Received: 28 March 2020 | Revised: 23 April 2022 | Accepted: 3 May 2022 | Published on: 4 July 2022

DOI: 10.1002/smj.3413

RESEARCH ARTICLE

STRATEGIC MANAGEMENT JOURNAL WILEY

How dynamic capabilities change ordinary capabilities: Reconnecting attention control and problem-solving

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Funding information
Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung, Grant/Award Number: PP00P1_150490; European Commission, 7th Framework Programme for Research, Grant/Award Number: 230740

Abstract

Research Summary: Building on the attention-based view of the firm, we elaborate the concept of dynamic capabilities and identify two constitutive elements: attention control and problem-solving. We show empirically that the control element of dynamic capabilities regulates how organizations (dis-)engage attention on operational versus change-oriented tasks. On this basis, we develop a process model of how control and problem-solving interact to reconfigure resources and thus modify ordinary capabilities. We study the adoption of lean management in the R&D unit of a large U.S. corporation. Our longitudinal case study identifies obstacles that organizations have to overcome to establish effective dynamic capabilities that enable their adaptation to changing environmental circumstances.

Managerial Summary: "The vast majority of all change initiatives fail": We hear this statement a lot in our interactions with practitioners. In this article, we suggest an explanation of why achieving persistent, behavioral change is hard: attention to change processes is difficult to maintain over an extended period of time. Initiatives start, then fade away. By studying the interplay of control mechanisms (that keep

organizational attention on the long-term goals) and problem-solving tools (that identify what and how to change in the short term), we provide a framework that can generate actionable implications for executives. In particular, we focus on the decisive and yet underestimated role played by key performance indicators in sustaining attention on change initiatives.

KEYWORDS

attention control, attention-based view, dynamic capabilities, ordinary capabilities, problem-solving

1 | INTRODUCTION

This article analyzes how dynamic capabilities change ordinary capabilities. While the discussion about the antecedents and consequences of dynamic capabilities is vast, our understanding of how a firm's dynamic capabilities modify its ordinary capabilities is less extensive. Building on the evolutionary and behavioral tradition in strategy, we regard capabilities as learned and stable patterns of collective activity through which an organization operates, or as routines (Helfat & Peteraf, 2009; Nelson & Winter, 1982; Zollo & Winter, 2002). Routines are hierarchically structured: higher-level routines are the dynamic capabilities that enable an organization to systematically alter its lower-level routines, or ordinary capabilities (Helfat & Winter, 2011; Winter, 2003; Zollo & Winter, 2002).

To explore how dynamic capabilities change ordinary capabilities, we leverage the attention-based view (ABV) of the firm (Ocasio, 1997). We know that individuals (e.g., Laureiro-Martinez, 2014) and organizations alike (e.g., Ocasio, 1997, 2011) struggle to keep their attention focused for long periods. Yet, change requires focus, particularly when it is gradual and continuous, lest inertia prevail. Ocasio and Wohlgezogen (2010) noted that a firm's control mechanisms can be interpreted as tools to guide its attention over time. We build on this insight to develop a process model that identifies attention control and problem-solving as core elements of a dynamic capability. Within our model, the structured interaction of these two elements enables the dynamic capability to reconfigure resources and thus change ordinary capabilities. We also identify three "fallacies" that can hinder the effects of this dynamic capability by impeding the interaction between control and problem-solving: two relate to the inability of an organization to manage its attentional resources effectively, and one to the inability to solve problems effectively. By overcoming these fallacies, our case organization learnt how to align attention control and problem-solving processes.

Our model is grounded in the study of a dedicated research and development (R&D) unit. Unlike previous studies, we do not focus on how new product development (NPD) processes change a firm's products or services, but on how the NPD processes themselves are changed over time. In so doing, we operationalize the concept of dynamic capabilities through lean management, which our case company used to adapt its ordinary capabilities to changing environmental needs. In this setting, ordinary capabilities are the firm's NPD routines (operationalized in models such as Waterfall or Agile development), and we study the processes through which such routines change over time.

Our contribution is threefold. First, we provide a theoretical elaboration of the concept of dynamic capabilities. We identify attention control and problem-solving as the fundamental and interconnected building blocks of the core process through which dynamic capabilities affect ordinary capabilities. Thus, we address Helfat and Winter's (2011) call for more granular studies of the interplay between dynamic capabilities and ordinary capabilities, particularly during gradual change. Second, the joint analysis of attention control and problem-solving extends the ABV, showing how the interaction of these two elements leads to actions and choices that affect tangible and intangible resources on a routine basis. We explore the obstacles that may lead to the depletion of scarce attentional resources during phases of change. Third, we extend the ongoing discussion about the relationship between control mechanisms and adaptability outcomes (Cardinal, Kreutzer, & Miller, 2017) by developing an attentional, process-based perspective on control (Ocasio & Wohlgezogen, 2010). This perspective complements the more traditional contingency approach to control (as discussed in Cardinal et al., 2017), that is, the analysis of which control tools lead to improvements.

In short, we develop an integrated perspective on attention control and problem-solving that explains how dynamic capabilities lead to new ordinary capabilities, in response to steady and continuous environmental change.

2 | DYNAMIC CAPABILITIES: BETWEEN PROBLEM-SOLVING AND CONTROL

A "dynamic capability is exemplified by an organization that adapts its operating processes through a relatively stable activity dedicated to process improvements" (Zollo & Winter, 2002, p. 340). Also, dynamic capabilities reconfigure the resource base of a firm (Teece, 2007; Teece, Pisano, & Shuen, 1997), for example, in terms of its human resources, organizational structures, or tangible assets (Eisenhardt & Martin, 2000; Helfat et al., 2007; Helfat & Winter, 2011). To explicate dynamic capabilities, Teece (2007) developed a general framework with the "sensing, seizing and transformation" process. He explicitly called for studies that shed light on how dynamic capabilities impact operational processes and emphasized the importance of extending our understanding of the microprocesses (or "microfoundations") that underpin dynamic capabilities.

Yet, studies on the processes and essential mechanisms through which dynamic capabilities impact ordinary capabilities are scarce. Most literature has closely examined aspects of dynamic capabilities related to their development (e.g., Zollo & Winter, 2002), their antecedents (e.g., Eisenhardt, Furr, & Bingham, 2010), the functional domains where they appear (e.g., Schilke, 2014), their attributes (Stadler, Helfat, & Verona, 2013), and their managerial content (e.g., Martin, 2011). Those few studies that have looked at the impact of dynamic capabilities on ordinary capabilities have focused on the important aspects of search and problem-solving (Salvato, 2009), knowledge acquisition (Heimeriks, Schijven, & Gates, 2012), and learning processes (Zollo & Winter, 2002), generally in fast-changing environments. Some have also emphasized that it is crucial to differentiate dynamic capabilities in fast- and slow-moving environments—for example, Eisenhardt and Martin (2000). However, research in settings of steady and continuous change is rare. Stadler et al. (2013, p. 1782) focus on "dynamic capabilities directed toward obtaining resources and further developing them to the point where they are commercially usable" in the relatively stable context of the oil industry. Studying how dynamic capabilities were exercised at a manufacturing company over two decades, Danneels (2010) focuses on managers' mental models (or what he calls "resource cognition" [p. 3]) underpinning different resource-alteration modes. Schilke (2014) finds that the effects of

dynamic capabilities vary depending on environmental dynamism, and that they are more useful in contexts of moderate change.

Despite these exceptions, we believe that Helfat and Winter's (2011) point remains valid. The literature is over-preoccupied with dramatic, rapid change, even though change is often incremental and, in a way, mundane—as noted by, for example, Rosenberg (1976). Firms facing gradual change need to maintain their attention on organizational adaptation over a long period. The slow pace of change may weaken organizational commitment, leading to a situation in which "the sensing, creating, and learning functions are left to the cognitive skills of a few individuals," placing firms in a strategically vulnerable position (Teece, 2007, p. 1323).

The literature on management control provides many ideas about how to generate and sustain commitment to specific goals. Yet, as stressed by Cardinal et al. (2017), control research has paid relatively little attention to issues of change and adaptability—the traditional focus of dynamic capabilities research. As they note, this is indeed "troubling" (p. 2017) considering the pervasiveness of change processes in modern organizations. Management control helps managers determine whether activities are in line with objectives, and adjust them if required (Hewege, 2012; Whitley, 1999). Thus, control has been perceived as an intermediate function linking an organization's strategic and operational levels (Anthony & Govindarajan, 2007). Management control (Cardinal, 2001; Snell, 1992) pertains to the means to mobilize and orchestrate collective action toward achieving an organization's objectives (Eisenhardt, 1985; Ouchi, 1977, 1979; Snell, 1992). Specifically, "Control can be defined as any process by which managers direct *attention*, motivate, and encourage organizational members to act in desired ways to meet the firm's objectives" (Cardinal, 2001, p. 22, emphasis added).

The connection between control and attention is central to our analysis, and relatively understudied. In his landmark 1997 study, Ocasio noted that attention is both a structural and a cognitive process that "encompass[es] the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers" (p. 189). Attention processes are at the core of any organizational choice about which "issues" (p. 189)—for example, problems—to focus on, and also which "answers" (p. 189)—for example, routines, procedures—to select in order to solve them. On this basis, Ocasio and Wohlgezogen (2010) discussed conceptually how different types of control direct attention toward different issues and answers. Ocasio (2011) puts forward the concept of attentional engagement to categorize different approaches to attention. Attentional engagement is "the process of intentional, sustained allocation of cognitive resources to guide problem-solving, planning, sensemaking, and decision making" (Ocasio, 2011, p. 1288). It focuses time, energy, and effort on a selected set of stimuli (goals), a repertoire of action responses, and the relationships between them (Ocasio & Joseph, 2018). Attentional engagement builds on two distinct yet connected and complementary processes: executive attention and attentional vigilance, or sustained attention. Executive attention enables people to switch their attention from one stimulus to another, while attentional vigilance enables them to attend to something over an extended period. "Effective decision making in organizations would be impossible if one or the other of these two forces were missing" (Ocasio, 2011, p. 1289). However, although this cognitive analysis identifies a logical antecedent to action and choice, it does not explore how attentional engagement leads to action, or what might prevent it.

Interestingly, Laureiro-Martinez (2014) studies exactly this missing link at the microlevel. In a laboratory study, she analyzes how attention control leads to the routinization of problem-solving activities, hence improving problem-solving performance in individuals. This is individual-level evidence of a connection between attention control and the development of new routines. Yet, we do not know how this process would unfold at the organizational level.

In interpreting the findings from our inductive case study, we shall build on the ABV to show how our focal organization leveraged its control processes to achieve and sustain "attention engagement" in its change initiatives and, in so doing, change its behavior.

Below, we present our inductive and longitudinal study. Our original question was: How do a firm's dynamic capabilities impact its ordinary capabilities in cases of gradual and steady change? Our focus evolved from the problem-solving aspect of dynamic capabilities to the interaction of problem-solving and attention control. We did not start with specific hypotheses on such a relationship, as control was not even central to our initial theorizing. We shall elaborate the theoretical contribution of our findings as we present them and conclude with a process model that elicits the core elements and mechanisms of a dynamic capability that leads to the continuous adaptation of ordinary capabilities.

3 | METHODOLOGY

3.1 | Research design

We adopted a qualitative research design (Burgelman, 1983; Miles & Huberman, 1994) and conducted a longitudinal single case study aimed at collecting detailed evidence related to our research question (Eisenhardt & Graebner, 2007; Yin, 2009). We build upon Burawoy's extended case method (Burawoy, 1998) as well as Langley's (1999) approach to time bracketing and Gurses and Ozcan's (2015) approach to analyzing evidence along a timeline. On this basis, we develop a theory-elaboration study (Lee, Mitchell, & Sablynski, 1999) that follows the approach of construct specification (Fisher & Aguinis, 2017). As discussed in the introduction, we build on pre-existing theory on dynamic capabilities and extend it to a context of gradual, stable change. In so doing, we refine the concept of dynamic capabilities by distinguishing its problem-solving and control elements. The latter emerged inductively from our empirical observation. In the terminology suggested by Fisher and Aguinis (2017, p. 417), this is a construct-splitting study, as we split the construct of dynamic capabilities into two of its constituent elements: control and problem-solving.

3.2 | Empirical setting

To study dynamic capabilities, we built on Zollo and Winter (2002) and Winter (2003) for a broad definition of our core concept, and on Helfat and Winter (2011) to frame the relationship between dynamic capabilities and ordinary capabilities. Empirically, we observed the process by which an ordinary capability was gradually changed over more than 10 years. The ordinary capability is our case firm's new product development (NPD) capability, which is its core business. NPD is altered by the dynamic capability of lean management.

Our case company is Newpro, an R&D organization within a larger group whose main business is developing new products. Newpro employs about 120 people and is part of AutomationInc, a mid-sized German firm that is one of the leading suppliers of industrial networking and factory automation solutions to the automotive industry. AutomationInc itself is part of a larger U.S. corporation, CableCo, which took it over in 2007. Newpro's role within AutomationInc is like that of an independent organization. Its clients are both internal departments and external firms and, like many modern R&D organizations, Newpro is market-

oriented. For example, it consistently uses net present value (NPV) to assess project performance rather than relying on a centrally allocated R&D budget.

Studying Newpro was attractive for several reasons. First, the firm had recently adopted lean management. This allowed us to compare adaptations of the firm's NPD capabilities before and after the implementation of lean management and, thus, to better identify its effects. Second, CableCo, AutomationInc, and Newpro were fully committed to adopting lean management, and CableCo had substantial experience with using it. This gave us confidence that we could observe a case where lean management was likely to be implemented on the basis of relevant experience, and where it would affect the operation of NPD.

Lean management is a method for continuously developing organizational capabilities in accordance with market requirements (Karlsson & Ahlström, 1996). It focuses on the creation of value and the elimination of waste. What constitutes value is determined by the preferences of intermediate and end customers. These preferences change over time, and lean management continuously reconsiders the firm's activities against the background of value and of waste. Waste is the inverse of value and can be defined as "any human activity which absorbs resources but creates no value" (Womack & Jones, 2003, p. 15). It indicates a mismatch between the firm's operational capabilities and the requirements of the market. Lean management provides tools to continuously refine the firm's operations, achieve a stable orientation toward value-adding activities, and remove the waste that frequently occurs due to changing customer needs (i.e., the firm's environment). This is exactly what a dynamic capability is meant to achieve: the continuous adaptation of ordinary capabilities to enable an organization to adapt to its changing environment (Anand, Ward, Tatikonda, & Schilling, 2009). Unlike other approaches like TQM, lean management assumes that market and environment are subject to constant change; it "views the entire company [...] as a dynamic learning entity that grows by acquiring new organizational capabilities" (Jackson, 1996, p. 9). As noted by Benner & Tushman (2002, p. 679): "dynamic capabilities are anchored in both exploiting current technologies and resources for efficiency benefits and in generating new possibilities through exploration."[1]

Given that we study an R&D organization, our ordinary capability is not found in operations, but in the approaches that Newpro follows to develop and deliver new product ideas. More specifically, we focus on how lean management (as dynamic capability) supported the transition of NPD (as ordinary capability) models as Newpro shifted from Waterfall to V-model and finally to Agile. Such adaptation is crucial for the competitiveness of organizations such as Newpro, as they have to respond to varying environmental circumstances.

In the Waterfall model, NPD work is broken down into five to seven distinct sequential phases, ending with testing. V-model is an extension of Waterfall where each development phase has an associated testing phase. Finally, Agile breaks the project into small sections (called "sprints") that are detailed and planned as the project unfolds. Testing and the collection of customer feedback are done at the end of each sprint. Supporting Information Appendix B reports a detailed description of the NPD models we observed, while Figure 1 provides an overview of the ordinary and dynamic capabilities in our case.

As Figure 1 also shows, Newpro switched NPD models (from Waterfall to V-model and then to Agile) during the observation period, while lean remained the constant overarching system

[1]For an expanded introduction to lean management, and its delineation to Agile development and to TQM, see Supporting Information Appendix A.

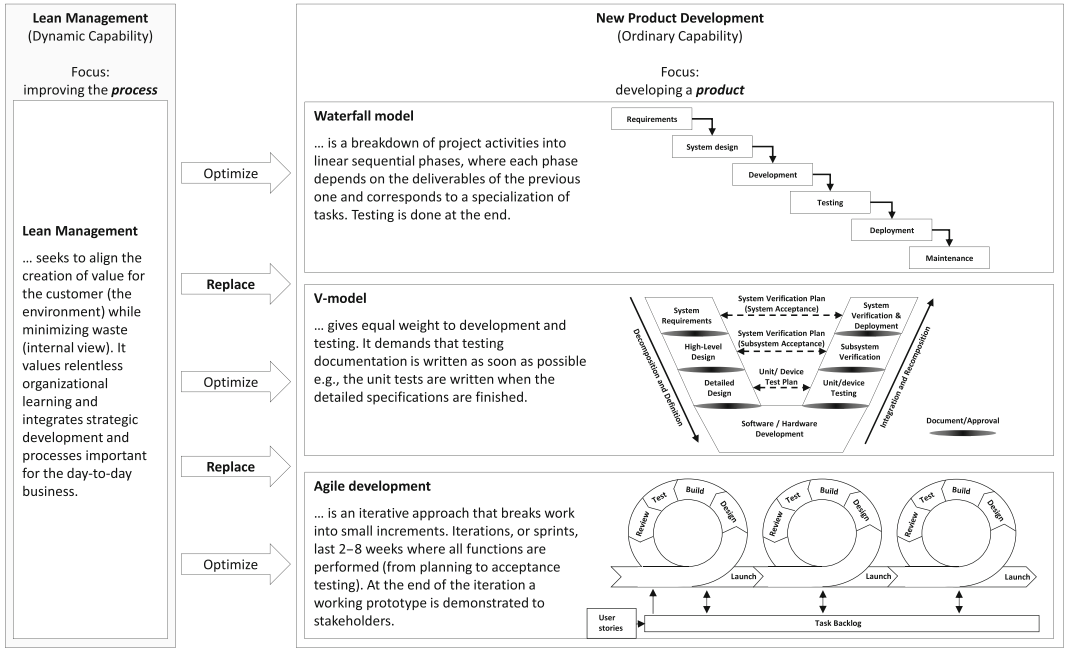

FIGURE 1 Dynamic capability and ordinary capability observed

for introducing such changes [1, 2].[2] This provides prima facie evidence that lean management, as a dynamic capability, is more stable than the ordinary capabilities.

3.3 | Data collection

At the end of 2010, Newpro implemented lean management. In 2011, we contacted Newpro asking them to join a research project on lean management in NPD, set up by the authors (with EU funding). In the course of this project, we collected data through on-site visits and off-site project meetings. Further, once we understood Newpro's dedication to lean management, we decided to focus on this company to answer our research question. In mid-2012, we started collecting data intensively on site. By the end of 2014, lean management was operating seamlessly and sustainably, and we ended our on-site data collection. Given CableCo's prior experience and both AutomationInc's and Newpro's dedication, we expected lean management to take off within a year or so—but it was not so. As we looked into our data, and interacted with the company in the field, we came to realize that while problem-solving tools were implemented relatively easily, the alignment between problem-solving and what we came to call "control" took more time and effort than expected. The (lack of) interplay between problem-solving and control emerged from our data as the key issue that explained the slow initial implementation of lean management. As Newpro improved its ability to adjust problem-solving and control in a synchronized way, it also learnt how to use lean management to change its ordinary capabilities more quickly.

[2]Numbers in brackets refer to Supporting Information Appendix G, which contains a table with empirical evidence and quotes, with the original German alongside the English translation where appropriate.

TABLE 1 Overview of data sources

Data source	Details
Interviews	27 formal interviews with 15 key informants (ranging from 21 min to 2 h with a total of 23 h and an average of 51 min), mainly conducted in person at Newpro's site, all recorded and transcribed, totaling 308 single-spaced transcript pages (for details see Table 2) 28 informal interviews (totaling about 15 h) with the 15 key informants conducted at various occasions such as workshops, conferences, or in between formal interviews, captured by 17 pages of notes
Observations	Observation of 26 events (ranging from 20 min to 2 days) with a total of 67 h and 48 pages of notes capturing lean management tools, how they function and how they took effect, their implementation process, the events that triggered the implementation of those tools and the NPD changes they induced (for details see Table 3)
Presentations	Eight presentations of Newpro representatives at workshops and conferences on lean management at Newpro (about 45 min each)
Publications	Two book chapters by company representatives with descriptions of Newpro's lean management journey and its NPD approaches, and three interviews with executives of the firm published in trade magazines
Newsletters	101 firm internal newsletters
Training material	73 files with firm internal training material and templates pertaining to lean management or new product development totaling 1,692 pages and slides
Intranet	Reports, meeting minutes, project databases, internal firm Wiki
Public databases	Public database (Bundesanzeiger) with accounting and general company reports
CableCo website	News releases

Overall, our data span the period from 2007 to 2017. In 2007, AutomationInc was acquired by CableCo, which has a strong lean management orientation across all its functions. Hence, we traced Newpro's lean management activities from then on by means of archival data and retrospective interviews, and we followed its activities until 2017 by combining interviews and archival data with phone calls and emails, and by collecting secondary data. Expanding data collection beyond the focal period helped us to contextualize and interpret our data, and also to understand the long-term effects of lean management.

We used three main data-collection mechanisms: interviews, non-participatory observation, and archival documents. The first author engaged in data collection and data analysis, whereas the second author had neither a relationship with the company nor any involvement in data collection, and acted as a devil's advocate throughout. This approach helped us to avoid potential issues of analysis bias caused by closeness to the case. For an overview of our data and sources, see Table 1.

3.3.1 | Interviews

Between July 2012 and July 2014, we conducted, recorded, and transcribed formal interviews with informants from multiple hierarchical levels to obtain a deep understanding of our subject

matter. We first spoke to those individuals who seemed to know most about Newpro's strategy, markets, NPD, and use of lean management (see Table 2). In total, we conducted 55 interviews with 15 informants (27 formal, supplemented by 28 informal interviews). Overall, we developed a database covering 38 interview-hours and 325 single-spaced pages of transcripts and notes.

Given the diverse backgrounds of our interviewees, we did not use standardized interview guidelines. Following an ethnographic interviewing approach (Spradley, 1976), we mainly asked open questions to allow our informants to freely recount their experiences and emphasize key events (see also Rubin & Rubin, 2005). Whenever necessary, we interjected to probe specific issues. The interviews were audio-recorded and transcribed, usually within 2 days. Especially early on, we learned a great deal from every interview and event. We used these insights to prepare for the next interview or observation. We reiterated this approach until we reached an in-

TABLE 2 List of interview partners

Relevant position	Hierarchical level	Time in relevant position (years with Newpro)	# of formal interviews
Head of AutomationInc	Top management	4/2009 to date of interview (27 years)	1
Former Head of Newpro	Top management	4/2009 to 4/2012 (4 years)	1
Current Head of Newpro	Top management	4/2012 to date of interview (21 years)	3
Lean Director 1 (CableCo)	Staff at corporate level	7/2006 to date of interview (7 years)	1
Lean Director 2 (CableCo)	Staff at corporate level	6/2011 to date of interview (7 years)	1
Current Project Management Officer	Staff at unit level	10/2011 to date of interview (1.5 years)	9
Former Project Management Officer Lean Black Belt	Staff at unit level	4/2008 to 10/2011 (5 years)	1
Head of Program Management	Middle management	4/2012 to date of interview (23 years)	2
Head of Product Management	Middle management	2009 to date of interview (23 years)	1
Department Head Documentation Lean Black Belt	Lower management	1/2007 to date of interview (>20 years)	2
Department Head Software 1	Lower management	2007 to date of interview (12 years)	1
Department Head Software 2	Lower management	2010 to date of interview (5 years)	1
Department Head Hardware	Lower management	10/2012 to 10/2013 (<1 year)	1
Project Manager 1	Employee	2008 to date of interview (9 years)	1
Project Manager 2	Employee	7/2012 to date of interview (<1 year)	1
			Total: 27

depth understanding of Newpro's lean management activities, how they were embedded in the firm's wider strategy, and how they affected the firm's NPD routines. Further, we used informal interviews to clarify questions, when required. We did not audio-record these, in order to allow a natural flow, but we took notes in all cases.

Our interviews allowed us to understand how the case had unfolded before our involvement (2007–2011), and to understand concurrent lean management developments between 2012 and 2014. By 2014, lean management had taken full effect and was sustainably implemented. However, fieldwork continued until May 2017, as we used follow-up interviews and emails to trace how lean management continued to operate.

3.3.2 | Observation

We observed relevant events through a two-day on-site data collection at Newpro in July 2012, followed by a four-month organizational ethnography-like field study between November 2012 and April 2013 (Van Maanen, 2011). During that time, we regularly visited the firm and spent about 45 days on site in total. We observed formal and informal meetings, focus-group discussions, and workshops, which allowed us to draw a coherent picture of the organization's lean management activities in R&D and how they were embedded in the wider organizational context. A number of events, such as Lean Daily Management or Five Whys sessions, occurred during this observation period, which allowed us to gather first-hand information on the deployment of lean management (see Table 3). For confidentiality reasons, these events could only be documented with field notes.

3.3.3 | Documents

We reviewed extensive archival data, including 1,692 pages and slides of lean management training material, 101 company newsletters, various presentations, and reports from

TABLE 3 Overview of events observed

Event	Frequency	Duration (average)	Number of observed events
Lean Daily Management	Weekly (Monday afternoon)	20 min	7
Project review	Weekly (Monday afternoon)	20 min	7
Kaizen event (workshop focused on process improvement)	As required (in R&D, about every 2 years)	1 week	2
Five Whys problem-solving event	On demand	1 h	1
Five Whys training session	On demand	4 h	1
Focus group discussions and external workshops with lean management experts	3–4 times a year	1–2 days	8
			Total: 26

workshops and conferences. Furthermore, we were granted access to the firm's intranet and internal Wiki system. We used this archival data to triangulate our evidence from interviews and observations and improve the internal and construct validity of our findings (Gibbert, Ruigrok, & Wicki, 2008; Mathison, 1988). We stopped collecting data from interviews and observations once it no longer provided additional insights and our core findings became validated.

3.4 | Data analysis

We began data analysis immediately after the interviews, by completing our notes and transcribing audio files. Following best practice (Eisenhardt, 1989; Eisenhardt & Graebner, 2007), we iterated between empirical data, emerging constructs, and the literature to develop new theoretical understanding. We performed the following steps, partially iterating between them (see Supporting Information Appendix C for more detail).

First, we developed the *case history* (Step 1) and identified key events, which we located on a timeline (see Supporting Information Appendix D) and later used for temporal bracketing in Step 3. We then deployed *thematic coding* (Step 2) (Flick, 2018; Gibbs, 2007) to identify how lean management functioned as a dynamic capability. Using NVivo, we captured and coded all changes to Newpro's market environment, NPD routines, and lean management routines. At this stage, we operationalized routines as "processes" (i.e., sequences of actions taken to achieve a particular end) occurring either at the higher level (lean management) or at the lower level (NPD model). As we sought to account for the delays in implementing lean management, two central themes emerged: problem-solving (relating to Five Whys) and, unexpectedly, control (relating to Lean Daily Management), along with three fallacies that caused the delays. To decompose our case-study data and trace the emergence of lean tools, their mutual interactions, and how they began to take effect, we used *temporal bracketing* (Step 3) (Langley, 1999). We identified five phases, which are distinct in terms of the maturity of lean management, the scope of interaction between its tools, and their effectiveness on the adaptation of NPD routines. Next, we *visually mapped* the *relationships* (Step 4) among the lean tools, aiming to understand their interactions with each other and with Newpro's strategy and NPD routines. Supporting Information Appendix E illustrates the processes we studied in detail, to show when and why the change of NPD routines stalled, and to identify the fallacies that caused this stagnation. Finally, we *revisited existing theory* (Step 5). Deploying the extended case method (Burawoy, 1998), we went through several cycles of analysis of the empirical data from our case company and comparison with extant theory, which led us to two stages of extension and specification respectively. In the first stage, control emerged from our data, we identified it as a crucial concept, and we moved from the visual map (Supporting Information Appendix E) to a more theoretical model (Figure 2). In the second stage, after creating the model, we refined it by comparing our findings with the extant literature and iterating between theory and data to increase the generalizability of the emergent theory (Eisenhardt, 1989). We identified the ABV of the firm (Ocasio, 1997) as an approach that helped us to add significant theoretical depth and to fully develop the mechanism by which control and problem-solving interact and impact resource reconfiguration (see Figure 3).

Below, we present our findings longitudinally. We report quotations from our data in the main text, and more extensively in Supporting Information Appendix G. Quotation numbers in

the main text correspond with those in Supporting Information Appendix G, where we also report the original text when the interview was in German.

4 | FINDINGS

In this section, we describe the process of implementing lean management at Newpro (see Supporting Information Appendix D for the overall timeline). Phase by phase, we present evidence of resource reconfiguration over time. At the end of this section, we summarize the main changes in resources (see Table 5).

Our findings highlight how Newpro learned how to solve problems in a typical lean management manner. To illustrate this, we focus on the implementation of Five Whys, a core tool for problem-solving, and how Newpro learnt how to control problem-solving to improve NPD performance. We also focus on the implementation of Lean Daily Management, a core tool for process control in lean settings.

It took 5 years to see the full impact of lean management. This is a surprisingly long time, particularly given Newpro's dedication and commitment, and the prior experience and resources of CableCo [3]. So why did the initial implementation take so long? From our analysis three fallacies emerged to which Newpro fell prey when implementing lean management: the fallacies of *transfer*, *interpretation*, and *expectation*. The key insight was that it took Newpro a long time to learn about control and how to align it with problem-solving—as opposed to learning about the problem-solving tools themselves.

4.1 | Phase 1: Before lean management (2007–2008)

Until 2007, the operational process at Newpro followed the Waterfall model. Over time, the firm's product variations proliferated in an uncontrolled way. In addition, as development projects became more complex [4], Newpro ran into severe quality problems. These could no longer be solved with Waterfall, which involves testing product quality very late (i.e., *after* product development). Often, engineers would hastily test the product concept themselves once the whole development process had been completed. This procedure missed many quality problems, because when the same engineer developed *and* tested a product, they tended to "test around" weak spots [4]. For this reason, Newpro decided to replace Waterfall with the V-model [5]. In the V-model, each development stage has a corresponding testing stage, and responsibilities for testing are divided among several employees (see Figure 1). However, by the end of Phase 1, Newpro's processes had barely changed. The process steps to be performed when following the V-model were not specified; the associated documents were not developed; and employees were not assigned to roles [6].

In 2007, AutomationInc and Newpro were acquired by CableCo. As a consequence, the newly acquired organization had to adopt lean management [7] as a way to speed up the transition to the V-model. Lean management first diffused from CableCo to AutomationInc's operating units, such as production [8]. Then, starting in 2009, Newpro began to adopt lean management from those units.

4.2 | Phase 2: The setup of lean management (2009–2010)

In 2009, Newpro's NPD performance was still inadequate, with frequent quality problems and overlong project lead times [9]. Accordingly, top management requested that the V-model be

refined and diffused throughout Newprqo [10] and pushed for the introduction of lean management, convinced that it would enable Newpro to improve its NPD performance rapidly [11–18].

CableCo's experienced "Lean Directors" moved to Newpro to provide training. Both CableCo and AutomationInc had successfully introduced lean management in operations, and were convinced that they had the capabilities to implement it at Newpro too. CableCo, however, had no R&D function before acquiring AutomationInc and Newpro; nor did it have experience in the deployment of lean management to NPD [19, 20]. Hence, training content had only limited applicability to Newpro:

> *... you just saw that whatever training courses or the like were either not relevant, or we understood them in an oversimplified way. Although we understood the principles, what came out of recommended transferable actions was simply not transferable or, in our view, too simple for the complex situation we face here. [Head of Newpro, 21] [22].*

During this phase, two main lean-related elements were introduced [23]: Lean Daily Management and Five Whys. The objective of Lean Daily Management is to monitor process performance and enable dialogue and learning throughout the organization. Further, Lean Daily Management allows management to initiate action to solve problems and, in turn, improve processes. Lean Daily Management emerged as the key element to understand how Newpro leveraged the attentional resources of its members. Its two central elements are a *dashboard* and a *daily meeting*. The *dashboard* is designed like a matrix, with Key Performance Indicators (KPIs) on the horizontal axis. The KPIs are process metrics for Safety, Quality, Delivery, Cost, and Inventory ("SQDCI") [24]. Vertically, the board lists bowler charts for each KPI with target values, actual values, and (in case of missed targets) Pareto analyses and Five Whys outcomes, showing the causes of deviations and action plans to address them (see Supporting Information Appendix F). The supervisor conducts a *daily meeting* in front of the board. The values for each KPI are updated daily, using different colored pens depending on whether the target was reached (green) or missed (red) [25]. If a KPI is missed, operational work is interrupted, and the employees involved must focus on solving the underlying problem. Hence, Lean Daily Management played two distinct attentional roles. First, it revealed which tasks were underperforming. A red KPI would trigger a problem-solving cycle; in other words, it directed attention away from routine tasks toward problem-solving (as discussed below). Following Ocasio (2011), we call this *executive attention*. Second, through the continuous revision of the KPIs and their target values, Lean Daily Management kept attention focused on the implementation and improvement of the desired NPD model. Again, following Ocasio (2011), we call this *sustained attention*, or vigilance.

To solve problems, Newpro used the Five Whys method. Five Whys is a standardized process for problem-solving: it aims at finding the root cause of a problem and developing countermeasures (solutions) to prevent it from reoccurring. Participants describe the problem in detail, then seek out the root cause by asking "Why?" roughly five times in succession [26]. Typically, a Five Whys takes about an hour, is guided by a one-page template, and involves about five people. Finally, countermeasures are put in place.

In mid-2009, Newpro revised and detailed the V-model for customization and better adoption [27–28]. However, the impact on the NPD process was negligible:

> *Even when the development process, the so-called V-model, was revised [...] in mid-2009, the influence of the lean principles remained marginal. [Book section, 29].*

In 2010, Newpro started to set up Lean Daily Management. Since it was already used by various production units of CableCo and AutomationInc, Newpro employees visited them to better understand the method and how it was practiced there [30, 31]. They realized that Lean Daily Management could not simply be "cut and pasted" from operations. In contrast to the manufacturing context, R&D processes are less repetitive, and have much longer cycles—so Newpro quickly decided to hold weekly rather than daily meetings [32]. However, implementation stalled because of unexpected difficulties in finding the right KPIs to measure NPD performance.

Newpro expected to pick and choose from the KPIs that operations had been using successfully for so long. Newpro's management thought they could "simply" train people on the process metrics of SQDCI, but that failed. For example, inventory captures the stock of material—that is, parts on shelves in the production department. But R&D has neither parts nor shelves. Further:

> *... if you were to apply the [lean management] principles of manufacturing to product development, in manufacturing you want to exclude all variability. For a good reason: you want to create a reliable process. [But] in development, it is counterproductive if you exclude risks. [Department Head, 33] [34].*

Newpro spent a lot of time trying to adapt KPIs rather than create new ones [35–38].

Eventually, they realized that they had to translate the overarching objectives of lean management to R&D and, based on that translation, develop KPIs from scratch. In order to generate new, R&D-relevant KPIs, they started making specific comparisons between operations and R&D:

> *We thought about what we could take as inventory. Then we came up with the idea that projects that have been lying around for a long time are also inventory. [Project Management Officer, 39] [40].*

Our informants consistently labeled the compilation of KPIs as a problem [41]. Although CableCo's Lean Directors had been helpful in training and setup, their ability to support the development of R&D KPIs was limited. Nor could textbooks provide "ready-to-use" KPIs.

> *I believe that, for example, regarding the KPIs, the book can suggest some interesting ones. But whether they really fit your business, your company, or the company's strategy, and how you can determine these with possibly low effort; no book can provide that. [Project Management Officer, 42] [43].*

Newpro had to define new KPIs. This came as a surprise, and developing KPIs took the whole of 2010. The final set included KPIs such as booking accuracy (booked vs. budgeted engineering hours), test automation ratio, and right-first-time percentage (to reduce redesigns). Further, Newpro specified the V-model during Phase 2. To do so, it defined new document templates and approval milestones, as well as a role concept for standardized project implementation—but the changes did not take root:

However, they just tossed out the documents and didn't provide a proper introduction, and it [the V-model] never got off the ground. [Project Management Officer, 44].

As a result, Newpro's NPD processes remained largely unaffected, and people continued working with the Waterfall model.

4.3 | The transfer fallacy

In Phase 2, Newpro realized that the functioning of Lean Daily Management is based on two distinct and interdependent parts: performance metrics based on the KPIs and their regular assessment by means of the dashboard meeting (see Figure 2, the Lean Daily Management box under Dynamic Capability).

While adapting the dashboard meeting was seamless [45], finding the right KPIs was arduous but crucial. What was going wrong? The dashboard meeting was meant to help Newpro's engineers identify problems, and hence decide when to step back from normal work and solve a specific problem. However, without KPIs that made sense for an R&D setting, the dashboard could not redirect the engineers' attention and energy from day-to-day work toward the specific problems with the V-model. Several participants voiced concerns about the inability of Lean Daily Management to tell them which specific problem they had to solve, and why:

And those who have had the process under control so far also think that this is messing everything up for me now, and that I have so much to [operationally] produce. That is critical. [Business Unit Manager, 46].

How do I get from where I am to something better? And they say, well, Pareto, and I concentrate on the most important point—but how do I start from nothing? [Head of Newpro, 47].

Hence, the lack of appropriate KPIs meant that Newpro failed to leverage Lean Daily Management as a tool to focus executive attention. As noted above, executive attention enables people to detach their attention from a specific stimulus and reallocate it to another. The

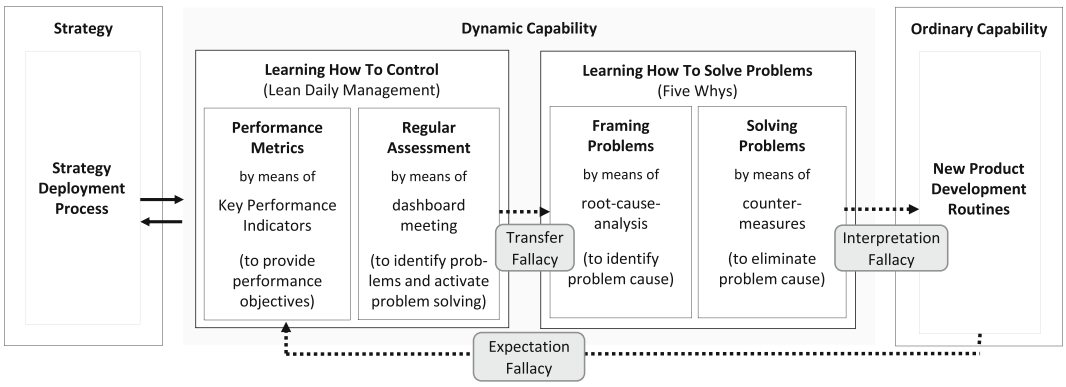

FIGURE 2 Learning how to control and learning how to solve problems

dashboard meeting was supposed to signal when to switch from operational work to problem-solving, but it could not do so because it was set up without appropriate KPIs. This *transfer fallacy* reflects the complexity of transferring KPIs from operations into an NPD setting. It prevents the connection between the Lean Daily Management and Five Whys boxes (see Figure 2).

4.4 | Phase 3: Startup (2011–2012)

In 2011, things began to change, thanks to the KPI redesign of 2010. Newpro introduced new, adapted KPIs in weekly Lean Daily Management meetings. Crucially, top management took the lead by attending the meetings and overruling any excuse for canceling them. KPIs were tracked regularly. Hence, attentional engagement processes did what they are supposed to do: guide behavior. The V-model, which in Phase 2 had only existed "on paper," was finally being implemented. Newpro employees started solving problems in response to the KPIs. When a target was missed, a Five Whys was initiated [48].

However, the inability to define appropriate KPIs at the outset was not the only problem that ensnared Newpro. A second fallacy caused a frustrating phase during which the NPD process still failed to improve. For some KPIs, targets were still consistently missed. In other words, even though employees' attention was now being focused on the salient problems, those problems still went unsolved. For example, the "cost" KPI simply stagnated:

> *We said that we now take this as our key figure here and, despite the improvements that have been initiated, it is unfortunately still in the red; we have not achieved our target values. [Project Management Officer, 49] [50–51].*

On further investigation, the firm discovered that Five Whys (the core problem-solving tool) had not been properly implemented. Engineers saw Five Whys as more of an instrument for documentation—in other words, as more of an element of control, rather than a tool that could support problem-solving. The first step of a Five Whys is root-cause analysis. But at Newpro, participants bypassed this stage and walked into meetings with solutions already defined, based on their general understanding of the problem and their own experience [52–54]. Then, during the meeting itself, they simply filled in the Five Whys template with text:

> *... some developers say, "I already know the problem. I already know the solution. I know what I have to do, and now I have to think again about four 'Why?' answers to do justice to the template." [Project Management Officer, 55] [56–62].*

> *... the problem is the description [i.e., problem statement] being too vague, too open, not clear [...]. Then they start without any data gathering, using gut feeling [...]. That, if you ask me, is the biggest struggle and the biggest problem with finding good countermeasures. [Lean Director, 63] [64–65].*

What caused this mistake? It was the simplicity of the tool itself. Newpro assumed that distributing Five Whys templates and holding a brief training session would suffice—but they were wrong. Five Whys requires extensive training and practice.

...we might think too superficially about the Five Whys process. [Lean Director, 66].

...the Five Whys exercise is really very difficult. [Lean Director, 67] [68].

In 2012, Newpro responded by comprehensively retraining their people to understand the real intent of the Five Whys method. In the third quarter of 2012, this effort bore fruit. Now, when NPD process performance fell short, Five Whys was performed and performance *did* improve. Lean Daily Management showed that most KPIs had turned sustainably green, indicating improved process performance.

4.5 | The interpretation fallacy

In Phase 3, Newpro had to learn that Five Whys, like Lean Daily Management, has two parts that support two different processes: problem-*framing*, through root-cause analysis, and problem-*solving*, through countermeasure development. Five Whys only helps to solve problems when preceded by a proper analysis of the problem and its root cause. Engineers' attention was focused on areas in need for improvement, and the KPIs were working—but the tool was only used to document the solution that people assumed was needed. Newpro's engineers felt controlled by the template, rather than empowered to solve problems. Thus, by wrongly considering Five Whys as an instrument for control and documentation, the engineers fell into an *interpretation fallacy* (see Figure 2).

The distinction between problem-framing, or formulation, and problem-solving is not new in the literature (e.g., Baer, Dirks, & Nickerson, 2013; Lyles & Mitroff, 1980; Newell & Simon, 1972; Vaccaro, Brusoni, & Veloso, 2011). Yet, traditionally, more attention has been devoted to problem-solving, in both practice and education. Our evidence highlights that people tend to jump directly to the solving phase. They ignore the fuzzier front end of the process, where framing the problem at hand should help to impose a structure, set priorities, and stop people jumping straight to a solution that may not address the underlying problem. Our finding is consistent with work in education that has identified people's tendency to adopt predefined solutions, most likely close to their own area of expertise. Bhardwaj, Crocker, Sims, and Wang (2018), in the context of their analysis of strategy courses in business schools, called this issue "plunging-in bias" (p. 279). We have found evidence that this issue also occurred in our setting.

Newpro finally noticed this fallacy when Lean Daily Management revealed that problems were identified, but not solved. On closer inspection of the Five Whys, Newpro realized that it had not been implemented properly. Hence, root causes were not being identified. By retraining its members, Newpro redirected their efforts toward framing the problem based on its actual root cause before developing countermeasures:

[...] in a meeting the group was no longer focused on the problem [...]. Then you said, "Stop; now we're going to systematically approach the whole thing with a Five Whys analysis in order to focus the discussion again." It [Five Whys] is also well suited for this. When I follow this system [Five Whys], I first have to sit down and put my problem description on paper. [Head of Software Department, 69].

[...] and you actually saw exactly how people started to realize for the first time what is important [...]. They weren't even aware of the problem. The risk of what is there

> *and what to look out for. You really noticed from their tone of voice what a learning effect they had from this Five Whys round. So this aspect really impressed me—this learning effect that was directly perceptible to those involved. Their sense of the problem completely excluded what had actually led to the error they were discussing. [Head of Software Department, 70].*

Through training and development, Newpro learned about problem-framing and -solving techniques (see Table 4) and overcame the *interpretation fallacy*. As the firm learnt how to address the root cause of their problems, Five Whys quickly became far less frequent [71] and KPIs turned green. By the end of Phase 3, Waterfall was history [72]. Test procedures were now carefully planned at the beginning of each NPD project. Also, the actual testing was conducted in several steps throughout the development process, and by employees other than those who generated the test plans. For conducting the system verification at the end, Newpro set up a systems testing department. Indeed, performance improved so much that the V-model became an exemplar success story throughout the organization, and even served as a role model within CableCo [65]. By solving the interpretation fallacy, Newpro started impacting their NPD processes.

4.6 | Phase 4: Up and running (2013–2014)

In 2013, as a result of the continuous improvement of the KPIs, the implementation of lean management led to a continuous refinement of the NPD process and an improvement of NPD performance:

TABLE 4 Overview of fallacies that hindered NPD process improvement

	Transfer fallacy	Interpretation fallacy	Expectation fallacy
	Perception that KPIs are universally applicable	Perception of five whys as a tool for control	Expectation that KPIs will be stable and enduring
Symptom	Unsuitable KPIs	Continuously red (missed) KPIs	Continuously green (met) KPIs
Learning	Learning about how to control	Learning about how to solve problems	Learning about how to control
Response	Translating improvement goals and developing KPIs applicable to the NPD environment	Enabling root-cause analysis through Five Whys retraining	Continuously adjusting KPIs and target values
Attentional engagement	*Executive attention* through which employees switch between operational work and problem-solving		*Attentional vigilance* through which employees sustain attention on problem-solving
Effect	Implementation of new, V-model-based NPD process that had only existed on paper for around 2 years	Solutions addressed root cause of problems and led to rapid improvement of the NPD process	Continuous improvement of the NPD process

Abbreviations: KPI, key performance indicator; NPD, new product development.

> *[...] the V-model was consistently developed further. [...] document templates were improved, non-value-adding work steps and approvals were removed or merged, and suggestions from internal offices and external audits were incorporated. These process improvements ensured project implementation and compliance with quality requirements. [Proceedings, 74] [75].*

Finally, Newpro's V-model was mature and effective. However, by 2013, the average project lead time was considered too long. Customers became more demanding in this regard. Product variety continued to increase as the market demanded ever more custom-fit solutions and additional product features such as safety [76], sustainability [77], or value for money [78–80]. Also, the NPD process lacked flexibility, and was too expensive in terms of requirement changes during the project [81]. Thus, in the first quarter of 2013, Newpro decided to integrate elements of Agile development into their processes to become faster and more responsive to customers' needs. What became known as the V-hybrid [82] was meant to include the first (requirements definition) and last (system verification and test) steps of the V-model, while the intermediate steps were redesigned according to Agile principles.

And yet, Newpro's learning journey was still not over. Once Newpro had finalized their KPIs, they held on to them and treated them as enduring—led astray, once again, by their experience in lean operations. In operations, KPI targets such as "0 ppm" (parts with defects), "infinite MTBF" (mean time between failures), or "100% OEE" (overall equipment efficiency) are constant and stable (you cannot go below zero, or above 100%). But this is not so in R&D. When Newpro ran into stagnating improvement and continuously green KPIs, they realized they needed to tighten their objectives and toughen up their KPI targets in order to rekindle fading focus on continuous improvement [83–85]. However, they expected the KPIs themselves to remain valid—which, as it turned out, was a mistake.

...you have to think about how you can not only set the bar higher, but also the measurement system. [Head of Program Management, 86–88].

When Newpro introduced Agile elements into their V-model, they needed to refocus their attention on the KPIs once more [89]. For example, the KPI for inventory had captured the average duration of projects between different gates. While interesting, this value was of limited use for planning—so Newpro introduced a new KPI that reflected the load factor of the department over the coming 2 weeks, which allowed for more active capacity management [90, 91]. Again, Newpro could not rely on KPIs adopted from elsewhere, and had to adapt and develop their own [92]. Moreover, the KPIs had to be aligned with strategic changes at CableCo or AutomationInc; hanging on to old KPIs would misdirect NPD change activities [93, 94]:

> *If you have geared your KPIs towards always delivering on time, but the strategy tells you that above all you have to work cost-efficiently and you do not adjust the KPIs, you will never achieve cost efficiency. [...] That is why it is so critical to constantly question the KPIs and adjust them towards the direction in which you want to develop. [Project Management Officer, 95].*

Eventually, Newpro understood that KPIs are not set in stone in an NPD environment. They needed to be reviewed and regularly adapted [96–102], or the firm would not sustain continuous improvement:

> *If a KPI no longer shows potential for improvement, it can be assumed that either the target is set too low or that it is an irrelevant KPI. Relevant KPIs have a direct impact on the success of the project. In both cases, there is a need for action in order to promote continuous improvement. [Proceedings, 103].*

Newpro went from a stable KPI set to one that was adapted frequently in response to environmental changes. Understanding that R&D KPIs—unlike their counterparts in operations—require not only careful development [104] but also frequent and continuous adjustment took quite some time.

4.7 | The expectation fallacy

In Phase 4, Newpro expected Lean Daily Management to be effective over the long run. But while this was largely true for the dashboard, it was not for the KPIs. Thus, the firm fell prey to an *expectation fallacy*, because it wrongly expected all the KPIs to remain relevant.

In reality, once all the KPIs turned green, attention was dissipated: the feedback loop in Figure 2 was missing. This observation is related to Ocasio's concept of attentional vigilance, or sustained attention, which is about the ability to maintain focus on a task or problem over an extended period of time. To sustain attention on problem-solving, Newpro needed to raise the KPI thresholds to more ambitious values that motivated action (i.e., problem-framing and -solving):

> *... if we now let the metric disappear, then people would get the impression that no one is looking at it anymore, that it's not important, and accordingly the process discipline would surely decline further. [Project Management Officer, 105].*

Further, as a new NPD approach (Agile) was introduced, attention needed refocusing. KPIs were redefined to align with the new NPD model, and to direct and sustain employees' focus on its salient tasks and problems. In overcoming this third fallacy the firm learned—once again—how to control its change processes:

> *That is why we put them through the mill every year, or every one and a half years, because we have reached a stable state again and then want to develop again. We would not develop further if we did not adjust or tighten the key figures again. [Project Management Officer, 106] [107–108].*

Finally, Newpro had attained a system that combined executive attention, through a functioning dashboard meeting, and vigilance, through the continuous adaptation of KPIs and target values. By mastering these two distinct yet connected processes, the firm developed a sustainable system of attentional engagement.

By the end of 2014, lean management was up and running, as confirmed by the report of the Project Management Officer [109]. In Phase 4, Newpro's V-model was refined and became mature. For example, non-value-adding process steps and unnecessary approval gates were eliminated. Further, Newpro had implemented elements of Agile into its software development projects. Agile required an adaptation of the organizational structure (from sizeable project teams to small, interdisciplinary, self-organizing Agile teams); of roles and responsibilities (from

project managers to product owners, Agile masters, and team members, the latter partly taking on leadership roles); and of decision-making (from centralized to decentralized decisions on organization and task allocation).

To conclude, as Newpro identified and overcame all three fallacies, it achieved faster and greater improvement in its NPD process. It succeeded in bringing to life the V-model, which had only existed on paper. Over time, Newpro slowly but steadily improved its V-model NPD process and, remarkably, managed to hybridize it with Agile elements. Table 4 summarizes the three main obstacles Newpro had to overcome in order to develop its dynamic capability. To interpret two of the three fallacies and their connections, we build on Ocasio's (2011) conceptualization of attentional engagement (see Table 4).

4.8 | Phase 5: Lean management enables rapid transition to Agile (2015–2017)

In 2015, Newpro realized that although V-hybrid had improved its situation, it was not a permanent solution [110, 111]. For example, lead time could not be reduced any further [112]. Further, V-hybrid was only deployed to software projects; for more complex projects with a high share of hardware development, Newpro had continued to use the V-model. Newpro decided to extend its efforts to adopt Agile development. To learn more, the organization began networking with about 20 German manufacturing firms and an applied research institution, and enlisted support from coaches.

Unlike the previous changes, the transition to Agile was fast and smooth, proving that lean management (as a DC) had put down strong roots within Newpro. Newpro was able to master a large-scale change from V-hybrid to Agile. This last transformation, which was fairly radical [113], was achieved so rapidly that it surprised even the consultants hired for facilitation [114]. The dynamic capability was finally in place; control and problem-solving issues were clearly understood. By the end of Phase 5, Newpro had completely and successfully switched to Agile, and was using it for all its products. To do so, Newpro reorganized its departments, redesigned its development process and templates, and provided Agile training to its employees. Also, given that Agile teams are small, it required its employees to develop wider skill sets than they had needed for Waterfall or V-model, where greater specialization is possible [115]. Further, Newpro developed 3D printing skills, since Agile, when used for hardware components, demands rapid prototyping.

Overall, Agile enabled Newpro to rapidly deliver innovative products in a fast-evolving technology landscape and to a market characterized by customer requirements of increased demand [116, 117]. Based on this success, management at CableCo decided to roll out Agile development globally. Crucially, the transition to Agile took place quickly and smoothly. Newpro had learnt how to control and solve problems in an adaptive way, and we found no evidence of any of the three fallacies described above. This, we argue, shows that Newpro had developed a dynamic capability, based on the structured interaction between (learning how to) control and (learning how to) solve problems. In the words of one of our participants, a standard procedure (i.e., a new routine) was in place:

> *Standard procedure: KPI, I have my target value, I miss the target value, so I derive Five Whys, which of course triggers the improvement process again. These are always*

the activities that, I would say, keep the whole thing going and develop and trigger new activities. [Head of Newpro, 118] [119–122].

4.9 | Resource reconfiguration

In order to develop new products of higher complexity and with shorter lead times, Newpro developed its ordinary capabilities and altered its resources. There is ample evidence of resource reconfiguration. For example, the Waterfall model includes a single test once the product is developed, whereas the V-model features multiple, more granular tests. Also, Newpro modified its human resources as it changed roles and responsibilities and developed skills. For example, in the Waterfall model, a single person developed and performed all testing. In the V-model, this responsibility was shared by several employees, and the actual testing was done by employees other than those who had generated the test plans. In addition, the firm changed its organizational structure when moving from Waterfall to V-model, and further to Agile; while the first two NPD models are based on a functional organization, the last is based on interdisciplinary teams. Finally, compared with other operations such as manufacturing, NPD is characterized by low tangibility and few physical assets. And yet, we observed a change in tangible assets—namely, the documents and templates that accompanied each project were completely reworked when moving from one NPD model to the next. Overall, we observed that Newpro enacted dynamic capabilities as it altered—by means of lean management—its operational processes as well as its resource base. As noted by Helfat and colleagues (Helfat et al., 2007; Helfat & Winter, 2011) and by Eisenhardt and Martin (2000), a firm's resource base pertains to e.g., human resources, organizational structures, or tangible assets. In Table 5, we show how each of these resource types changed in our case study firm. The changes were gradual and incremental, but their cumulative impact was substantial. The new dynamic capability enabled the implementation and deployment of the V-model and, once the three fallacies were overcome, of Agile development methods through the broad reconfiguration of resources.

5 | DISCUSSION AND CONCLUSIONS

Dynamic capabilities are an important source of competitive advantage, as they can add "unique value to firms through systematic change, enhancing operational efficiency and enabling increased alignment with the environment" (Schilke, Hu, & Helfat, 2018, p. 405). In our study, we find that the emergence of a viable dynamic capability is enabled by the structured interaction between (attention) control and problem-solving. Three fallacies revealed by our fieldwork capture the main obstacles our focal organization had to overcome in the course of learning how to control and solve problems. Each of these fallacies matters because it identifies a specific difficulty in developing a dynamic capability. Once the three fallacies were overcome, the interaction between attention control and problem-solving enabled dynamic capabilities to impact resources and hence modify ordinary capabilities. Our model (which builds upon and extends Zollo and Winter's early model) captures the process connecting the building blocks of a dynamic capability to its impact on ordinary capabilities (see Figure 3). It unpacks how dynamic capabilities (in the center of the figure) support the implementation of a new strategy (left side), impacting ordinary capabilities (right side).

TABLE 5 Evidence of resource changes at Newpro

Resources	Change of resources from ...	to ...
Operating process, operational capabilities	Waterfall • Breaking the work down into five to seven distinct consecutive phases • Creating a timeline for the whole development project before progressing the project by sequentially completing each phase	Agile development: • Partitioning the project into work buckets with identified dependencies and priorities, but not sequenced in any particular order • Detailing work as the project unfolds, possibly adding tasks • Small project teams pick tasks from the task repository and work through them in so-called "sprints"
	Waterfall and V-model: • Detailed capturing of customer requirements at the beginning of the project	Agile development: • Capturing simple descriptions of desired product features expressed by customers—So-called "user stories"—At the beginning of the project • Collecting customer feedback frequently, i.e., at the end of each sprint
	Waterfall: • Both planning and executing testing carried out in a single step, at the end of NPD • Testing the whole product	V-model: • Planning testing procedures at the beginning of NPD • Executing testing in several steps and on various levels (e.g., component, subsystem, and eventually product level) • Testing frequently, i.e., at the end of each sprint
Organizational, formal structures	Waterfall: • No systems testing department	V-model: • Systems testing department
	Waterfall and V-model: • Functional departments • Centralized decision-making	Agile development: • Small interdisciplinary teams • Decentralized decision-making
Human resources, skills	Waterfall and V-model: • Functional departments with employees mastering narrow skill sets	Agile development: • Small cross-functional teams with employees mastering broad skill sets, including leadership roles
	Waterfall: • Planning and executing testing procedures is done by the same person	V-model: • Testing procedures executed by different employees from those who plan the testing • Testing done in several steps and on several system levels; thus, more employees are enabled to perform testing procedures
		Agile development: • Developing and deploying 3D printing skills for rapid prototyping

TABLE 5 (Continued)

Resources	Change of resources from ...	to ...
Tangible, physical resources	Waterfall and V-model: • Project documents (e.g., customer requirements are captured by so-called "requirement specifications") and are very different from those of Agile development	Agile development: • Project documents (e.g., customer requirements are captured by so-called "user stories") and are very different from those of waterfall and V-model

In our model, attentional engagement plays a fundamental role by enabling an organization to remain focused on change processes over an extended period. Attentional engagement (box A) is essential to our interpretation of control within dynamic capabilities, and its relation with problem-solving is core to our elaboration of the concept of dynamic capability. First, once a strategic direction is chosen, goals and related KPIs must be determined so that organizational members can act in line with the strategy (arrow 1 in Figure 3). KPIs engage and direct employees' attentional resources toward the processes underpinning the functioning of a dynamic capability. This may seem obvious—and, in principle, it is. In practice, however, knowledge of KPIs is far less codified and transferable than that of problem-solving tools. For example, the weekly dashboard meeting was important to activate executive attention (right-hand side of box A) and signal when to switch from operational to problem-solving tasks. Yet, in the absence of appropriate KPIs, the transfer fallacy thwarted the connection between the control and problem-solving elements of the dynamic capability, and problems were not solved. Once this fallacy was addressed, the weekly meeting became an effective "executive attention" tool (arrow 2).

Second, setting up an attention control system is necessary, but not sufficient. Learning how to solve problems (box B) is demanding. Before problems can be solved, they must be framed precisely (framing; left of box B). In our context, for example, framing meant developing an accurate problem description at the beginning of the Five Whys. When that did not happen (because of the interpretation fallacy), no meaningful solution could be found, and ordinary capabilities did not change. At this point, though, the persistent inability to meet the agreed KPIs shifted attention to the analysis of what was wrong with the implementation of the Five Whys. Once the interpretation fallacy was resolved, the framing part of the Five Whys was duly implemented and hence viable countermeasures ("solving" the problem; right of box B) were identified. Hence, ordinary capabilities were affected (arrow 3).

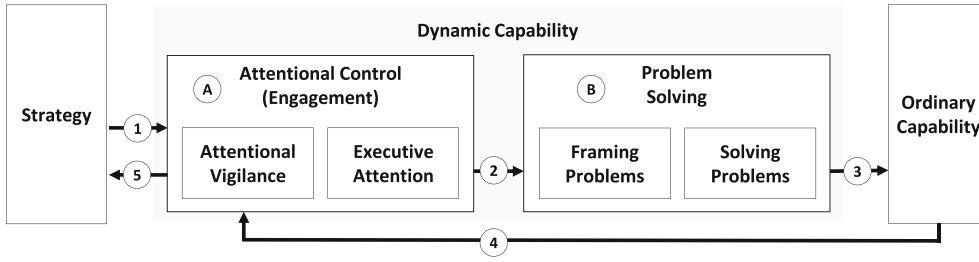

FIGURE 3 A process model of dynamic adaptation

However, the process is not yet over. Implementing new practices generates feedback (arrow 4), linking back to the control element of the dynamic capability. Over time, performance improves and KPI targets are systematically met; consequently, attention to these tasks decreases. Thus, third, in order to sustain attention on organizational adaptation, KPI targets and KPIs themselves need to be adapted in order to keep people's "eye on the ball"—i.e., to sustain attention on the improvement effort over time (attentional vigilance; left of box A). At this point, another fallacy can arise, in relation to the expectation that KPIs and their target values are stable over time. They may be so for a while, but they also need to be adjusted. If they are not, attention dissipates and control ceases to be effective. When KPIs are being consistently met, KPI targets are tightened to return attention to problem-solving once again. Consistently missed KPIs (despite lean management being in place and functional) induce strategic action (arrow 5) and, in turn, the development of new KPIs (arrow 1). Thus, refining KPIs sustains attention on organizational adaption.

In sum, we have developed a process model that offers insights into two core elements of a dynamic capability (i.e., problem-solving and attention control), and the mechanisms through which these elements recurrently interact to modify ordinary capabilities through resource reconfiguration. Our core mechanism builds on the distinction between executive attention and attentional vigilance on the one side, and problem-framing and -solving on the other. Executive attention processes enable organizational members to switch their attention between operational and adaptive tasks; attentional vigilance keeps their attention focused over time. Both are activated by the design and redesign of effective KPIs. Together, they allow us to explain why and how firms manage to keep their attention engaged on change processes over an extended period of time. Problem-solving processes need guidance and direction to achieve resource reconfiguration. Attentional engagement processes are there to transform broad strategic guidelines into concrete, inter-temporally coherent actions. The structured interaction of attention control and problem-solving explains the successful modification of ordinary capabilities.

Our findings are important because extant literature has conceptually (Schreyögg & Kliesch-Eberl, 2007; Zollo & Winter, 2002) and empirically (Heimeriks et al., 2012; Zahra, Sapienza, & Davidsson, 2006) focused on the emergence and evolution of dynamic capabilities, while paying less attention to their use and operation. Danneels (2010) provides one of the few micro-studies of different modes of resource reconfiguration. To date, the literature offers little explanation of how dynamic capabilities modify ordinary capabilities—even though this process is central to many foundational works on dynamic capabilities (Eisenhardt & Martin, 2000; Zahra et al., 2006) and, as noted by Schilke et al. (2018, p. 419), we need "greater knowledge of causal mechanisms in dynamic capability research."

Our study contributes to understanding the micro-processes through which dynamic capabilities modify ordinary capabilities. We answer the call by Helfat and Winter (2011) to focus on incremental and operational changes and highlight the theoretical importance of such changes for studies of innovation and adaptation. In the past, most studies have associated dynamic capabilities mainly with rapid implementations of large-scale changes (e.g., through acquisitions, Heimeriks et al., 2012). Change, however, is often incremental, and dynamic capabilities are also enacted in relatively stable environments (Helfat & Winter, 2011; Schilke et al., 2018; Zollo & Winter, 2002). Likewise, even if the trigger for a specific change process is a discrete exogenous event (such as the COVID-19 crisis and the rapid adoption of home-working practices), the ensuing implementation process may still be long, and require further adaptations. We find that attentional engagement is crucial in ensuring continuity in change processes and

sustaining high levels of engagement among all the employees involved (Eisenhardt & Martin, 2000).

Further, our model has implications for the ABV. It highlights how the components of attentional engagement (executive attention and vigilance) relate to each other, how they interact with problem-solving, and, thus, how they affect ordinary capabilities, activating problem-framing and -solving processes. The interaction between control and problem-solving is important. The ABV looks at strategy as patterns of attention (e.g., Ocasio & Joseph, 2018). We extend this view by connecting patterns of attention to a view of strategy as patterns of actions, informed by attentional processes. Our model provides a step in this direction, showing a mechanism in which attentional processes activate and maintain problem-solving tasks and, in turn, impact resources. We show that the ABV is not only about cognitive processes that precede action but is also fundamental to explaining the emergence of operational processes that lead to significant managerial outcomes—namely, resource reconfigurations.

On this basis, our approach builds upon and extends past ABV work on the origin of strategies. For example, Ocasio and Joseph (2018) compared Apple and Motorola in terms of their abilities to sustain attention over time. Despite starting with similar strategic ideas on smartphones, the two companies achieved very different performance levels. Our approach confirms the authors' intuition, but also provides a clear mechanism through which dynamic capabilities enable the transformation of an idea into a concrete, successful strategy: the structured interaction between attention control and problem-solving tasks.

Finally, our research has implications for the literature on management control. We highlight problem-solving, which has traditionally been peripheral to this literature (Cardinal, 2001; Snell, 1992), as an important complement to control related to adaptability outcomes such as innovation and change. We also highlight the importance of control processes. Building on the ABV, we frame the discussion about control as attention control. While this connection between attention and control is not new (e.g., Ocasio & Wohlgezogen, 2010), our attentional interpretation reveals control as a set of processes that induce problem-solving and enable organizational members to focus and refocus their (scarce) attentional resources over time. These processes enable the organization to attain its desired outcomes—in our case, adaptability (an understudied outcome category, as noted by Cardinal et al., 2017). While the control literature has focused on understanding which types of control (or sets of control types) are effective contingent on what outcome types, our process-oriented research reveals the mechanism through which control (in alignment with problem-solving) enables organizations to adapt and change over time.

More generally, our study might help to reconnect ongoing strategy work on dynamic and ordinary capabilities to the original intuition of Nelson and Winter (1982): that organizations exist both to solve problems and to align conflicting interests and purposes. We believe that the joint analysis of problem-solving and attention control is an exciting and so far relatively unexplored area of research in strategy. For example, future research on dynamic capabilities would benefit from considering different types of control. The control literature distinguishes between three main types (Cardinal, 2001; Snell, 1992): *input control* is concerned with selecting and training employees; *behavior control* is concerned with following operating procedures; and *output control* is concerned with target results. The effectiveness of these types essentially depends on knowledge of cause-and-effect relationships, and on how standardized the desirable performance is. We have focused on output control. When managers control outputs, they set targets, such as shorter NPD cycles, for employees to pursue. This type of control requires employees to find or develop new means to reach the established targets (as opposed to using

means that are predefined or readily available). This is consistent overall with the environment we study, and partly explains the contrast with operations, where behavioral control is also important and feasible. Future research might focus on the interplay of problem-solving and different types of control instead, answering the challenge posed by Ocasio and Wohlgezogen (2010, p. 191), who argue that it would be "important to examine in detail how different types of control affect attention in different ways." The dynamic capability framework can provide a common ground to connect the analysis of different types of control to that of different phases of dynamic capability deployment (sensing, seizing, reconfiguring). For example, one might argue that input and output controls are difficult in the sensing phase, because it aims at exploring new avenues.

Many investigations have usefully built on Teece et al.'s (1997) distinctions between coordinating, learning, and reconfiguring processes, and Teece's (2007) processes of sensing, seizing, and transforming. Making these different organizational processes concrete has shown how dynamic capabilities manifest themselves in organizations. In our data, we find evidence related to sensing (e.g., Newpro's recognition that the external environment was changing), seizing (e.g., Newpro's commitment of resources to develop new processes), and transforming (e.g., the actual reconfiguration of routines). In addition, though, we extend Teece's framework by providing micro-level evidence about the specific processes that enabled the initial sensing of a need and the seizing and transforming to actually generate a continuous process of resource reconfiguration. By connecting Teece's framework to the ABV, we also partially address the caution of Teece (2007) that the "sensing, creating and learning functions" should not depend entirely on the cognitive skills of a few individuals, but should involve and direct the wider organization. Our study serves as a step toward exploring how to effectively direct and aggregate individual-level activities into organization-level processes. The analysis of how KPIs are defined and evolve over time might offer interesting insights into this possible aggregation process. Future research could go further by building on recent individual-level work on attention control (e.g., Laureiro-Martínez, Brusoni, Canessa, & Zollo, 2015) also building an explicit connection with the dynamic capabilities framework (Helfat & Peteraf, 2015).

Further, our analysis builds on routines research in the evolutionary tradition of Nelson and Winter (1982). Different approaches exist to conceptualize and study routines. The landmark study of Feldman (2000) initiated a line of work based on different theoretical, and even epistemological, premises. By highlighting issues of control, our approach is a small step toward reconnecting these two approaches. For example, Dönmez, Grote, and Brusoni (2016) adopted the ostensive-performative approach to analyze how interdependent routines enable organizations to "control" transitions between stability and flexibility. Similarly, Collinson and Wilson (2006) studied the workings of control routines that inform the implementation of other routines, adopting a hierarchical view of routines similar to our own and that of Winter (2003). Future work might further contribute to reconnect the two important traditions of routines research.

More generally, our process model develops Ocasio's (1997) intuition that in order to understand competitive advantage, we need a theory that integrates "an attention-based view of the firm with resource and industry perspectives" (p. 205). By combining the ABV with the dynamic capability framework, we have developed a perspective that connects control and problem-solving and enables us to understand, at a high level of granularity, the unfolding of processes of change, adaptation, and resource reconfiguration as they happen in real time.

Lastly, we suggest that our micro-level, attention-based approach might help bridge the chasm between different conceptualizations of dynamic capabilities, as discussed in Peteraf, Di

Stefano, and Verona (2013). In our view, at their very core, these differences might be reconciled by looking at the alternative attention structures that firms develop around their processes and practices. An attention-enhanced dynamic capability approach might explain variance in firms' ability to turn comparable practices or resources into sustainable competitive advantage—that is, what sustained attentional vigilance enables them to achieve. Furthermore, however, it can also help explain, through the behavioral changes enabled by executive attention, why certain firms are better than others at switching gears in response to varying rates of environmental change.

ACKNOWLEDGMENT

We are indebted to Florian Rittiner for excellent support during the data collection phase, as well as to the participants of seminars at Università Bocconi, ETH Zurich and U. of Zurich for their comments and suggestions. All errors are of course our own. Anja Schulze gratefully acknowledges the support by the European Commission's 7th Framework Programme for Research (Grant No. 230740) and the Swiss National Science Foundation (Grant No. PP00P1_150490). And we sincerely thank Connie Helfat and two anonymous reviewers for their insightful comments and suggestions throughout the review process.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions.

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How to cite this article: Schulze, A., & Brusoni, S. (2022). How dynamic capabilities change ordinary capabilities: Reconnecting attention control and problem-solving. *Strategic Management Journal*, *43*(12), 2447–2477. https://doi.org/10.1002/smj.3413