Motors, Volvo and BMW and through close customer interaction it maintained its role as one of the leading robot manufacturers in the world both from a market share and technology perspective. However, due to strong price erosion in the automotive industry, it was estimated that future growth would come from other industries. Internally referred to as ‘potentials’,

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5 Robotics’ Stage Gate Model followed a standard format. It had seven gates where Gate 0 occurred when the project officially was started and Gate 7 occurred when the retrospective evaluation was done after each project.
examples of such new customers were the US Postal Service who wanted to automate the sorting of mail, IKEA who wanted to automate the production of flat packages, and Foxconn, a Chinese producer of electronic consumer products. A Robotics engineer stated enthusiastically:

Foxconn builds Ericsson, Nokia and Samsung [mobile phones]. They build iPods, they build laptops. They have over a half million employees. They can have 200,000 employees in one factory. In one factory! I mean…they need robots. There we have a large future customer…And the [novel and digital type of] knowledge these customers have is absolutely necessary to stay at the technological forefront.

Thus, for Robotics to continue to be a technology leader they had to utilize the knowledge and input from close interactions with automotive customers as well as electronics, food and pharmaceutical industry customers. The challenge, however, was that these ‘potentials’ wanted radically different industrial robot systems. For example, while automotive customers preferred robust solutions, ‘potentials’ preferred smaller and more flexible solutions. A normal size automotive factory has hundreds of large, medium and small robots which are combined into different production cells. Automotive customers therefore preferred large and reliable steering cabinets, since their main priority was to avoid costly breakdowns. The ‘potentials’, on the other hand, have few robots in their factories and their focus is on achieving flexible solutions and minimizing the factory floor-space taken up by the robot and the steering cabinet. These customers therefore wanted small and flexible steering cabinets. To deal with this customer heterogeneity, Robotics therefore launched the ambitious VEGA project portfolio in 1999, which, as previously mentioned, included the development of three critical products: a new large robot (Voyager), a new modular steering cabinet (Endeavour) and a number of software products (Apollo). To emphasize the significance and challenge of VEGA, it is important to note that Robotics had never dared to launch three large new product development projects at the same time. From a financial perspective, product development costs would increase, but there would also be larger technical risks when functionality from three important products would have to be integrated. The VEGA project portfolio was the biggest NPD initiative in Robotics’ history and illustrates how the NPD complexity in enacting the constitutive rule increased dramatically. It led to the emergence of a new management control infrastructure and hierarchy of different types of management control practices. We turn to this issue next.
4.2 The VEGA portfolio – Increased complexity in enacting Robotics’ constitutive rule and the emergence of a new management control infrastructure

To improve planning and follow-up of the individual NPD projects, Robotics mandated that each project should develop two documents: the Market Requirement Specification (MRS) and the Technical Requirement Specification (TRS). The MRS focused on commercial issues where Robotics’ overall strategic plan served as input for choices regarding the project’s positioning, pricing and profitability. The MRS included financial measures, such as the revenues, costs and internal rate of return (IRR) of the project which was used to assess the project’s profitability. For example, describing the formalization of customer input into a MRS to be able to coordinate various activities and to ensure that customer requirements are fulfilled, one product manager mentioned:

In the last couple of years, we have started to make a more formal market requirement specification. Now product development and the sales department come together and write down what the customers want. We need to listen to the market… but of course it’s easier said than done.

The TRS, on the other hand, described the technical challenges for each project and ways of dealing with them, thereby translating customer input in the MRS into concrete design choices. A R&D manager described the translation process from market to technical requirements as follows:

First you write a Market Requirement Specification. That document is then translated into a Technical Requirement Specification. What we have now achieved is that we now have a document with figures and diagrams where everyone knows what is important and why.

The TRS focused on the technical aspects and included non-financial performance measures like the ‘mean time between failures’ (number of stops in relation to production time) or ‘mean time of repair’ (the time it takes to fix a stop). The number of pages in the TRS varied depending on the technical complexity of the individual projects but was normally at least the same number as the MRS (i.e. 60-80 pages).

To handle coordination issues between the different parallel projects, Robotics introduced an additional management control practice labelled the Product Development Forum (PDF). In this cross-functional group, the technical director, product managers, production managers,
project managers and sales managers made decisions regarding the prioritization between the concurrent projects by incorporating the overall VEGA portfolio (rather than just the individual project) perspective. In interviews, several participants of the PDF stressed the importance of this forum as it created an arena in which the individual project representatives needed to explain how their individual project decisions influenced other projects. The PDF can hence be theorized as an integrative liaison device that facilitated coordination and dealing with reciprocal interdependencies as it allowed “regular, personal, and intensive contact among experts and decision makers of different departments [and NPD projects]” (Miller, 1988, p. 286; see also Abernethy & Lillis, 1995). Describing the PDF, a R&D manager said:

The Product Development Forum is where you discuss the entire project portfolio. If something is starting to drift and affect something else… is it acceptable? In the Product Development Forum, you discuss the overview.

Describing the challenges with prioritizations, time pressure and constant debates in the PDF, the product manager for Endeavour stated:

Much of the work is about discussing pros and cons with different options. To try to prioritize with the limited resources that we have. There are constant debates… I wish I had a mathematical model that would calculate what to do.

We were able to observe that the PDF was a crucial control practice within Robotics to enact the constitutive rule of being a technology leader. The PDF helped to manage the increased NPD complexity that resulted from the NPD strategy of closely interacting with customer groups with radically different needs when it comes to developing robot solutions. It formed a cross-sectional platform for discussion and arriving at decisions that were in line with Robotics’ idea of being a technology leader through close interaction with automotive as well as electronics, food and pharmaceutical industry customers.

Overall, the new VEGA project portfolio launched in the late 1990s introduced a new formal management control infrastructure with various types of management control practices. It was a reaction to the increased complexity that Robotics had to handle because of firstly, its new and more heterogeneous customer base and secondly, the more complex design of the VEGA portfolio that led to changes in the way new product development was conducted within Robotics. In the following sections, we will ‘zoom in’ and analyze in more detail the management control related dynamics as well as the functioning and interrelation between the
different types of management control practices used within Robotics to coordinate and manage the new VEGA portfolio. To carve out and discuss the theoretically relevant dynamics and mechanisms, we will thus focus on the story of Endeavour (the steering cabinet).

4.3 Planning Endeavour and positioning it vis-à-vis parallel projects – the functioning of the PDF as management control anchor practice

When the Endeavour project commenced in January 2001, there were strong technical interdependencies between the projects because the function required to run a 500 kg robot would have difficulties to work with the previous generation of the steering cabinet and software. The Endeavour project manager also emphasized temporal interdependencies between the projects because all three projects needed to be completed before their integrated benefits could be realized. As he put it: “It was made perfectly clear to us, Endeavour needed to be finished on time.” The TRS showed how the integrated robot solutions would reduce the customers’ total cost of ownership. For example, rather than carrying out costly tests before a robot system was ready for production, the software in Apollo made it possible for the customer to simulate all robot systems in the computer and start production directly. The difficulty of managing competing customer needs was stressed in the Endeavour TRS:

It is clear that for almost any industrial robot system sold there are customer demands that cannot be met, and in some cases (not infrequently) an order is lost due to mismatch with the demands. There is no such thing as a standard steering cabinet. The demands between different customers vary a lot, and there is no reason to believe that there will be a change in the future.

The Endeavour MRS cost targets and TRS technical targets were primarily linked to the focus on ‘potentials’ and, therefore, as both the Endeavour project members and managers in the PDF emphasized, their requirements should be given high priority when designing Endeavour. But, as noted by the Technical Director, automotive customers were important too and their requirements should also be considered. To satisfy the requirements of both automotive customers and ‘potentials’, the Endeavour project team had to work hard with the technical design. The principle challenge was to reduce the size of the cabinet (as requested by the ‘potentials’) at the same time as robustness would be preserved (as requested by the automotive customers). The Endeavour project members engaged in intense discussions about how to achieve the targets set for the various non-financial measures in the TRS: in particular ‘mean
time between failures’ and ‘mean time of repair’. Since these measures were considered to be critical for the automotive customers, but less important for the ‘potentials’, the targets were debated.

The Endeavour project manager even said it was “almost [a] mission impossible”, because the Voyager project was being developed ahead of time. He described how the project team came to the point where they were “desperately trying to come up with anything that would take the project forward”. An innovative, but risky, solution that emerged was a modularized steering cabinet. In pre-studies, this type of design had been turned down because there was a high risk that the non-financial metrics in the TRS would not be met. The modularization design implied that instead of having one large cabinet, Endeavour could be built around three different modules or what were internally referred to as “suitcases”. The Endeavour project team modified it into a radical and highly unconventional solution which was suggested to the PDF. Rather than focusing on the technical risks, the Endeavour project manager urged the PDF to see how this extreme modularization would increase customer flexibility which suited the ‘potentials’. For example, customers such as Nestlé and IKEA, with limited factory space, could place one suitcase next to the robot and then the second or third in the storage room or under conveyer belts. By designing the technical aspects of Endeavour in this modular way, the size of each robot cell would shrink, which meant less factory space and thereby a more attractive offer to these customers.

Opinions in the PDF were split. For example, the sales manager for automotive customers described how automotive customers might be pushed “out of their comfort zone”, since he feared that this design would endanger the non-financial metrics in the TRS. In addition, the production manager described how both production processes and logistics might become more expensive if such a radical design was approved. The Endeavour project manager was fully aware of these shortcomings but argued in the PDF that since Endeavour costs and technical targets were based primarily on selling to ‘potentials’, this radical design should be accepted to make it possible to move the Endeavour project forward. When describing the debates in the PDF, the Technical Director explained that after intense discussions, the Endeavour project team was allowed to move forward with the “suitcase” design. All members of the PDF emphasized that this design concept had great potential, but that as it involved such high risk it would not normally have been approved.

The MRS also described how Endeavour needed to focus on reducing product cost by 25%. Due to increased competition, there was an “upper-limit price tag” regardless of how many new features Endeavour included:
From the cost-reduction standpoint, the product cost level of today’s system is too high, that is margins are too low. Over time, competition will also force us to continuously reduce the prices. Independent of how much customer value we can add to the system, there is an upper-limit price tag [excerpt from Endeavour’s MRS].

The 25% cost target was set by using historical trends and forecasted price erosions. This was calculated on 4% annual cost reductions and a product life cycle of six years. This cost reduction metric became the main financial target when the Endeavour project manager was evaluated at each gate in the Stage Gate Model. However, the actors in the PDF explained that they complemented the MRS of Endeavour with additional calculations that incorporated the VEGA portfolio perspective. For example, there was one systems configuration of Voyager, Endeavour and Apollo for picking and packaging that suited new customers (i.e. Foxconn, IKEA and US Postal Service) and another systems configuration for large automotive customers. In other words, there were different ‘versions’ of VEGA catering to the needs of different customers. Consequently, even though Endeavour was developed as a single project and could technically be sold to customers as a stand-alone end product, the Endeavour project manager was also evaluated based on profitability calculations for the entire VEGA portfolio. In this respect, the VEGA profitability calculations for which the Endeavour project manager was partly made accountable were affected by the performance of the two other projects. Evaluating project managers partly on factors they could not influence was something completely new at Robotics and broke from previously established accountability structures that focused on individual projects and their stand-alone performance. Accountability structures clearly changed due to the calculations made in the PDF, which, as explained by the project manager, created a new need for coordination among the different managers involved:

I can influence the outcome of the IRR calculation for my own project, but the financial outcome of the whole portfolio was something else, something outside my control. We needed to coordinate between the three projects and were forced to also keep track of the portfolio perspective.

6 The same also applied to the project managers of the two other projects who, from a Vega point of view, were partly also made accountable for the performance of Endeavour.
4.4 Economic downturn and increased focus on automotive customers – (re-)adjusting the strategies to enact the constitutive rule

In the early spring of 2001, Robotics’ overall sales forecasts indicated a dramatic negative change. Instead of selling between 12,000 and 13,000 robot systems, as had been predicted in the fall of 2000, the loss of primarily ‘potentials’ indicated an annual sales volume as low as 8,000. To maintain their role as technology leader, Robotics managers realized that they needed to shift back to a primary focus on large automotive customers who could quickly give a large boost to the revenue if a deal were to be won, and whose knowledge would be most important when further developing innovative robot solutions. As noted by the Endeavour project manager, this came as “a shock” for his project team since the ‘potentials’ had been the most important customers in the Endeavour MRS and TRS. However, pleasing the automotive customers was difficult because they often demanded considerable customization. A senior engineer described how Robotics tried to please BMW:

BMW was offering us a very larger order, 4,000-5,000 robots, or at least several thousand robots. However, for different reasons, BMW did not like [SC4, the existing generation of steering cabinets, i.e., the predecessor of Endeavour]. We therefore made a customized version for them. First prototypes, you know demonstration examples, just to show them something.

Even though the BMW order was important, the project manager of Endeavour was hesitant because BMW’s demands ran counter to the technical design laid out in the TRS. Instead of making a smaller steering cabinet, BMW wanted a large steering cabinet so that customer-specific features could go inside the cabinet. The PDF realized that Robotics needed large volume orders to meet sales targets. However, information from the Endeavour TRS and MRS showed that BMW’s demands could not be incorporated into the Endeavour project without high costs. Endeavour had just passed Gate 2 and the costly and time-consuming new product development work had already begun. Adding BMW’s demands would make it more challenging for the Endeavour project to achieve its targets specified in the MRS, TRS and Stage Gate Model. In addition, the technical uncertainty would increase dramatically with the risk of not completing the project on time and therefore ending up without a new version of the steering cabinet. Meeting the deadline was considered very important because, as previously mentioned, the Endeavour deadline had been set in relation to the Apollo and Voyager deadlines. The technical director commented:
The information from Endeavour’s Stage Gate Model was really important. At such a critical stage, we did not want to disturb the development of Endeavour.

The Endeavor project team emphasized the importance of letting them continue according to the plan with the suitcase design. When the managers in the PDF analyzed the information from the Stage Gate Model and MRS for Endeavour, they made a prioritization. To buy time, a small prototype budget was allocated to the team responsible for the BMW order. Robotics’ experience was that customer requirements often changed during contract negotiations and the hope was that by developing prototypes they could temporarily please BMW.

At about the same time, Peugeot and Renault also questioned the technical design in Endeavour. In addition to demanding a larger steering cabinet, they also wanted improved usability. The PDF therefore faced a dilemma. They could secure sales in the short term, but from a long-term perspective, Peugeot’s and Renault’s requirements were inconsistent with the design choices made in Endeavour. During the summer of 2001, tensions increased in the PDF. The sales manager wanted speed and customization whereas the technical and the production managers wanted standardization to make the steering cabinet easy to produce. A production manager commented:

We had a sales organization that focused on customer orders and a product organization that was responsible for products. Sales was much quicker and flexible, did not optimize costs, quality or how it was produced. It was more “we have an order, we have to fix it!” When several customers wanted the same thing, we realized it was time to make a standard product out of this.

Eventually the PDF decided to start a new development project, SC4Auto. This meant that the VEGA portfolio now consisted of four projects, two of which were steering cabinet projects (Endeavour focusing on ‘potentials’ and SC4Auto focusing on the automotive customers). Once again, the managers involved in the decision emphasized the importance of the information from the Endeavour TRS and MRS. They argued, based on information from these two management control practices and the fact that Endeavour had just passed Gate 2, Endeavour should not be disturbed. From a theoretical point of view, it is thus evident that information from the Endeavour Stage Gate Model, MRS and TRS were mobilized to frame the project as important and in line with the constitutive rule (i.e., that Robotics should be a
technology leader for both automotive customers and ‘potentials’). Changing Endeavour would undermine this rule as the new growth customers would not be satisfied with the type of steering cabinet that automotive customers wanted and apparently this was also the case vice versa. Relating the individual project to the VEGA portfolio perspective through the skillful use of information from these management control practices was important for the decision to start the new SC4Auto project, which focused on automotive customers. Having now two different steering cabinets within the VEGA portfolio should, according to the managers in the PDF, enable the enactment of Robotics’ constitutive rule of being a technology leader. The decision was seen as an acceptable prioritization since it protected the Endeavour project, which was at a critical stage and considered crucial for the ‘potentials’, and at the same time temporarily satisfied BMW, Peugeot and Renault.

4.5 Closing down Endeavour – the disciplining role of the PDF as management control anchor practice

In the fall of 2002, the global economy was in a steep downturn. This was evident to some extent for the automotive customers but much more so for the ‘potentials’ who drastically reduced their investments and willingness to interact with Robotics to share knowledge about new and innovative technological solutions. Even though Endeavour continued during 2001, it was challenged in the fall of 2002 in spite of the fact that information from Endeavour’s Stage Gate Model, MRS and TRS all showed that everything had gone according to plan, both in terms of technical content and costs. But by now, prototypes of Endeavour had also been delivered to automotive customers. Even though the idea of modular ‘suitcase’ architecture had been intensely debated internally, this was the first time a full prototype was demonstrated externally to the automotive customers. Shortly after, strong criticism emerged because it was obvious that the technical solutions could be associated with a considerable risk that quality would be compromised, and more specifically, the targets for the non-financial measures of ‘mean time between failures’ and ‘mean time between maintenance’ in the TRS were questioned. Describing the quality risks in Endeavour, a project member said:

I felt something was bound to happen. I mean, it felt damn strange with some solutions [in Endeavour]. One main thing was cables. I felt this is not going to cut it. We do not have a good solution [for the automotive customers].

However, because of the previous decision to start the new project SC4Auto, there were now two competing profitability calculations available to the PDF (one for Apollo, Endeavour,
Voyager; and another for Apollo, SC4Auto, Voyager). In these calculations, the strong criticism voiced by the automotive customers, who perceived the Endeavour prototypes as too radical in their mechanical design, needed to be considered. In addition, information from the SC4Auto Stage Gate Model and the MRS and TRS showed that the functionality had been well received, but some critical quality problems for the automotive customers remained. Seeing an even more radical design in Endeavour, the managers in the PDF argued that automotive customers would most likely refuse to buy Endeavour even if they extended the project’s deadlines. Hence, Endeavour would never be a suitable solution for the automotive customers. One reason why the design risks had not been adequately examined when Endeavour started was that the technical demands from electronics, food and pharmaceutical customers had been prioritized in the initial TRS. However, as already mentioned, by the fall of 2002 circumstances had changed. Instead of radical solutions for these customers, Robotics had re-focused on automotive customers as their key customers. This meant that the profitability calculations for Apollo, SC4Auto and Voyager became better than those for Endeavour. Discussing the close-down of Endeavour, one project member in Endeavour said:

Initially, we focused on the [‘potentials’] but then we changed to automotive over time…

But, I mean the original goal was not to please them [the automotive customers], but to target the rest [i.e., the electronics, food and pharmaceutical industries]… Automotive would have been addressed first after testing Endeavour on other customers.

Eventually the PDF decided to close down the Endeavour project, in spite of the fact that Endeavour’s Stage Gate Model, MRS and TRS showed that both technical targets and cost targets were met. In other words, from an individual perspective the project was progressing well and can be considered as successful. From an overall company perspective and in the light of Robotics aspirations with the VEGA portfolio, Endeavour could not, however, prevail against SC4Auto. As one product manager described it: “At first, you did not want to see it. It was too terrible to be true. We would normally never consider closing down a project so late in.” The main reason was that compared to Endeavour, SC4Auto was more in line with the constitutive rule of being a technology leader as the enactment of this rule was now made through the NPD strategy of mainly focusing on the automotive industry (and the strategic downplaying of ‘potentials’ who were interested in Endeavour). When explaining this decision, the technical director emphasized that important information required to arrive at this decision was provided by management control practices in the form of the SC4Auto’s Stage Gate Model,
MRS and TRS. Parallel to the critique of Endeavour, positive customer feedback from automotive customers on the SC4Auto had been received. The managers in the PDF realized that many automotive customers would most likely completely refuse to buy Endeavour, and request to buy the SC4Auto instead.

From a theoretical point of view, the PDF as a management control anchor practice in this sense was vital in enacting the company’s constitutive rule. In our case, this meant closing down Endeavour primarily based on information from other management control practices such as Stage Gate Models, MRS and TRS. It is also evident that the Endeavour project manager’s early emphasis on protecting Endeavour from disturbances, which led to the start of SC4Auto and at that time was seen as a reasonable prioritization, eventually led to the closing down of Endeavour when a different way of framing and positioning the project was emphasized at this later stage to enact the constitutive rule.

5. Concluding discussion
Based on a case study of Robotics, a producer of industrial robot systems, this paper analyzes how management control anchor practices are implicated in the management of complex NPD activities. Drawing on Ahrens (2018) and Swidler (2001), we show how the launch of an NPD portfolio called VEGA, comprised of three individual NPD projects (Endeavour, Apollo and Voyager), was vital in enacting the case company’s constitutive rule of being a technology leader and gave rise to a new management control infrastructure from which a particular management control anchor practice, the so-called Product Development Forum (PDF), emerged. In the form of an integrative liaison device (Abernethy & Lillis, 1995; Miller, 1988), the PDF was employed by a cross-functional management team to control both individual NPD projects and the overall project portfolio. We furthermore show how, over time, the enactment of Robotics’ constitutive rule changed as the NPD strategy (re-)focused on close interaction and knowledge exchange with primarily automotive customers and how this eventually affected how NPD activities were controlled by the PDF.

We contribute to the literature on management control and NPD (e.g. Davila & Ditillo, 2017; Jørgensen & Messner, 2009, 2010; Mouritsen et al., 2009) by focusing on how NPD activities are managed through management control anchor practices and how these interact with subordinate control practices. Additionally, we contribute to the notion of management control anchor practices (Ahrens, 2018; Swidler, 2001) by demonstrating how an anchor practice can emerge from adjustments made to NPD strategies in order to enact a constitutive
rule and by discussing how the specific nature of an anchor practice relates to the organizational context in which it is used. These contributions are elaborated below.

5.1 The role of management control anchor practices in complex NPD activities

Previous studies show that organizations employ a multiplicity of management controls to manage their NPD activities. Contrasting early studies in that field (Abernethy & Brownell, 1997; Abernethy & Lillis, 1995; Birnberg, 1988; Brownell, 1985; Hayes, 1977; Rockness & Shields, 1984), more recent research demonstrates that management control practices do not merely constrain but also in various ways enable NPD (Adler & Chen, 2011; Barros & Ferreira, forthcoming; Chenhall & Moers, 2015; Davila et al., 2009; Moll, 2015). Consequently, one important aspect is that management control practices mediate between an organization’s NPD activities and wider organizational concerns (Jørgensen & Messner, 2009, 2010; Mouritsen et al., 2009; Revellino & Mouritsen, 2009). In doing so, they are closely involved in creating an ‘opportunity space’ for management (Goretzki, Mack, Messner, & Weber, 2018, p. 497; see also Mouritsen et al., 2001) in the sense that through framing certain NPD activities differently, the multiplicity of management controls enables managers to see various potential directions or ‘futures’ and their respective implications. However, considering that different management controls allow for different and sometimes competing perspectives on the same project (see Mouritsen et al., 2009), the opportunity space they create has an equivocal nature that contributes to the complexity of managing NPD activities. The complexity further increases with the number of concurrent NPD projects. While we know from previous research that multiple and competing management control practices open for various directions, we know less about how priorities are formed in such situations. Are all management control practices and potential directions or futures they open equal or are some “more equal than others” (see Swidler, 2001, p. 79)? If some practices are more important or determinative than others, what exactly grants them this prioritized significance? This was not the focus in Mouritsen et al. (2009), nor in other work on management control and NPD that has focused on emphasizing the fluidity and temporariness of control practices (e.g. Christner & Strömsten, 2015; Revellino & Mouritsen, 2009).

We problematize this ‘analytical egality’ of controls and add to the ongoing research conversation on management control in NPD settings by exploring how (control) priorities are formed as well as how and why certain management control practices become more guiding than others. Drawing on the case of Robotics, this paper demonstrates that the opportunity space within which managers maneuver complex NPD activities can be underpinned by a
hierarchically arranged management control infrastructure governed by management control anchor practices (Ahrens, 2018; Swidler, 2001). The latter assume a “more central, more controlling, more determinative” (Swidler, 2001, p. 81) role in this arrangement as they enact the constitutive rule that characterizes the organization (Ahrens, 2018, p. 58).

In the case of Robotics, this constitutive rule was a strong commitment to be a technology leader. Although relatively stable, this rule was enacted in different ways with regards to the customer group(s) towards which it focused its NPD-related aspirations. At times, the enactment of the constitutive rule was narrower (focusing on automotive customers), while at other times more open (for automotive as well as the ‘potentials’, i.e. electronics, food and pharmaceutical industry customers). The broadening of the targeted customer base through the inclusion of the so-called ‘potentials’ increased the complexity of managing NPD activities and eventually the enactment of the constitutive rule. A crucial part of this was the shift from an NPD project to a project portfolio perspective. The changes in the enactment of the constitutive rule also gave rise to a new management control infrastructure at Robotics consisting of various management control practices. Analyzing this infrastructure, our study illustrates that management control in concurrent and interdependent NPD projects can be challenging and conflict laden as NPD is carried out through various concurrent projects in which various groups of actors with different views, interests and accountabilities are involved. Specific management control practices play a crucial role in managing such tensions and assume a dominant role; they become management control anchor practices (Ahrens, 2018; Swidler, 2001). In Robotics’ case, the Product Development Forum (PDF) constituted such a practice and disciplined NPD projects and related management control practices, i.e. the Market Requirement Specification (MRS), Technical Requirement Specification (TRS) and Stage Gate Models.

By studying how management control practices were used at Robotics and how they were related to the increasing complexity in the NPD process, we show that management control anchor practices frame processes of prioritization between individual projects and the project portfolio level. For instance, when key customers such as BMW and Peugeot wanted a larger steering cabinet at a time when Endeavour focused on making the steering cabinet smaller to satisfy the needs of ‘potentials’, the various project-level management control practices in place (i.e. the MRS, TRS and Stage Gate Model) were mobilized in the PDF to flesh out a pragmatic decision in which the Endeavour project was further pursued and a new (additional) project, which explicitly focused on the needs of automotive customers, was launched. When the ‘potentials’ became important customers and market changes were regarded as more
strategically important for Robotics, the enactment of the constitutive rule of being a technology leader became more challenging. This was especially evident because customer requirements became more heterogeneous, which led to control challenges when individual projects were not able to satisfy all customers’ needs. In such situations, the PDF enabled decisions that though considered optimal from an overall project portfolio perspective were sometimes sub-optimal for the individual project managers. Management control anchor practices can hence enable what can be referred to as an anchored prioritizations, which is crucial and a means by which to flesh out the functioning of the organization’s constitutive rule (see Ahrens, 2018).

We furthermore observed how the PDF interacted with other management control practices, namely the MRS, TRS and the Stage Gate Model. Interesting dynamics surfaced in this respect, especially with regard to Endeavour, which started as a project that focused on ‘potentials’, i.e. the new growth customers. As long as ‘potentials’ were considered as key customers, it was possible for the Endeavour project manager to frame this project as part of enacting the company’s constitutive rule. Mobilizing information from the project level management controls in the PDF helped him to safeguard Endeavour and restrain others from shutting it down. However, when Robotics shifted back to automotive customers, management control practices allowed for framing SC4Auto as more relevant, which eventually led to the ‘anchored prioritization’ of shutting down Endeavour. This was a striking decision because according to the MRS, TRS and Stage Gate Model, the Endeavour project was progressing well. Put in the context of information about other NPD projects and from the portfolio perspective emphasized in the PDF, however, it was framed in a more unfavorable way. The survival of the Endeavour project was thus closely related to how Robotics enacted its constitutive rule of being a technology leader, to how narrow or broad with respect to the customer base the respective strategic pursuits linked to the enactment of this rule were, and to how NPD activities were controlled.

The main management control practice guiding the process of adjudicating on the survival of the Endeavour project was the PDF. All other management control practices that were part of Robotics’ NPD management control infrastructure were subordinate to the PDF. The PDF structured and controlled the various NPD activities in a way that aligns with Ahrens’ (2018, p. 61) notion of management control anchor practices. It enabled (i) the enactment of the company’s constitutive rule of being a technology leader, (ii) enacted “antagonistic social relationships”, namely the relationships between different project managers, and (iii) was enacted “in a highly visible way” as all NPD project managers participated in the meetings and were involved in the decision-making process. Referring to prior research (Mouritsen et al.,
2009; Revellino & Mouritsen, 2009), we demonstrate that some management control practices (more than others) govern the space that management controls create for managers (see Ahrens, 2018; Swidler, 2001). Management control practices used in NPD settings consequently form a hierarchy. At the top of this hierarchy are management control anchor practices that are more determinative and controlling in discussions about NPD activities and how the latter are framed with respect to what Mouritsen et al. (2009) and Jørgensen and Messner (2009, 2010) refer to as wider organizational concerns. The theoretical concept of management control anchor practices thereby helps us understand why certain organizational concerns become ‘more important’ than others.

We reason that in the case of Robotics, the specific type of management control used as an anchor practice – an integrative liaison device (Abernethy & Lillis, 1995; Miller, 1988) – played a crucial role for handling the NPD related complexity. We thereby add nuances to previous studies that emphasize the importance of dialogue and interaction and the associated use of social controls in NPD settings (Bürkland et al., 2019; Feeney & Pierce, 2018; Van der Meer-Kooistra & Scapens, 2015). Previous studies demonstrate that management control practices like integrative liaison devices play an important role in this respect as they support as well as guide knowledge sharing and integration (Abernethy & Lillis, 1995; Bürkland et al., 2019, p. 167; Ditillo, 2004, 2012; Morris & Empson, 1998). Robotics’ PDF was such an integrative liaison device that aims at the integration of different actors and their knowledge to manage complex settings or situations. In this regard, Miller (1988) stated that “complexity creates reciprocal interdependencies that require close contact among managers (Galbraith, 1973; Thompson, 1967). Integrative liaison devices such as task forces and committees that allow regular, personal, and intensive contact among experts and decision makers of different departments [and projects] greatly facilitate such collaboration” (p. 286). Abernethy and Lillis (1995) further argue that “[t]hese co-ordination mechanisms provide a means of breaking down the functional [or other forms of formal] barriers imposed by mechanistic organizational structures” (p. 244). In our specific setting, the PDF was key when managers made ‘anchored prioritizations’ as it broke down (at least temporarily) the barriers between the individual projects and ‘forced’ senior managers to take on a ‘portfolio perspective’.

The PDF was used to enact Robotics’ constitutive rule, to frame conflict and negotiations between the different NPD managers concerned (antagonism) and was highly visible. All managers could see what happened and everyone else saw it as well (Ahrens, 2018, p. 61; Swidler, 2001, p. 87), which was crucial to enabling ‘anchored prioritizations’ (e.g. keeping Endeavour alive or closing it down). In this form of integration, it seems important to emphasize
the embeddedness of the different projects also from an accountability point of view. As described in the empirical section, among other types of information, the PDF mobilized profitability calculations that related to the actions of the concurrent projects. Thus, project managers were partly evaluated based on actions that were, prima facie, outside their control but which could be influenced through interaction with the other projects. In this way, management control practices were used to establish a link that bridged the differences between projects without harming the need for the individual projects to be unique. The PDF was in this sense used to frame accountabilities in a socializing way (Goretzki & Messner, 2016; Roberts, 1991).

Looking at this from an anchor practice perspective and highlighting the characteristics of especially ‘antagonism’ and ‘visibility’ hence adds to our understanding of the functioning of integrative liaison devices in NPD settings. If mobilized as management control anchor practice, integrative liaison devices can go beyond the ‘pure’ sharing and integration of knowledge. They can play a crucial role in framing accountability-related conflicts and through enacting an organization’s constitutive rule, they contribute to (or even enforce) ‘anchored prioritizations’. In this manner they avoid short-term opportunism and ad-hoc decisions taken by individual top managers (as was, for instance, seen in the Jørgensen and Messner (2009, 2010) case). Future micro-level research is needed to better understand the functioning of integrative liaison devices as management control anchor practice. For instance, how do participants mobilize different types of information to make sense of and assign significance to certain situations? Considering the framing of antagonism through integrative liaison devices, such discussions can be highly political, conflict-laden and characterized by uncertainty and/or ambiguity. Previous management control research in NPD settings has not paid particular attention to such micro-level dynamics. Research based on observations of discussions and debates in empirical settings like Robotics’ PDF and how managers establish ‘anchored prioritizations’ as well as how different types of information are mobilized in such situations can provide important contributions to our knowledge about the use of management control practices in complex NPD activities.

5.2 The relationship between a constitutive rule and its ‘dynamically conservative’ enactment

In addition to the contribution to the management control and NPD literature, our study adds to the notion of management control anchor practices (Ahrens, 2018; Swidler, 2001). More specifically, we elaborate on the analytical link between an organization’s constitutive rule and the strategies through which this rule is enacted. A constitutive rule characterizes an
organization, shapes its members’ identities and relates to the long-term and relatively stable objectives. It thus relates to the DNA of an organization. At Robotics it was evident that the strong commitment to be a technology leader that constantly creates novel ideas formed the company’s constitutive rule. Although this rule and the associated ambition was stable over time and never challenged, we saw that it was enacted in various ways. This was mainly due to variations in the economic environment that gave rise to changes in the potential market size and characteristics (e.g. relevant customers). This, in turn, led to distinctive technological preferences (e.g. modularity) but also an increased importance of notions like profitability. Making sense of the changing circumstances, managers at Robotics modified the company’s strategic pursuits in the belief that those adapted NPD strategies are the best to keep enacting the company’s constitutive rule. These adaptations, however, increased the overall complexity of managing NPD processes, which in turn gave rise to the management control infrastructure elaborated on above.

The case of Robotics therefore allows for discussing important analytical nuances with respect to the management control anchor practice framework. At first sight, it may appear as the NPD approach at Robotics was constantly in flux and that this was also related to changes in the organization’s fundamental characteristics. Analyzing the situation in more detail, however, we can see that the changing strategies relate to different ways of enacting the same constitutive rule; namely to be a technology leader. Given that circumstances change, enacting this rule might require modifications in the strategies. In this sense, Robotics enacted its constitutive rule in a ‘dynamically conservative’ (a term borrowed from Ansell et al. (2015) way. To maintain the constitutive rule that characterizes the organization and shapes its (as well as its members’) identity, it sometimes needs to adjust the way this rule is enacted, while keeping the rule stable. At Robotics, these modifications of how the commitment to technological leadership was enacted were made when the managers perceived changes in the company’s economic environment and realized that alterations in the strategies were needed to maintain stability.

Considering the dynamics between a long-lasting and relatively stable constitutive rule and more dynamic and adaptive strategies used to enact it, it is important to consider the functioning of management control anchor practices. These practices play a crucial role also – or perhaps especially – in light of ‘dynamic conservatism’ where a constitutive rule is enacted through modifications in strategies. A key role of management control anchor practices in these situations is to avoid excessive proliferation in which strategies are formed merely based on opportunism or short-term contingencies. This also relates to the multiplicity of management
control practices used in these situations and the ‘opportunity space’ in which managers maneuver the company. The case of Robotics, for instance, shows that NPD managers mobilized project-level management controls in ways that enabled them to frame their individual projects in favorable ways. The PDF, as a management control anchor practice, however, ‘disciplined’ this kind of framing by imposing a portfolio and overall organizational perspective on individual projects. Thus, through the characteristics of antagonism and visibility it prevented a potential strategic proliferation and eventually the collapse of the company’s constitutive rule by constantly forcing managers to return to common structures (Ahrens, 2018, p. 66; Swidler, 2001, p. 85). Since the anchor practice perspective is still novel in the management accounting and control literature more research is needed to flesh out, specify and add nuances to the concepts. In particular, the relationship and dynamics between an organization’s constitutive rule and the (NPD) strategies to enact this rule, as well as the management control infrastructure (including the respective management control anchor practice) of an organization, seem to deserve further scholarly attention and need to be studied in more detail and in different empirical settings.

Another aspect to further develop the theoretical concept of management control anchor practice concerns its design and evolution. The anchor practice in our case was different from the one studied by Ahrens (2018). Ahrens studied a bank, which is a highly regulated context, whose hierarchical setting and management control often works in a strict top-down way. The management control anchor practice that emerged out of this context (cost management) took a shape that facilitated the reproduction of the bank’s culture. It thus seems plausible that in an innovative and R&D intensive company like Robotics, which has always been characterized by an entrepreneurial engineering culture, an integrative liaison device became the management control anchor practice. Anchor practices are closely related to an organization’s cultural aspects and associated values, beliefs and established ways of doing things. There thus seems to be room for revisiting the link between organizational or industry cultures and the respective management control infrastructures and hierarchies that emerge/are designed in various settings (see Messner, 2016). Examining in more detail how management control practices and hierarchies relate to the respective settings in which they operate and how they are affected by changes in these settings needs further elaboration.

Furthermore, we explore a setting where we were able to detail the ‘birth’ of an anchor practice as the case organization’s management control anchor practice was explicitly developed as a reaction to a perceived increase in the complexity of enacting the company’s constitutive rule. It shows that anchor practices can be designed and not simply emerge as kind

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of *deus ex machina*. Nevertheless, both in our and the Ahrens (2018) case, there was only one management control anchor practice at a certain point in time. Therefore, we see the need for further research that focuses on how anchor practices actually come about, whether and how they evolve or if they are replaced by ‘new’ anchor practices. In this context, it seems also relevant to study whether and how multiple anchor practices can co-exist and function.
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| Company level and role                        | Number of interviews | Average length | Time of interview                                      |
|-----------------------------------------------|----------------------|----------------|-------------------------------------------------------|
| Top management                                |                      |                |                                                       |
| ✓ Technology Director                         | 1                    | 65 min         | Fall 2002                                             |
| ✓ Supply Chain Director                       | 1                    | 60 min         | Fall 2002                                             |
| ✓ Chief Financial Officer                     | 1                    | 60 min         | Fall 2002                                             |
| Development                                   |                      |                |                                                       |
| ✓ Project manager A                           | 3                    | 65 min         | Fall 2002, Spring 2003, summer 2005                   |
| ✓ Project manager B                           | 3                    | 70 min         | Fall 2002, spring 2003, summer 2005                   |
| ✓ Project manager C                           | 2                    | 60 min         | Spring 2003                                           |
| ✓ Project member                              | 1                    | 50 min         | Spring 2003                                           |
| ✓ Senior company specialist                   | 2                    | 60 min         | Spring 2003, spring 2004                              |
| ✓ Corporate research manager                  | 1                    | 50 min         | Spring 2004                                           |
| ✓ Technical manager A                         | 4                    | 50 min         | Fall 2002, spring 2003, spring 2004, summer 2005      |
| ✓ Technical manager B                         | 3                    | 55 min         | Fall 2002, spring 2003, Spring 2004                   |
| Purchasing                                    |                      |                |                                                       |
| ✓ Purchasing manager                          | 1                    | 60 min         | Fall 2002                                             |
| ✓ Purchasing                                  | 1                    | 55 min         | Spring 2003                                           |
| ✓ Supply chain project manager                | 1                    | 60 min         | Spring 2003                                           |
| Quality                                       |                      |                |                                                       |
| ✓ Quality manager                             | 1                    | 65 min         | Fall 2002                                             |
| ✓ Quality engineer A                          | 2                    | 55 min         | Spring 2003                                           |
| ✓ Quality engineer B                          | 1                    | 60 min         | Fall 2002, spring 2003                                |
| Logistics                                     |                      |                |                                                       |
| ✓ Logistics manager                           | 2                    | 70 min         | Fall 2002                                             |
| ✓ Material planner A                          | 1                    | 60 min         | Fall 2002                                             |
| ✓ Material planner B                          | 2                    | 65 min         | Fall 2002                                             |
| Production                                    |                      |                |                                                       |
| ✓ Production manager A                        | 1                    | 60 min         | Fall 2002                                             |
| ✓ Production manager B                        | 2                    | 70 min         | Fall 2002, spring 2004                                |
| ✓ Production engineer                         | 1                    | 60 min         | Fall 2002                                             |
| ✓ Production tester                            | 1                    | 60 min         | Spring 2003                                           |
| Accounting                                    |                      |                |                                                       |
| ✓ Accountant/Controller A                     | 3                    | 75 min         | Fall 2002                                             |
| ✓ Accountant/Controller B                     | 2                    | 70 min         | Fall 2002                                             |
| Sales                                         |                      |                |                                                       |
| ✓ Sales manager A                             | 2                    | 65 min         | Spring 2004, summer 2005                              |
| ✓ Sales manager B                             | 1                    | 60 min         | Summer 2005                                           |
| ✓ Customer order manager                      | 1                    | 65 min         | Spring 2004                                           |
| ✓ Product manager A                           | 1                    | 70 min         | Summer 2005                                           |
| Total                                         | 49                   |                |                                                       |