

A Thesis Submitted for the Degree of PhD at the University of Warwick

Permanent WRAP URL:

<http://wrap.warwick.ac.uk/160617>

Copyright and reuse:

This thesis is made available online and is protected by original copyright.

Please scroll down to view the document itself.

Please refer to the repository record for this item for information to help you to cite it.

Our policy information is available from the repository home page.

For more information, please contact the WRAP Team at: wrap@warwick.ac.uk



**Open, Temporal, and Cultural Practices
in New Ways of Strategizing**

By

Christina Angelika Wawarta

Thesis

Submitted to the University of Warwick

for the degree of

Doctor of Philosophy

Warwick Business School

September 2019



Table of Contents

Table of Contents	ii
List of Tables	vi
List of Illustrations.....	vii
List of Abbreviations	viii
Acknowledgements.....	ix
Declaration.....	xi
Abstract.....	xiv
Chapter 1 Introduction	1
1.1 Introducing the topic.....	2
1.1.1 Evolution of strategic management	
scholarship and avenues for further research..	2
1.1.2 Strategizing – practices of strategy-making....	4
1.1.3 Dynamic capabilities and their link to	
strategizing.....	6
1.2 Knowledge gaps.....	10
1.3 Research agenda	17
1.4 Research methodology.....	22
1.4.1 Philosophical stance.....	22
1.4.2 Research strategy	26
1.4.3 Data collection and case descriptions	28
1.4.4 Data analysis and interpretation framework ...	33
1.5 Thesis structure.....	34
Chapter 2 The Role of Strategy Tools in Open Strategy:	
A Waltz with Deductive and Inductive Practices	37
2.1 Introduction.....	38
2.2 Theoretical background	41
2.2.1 The evolution of strategy process and	
practice research	41
2.2.2 Strategy tools and the practice turn in	
strategic management scholarship	42

2.2.3	Opening up the strategy process	45
2.2.4	Materiality of strategy tools in open strategy.....	47
2.3	Method.....	48
2.3.1	Research context	49
2.3.2	Data collection	56
2.3.3	Analytical approach	60
2.4	Analysis and findings	66
2.4.1	The role of strategy tools in the open..... strategy process.....	66
2.4.2	Tool-based successive convergence of	
	deductive and inductive practices in open	
	strategizing.....	70
2.4.3	Tool-based open strategizing – birth of a..... novel dynamic capability	79
2.5	Discussion and conclusion.....	82

**Chapter 3 Three, Two One, Liftoff: NASA’s Practices for
Managing Temporal Tensions of Human Space**

	Exploration.....	88
3.1	Introduction.....	89
3.2	Theoretical background	92
3.2.1	Different views of time in management	
	studies	92
3.2.2	Social practices for temporal tension..... management over time.....	94
3.3	Method.....	100
3.3.1	Methodological overview	100
3.3.2	Case study description: Human space..... exploration at the Johnson Space Center	101
3.3.3	Data collection and data analysis	103
3.4	Analysis and findings	112
3.4.1	Temporal context and tensions of human	
	space exploration	112
3.4.2	Temporal practices and their role for..... longitudinal strategic change	120
	<i>3.4.2.1 Change-related temporal practices ..</i>	<i>120</i>
	<i>3.4.2.2 Vision-related temporal practices</i>	<i>121</i>
3.5	Discussion.....	125

3.5.1	Process model for the management of	
	long-term strategic change initiatives	125
	3.5.1.1 <i>Temporal tensions</i>	127
	3.5.1.2 <i>Temporal practices</i>	127
	3.5.1.3 <i>Outcomes</i>	127
3.5.2	Developing a temporal management	
	capability.....	128
3.5.3	Theoretical implications	130
3.5.4	Limitations and conclusions	132
Chapter 4	Cultural Oscillation as an Enabler of Ambidexterity:	
	A Longitudinal Study of a Team Subculture in NASA.....	133
4.1	Introduction.....	134
4.2	Theoretical background	137
	4.2.1 Incumbents and ambidexterity.....	137
	4.2.2 Ambidexterity, culture, and subcultures	138
4.3	Method.....	140
	4.3.1 Research context	141
	4.3.2 Data collection and data analysis.....	143
4.4	Analysis and findings	146
	4.4.1 Context of the emergence of the Pirate.....	
	subculture.....	146
	4.4.2 The Pirate subculture and its practices	149
	4.4.3 Subculture practices: Enacting culture to	
	develop a cultural capability	155
	4.4.4 Cultural oscillation of organizational and.....	
	subculture practices.....	157
	4.4.5 Cultural oscillation in the context of a.....	
	subculture lifecycle	162
4.5	Discussion.....	168
	4.5.1 A novel mode of ambidexterity: Cultural	
	oscillation.....	168
	4.5.2 Capability dynamics and practice	
	mechanisms of cultural oscillation	170
4.6	Conclusion	172
Chapter 5	Conclusion.....	173
5.1	Introduction.....	174
5.2	Overview of contributions	175
	5.2.1 Specific contributions from the three papers ..	175

5.2.1.1	<i>Paper 1: The Role of Strategy</i>	
	<i>Tools in Open Strategizing</i>	175
5.2.1.2	<i>Paper 2: Three, Two, One, Liftoff</i>	177
5.2.1.3	<i>Paper 3: Cultural Oscillation as</i>	
	<i>an Enabler of Ambidexterity</i>	178
5.2.2	Additional contributions related to the	
	common theme of the thesis	183
5.3	Limitations and opportunities for future research	186
5.3.1	Research limitations and mitigation	
	strategies	186
5.3.2	Future research avenues.....	189
References		191
Appendix A: Research instrument related to chapter 2.....		223
A1	Semi-structured interview guide for chapter 2	223
Appendix B: Research instrument related to chapter 3.....		225
B1	Semi-structured interview guide for chapter 3	225
Appendix C: Research instrument and timeline for chapter 4.....		226
C1	Semi-structured interview guide for chapter 4	226
C2	Key events and their implications on NASA's.....	
	organizational culture and the Pirate subculture.....	227

List of Tables

1.1	Knowledge gaps, the value of SAP research, and consideration in own research.....	11
1.2	Research objectives and research questions.....	21
2.1	Open strategy process at AutoParts and the role of its strategy tools	51
2.2	Overview of the empirical data and their use in the analysis.....	58
2.3	Coding structure for an open strategizing tool typology.....	63
2.4	Strategy tools' affordances and associated practices for..... strategizing	71
3.1	Research on temporal tensions and practices for their management	96
3.2	Three phases of human space exploration relevant for building..... a temporal management capability at NASA.....	106
3.3	Coding structure	109
3.4	Empirical examples of vision-related temporal practices	123
4.1	Contrasting the organizational culture prior to the Pirates with..... the Pirate subculture and the oscillated culture post-Pirates	151
4.2	Enacting the Pirates' subculture in practice with strong potential for conflict	155
4.3	Four practices implicated in cultural oscillation	159
4.4	Coding structure for the cultural capability lifecycle.....	164
5.1	Summary of research findings and contributions to theory and..... practice from the three papers	181
A1	Semi-structured interview guide for chapter 2.....	223
B1	Semi-structured interview guide for chapter 3.....	225
C1	Semi-structured interview guide for chapter 4.....	226
C2	Key events and their implications on NASA's organizational culture and the Pirate subculture	227

List of Illustrations

- 2.1 Interplay of strategy tools and their inductive and deductive
strategizing practices 76
- 2.2 Tool-based successive convergence of deductive and inductive
practices in open strategizing 78

- 3.1 Comparison of US space initiatives and US administrations.....
(1959-2019)..... 115
- 3.2 Development of NASA’s temporal practices over time..... 119
- 3.3 Process model for the temporal management of long-term
strategic change initiatives 126

- 4.1 Stages of the cultural oscillation process of the Pirate subculture
over time..... 154
- 4.2 Subculture lifecycle, direct and oscillatory effects, and conditions ... 163

List of Abbreviations

AoM	Academy of Management
ARM	Asteroid Redirect Mission
BHAG	Big Hairy Audacious Goals
DSGW	Deep Space Gateway
EISD	Exploration, Integration, and Science Directorate
EVA	Extravehicular Activity
GLM 2020	Global Market Leader 2020
HEOMD	Human Exploration and Operations Mission Directorate
ISS	International Space Station
JSC	Johnson Space Center
MCC	Mission Control Center
MCC-21	Mission Control Center for the 21 st Century
M&A	Mergers and Acquisitions
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautics and Space Administration
Pax	Participants
RISE	Revolutionize ISS for Science and Exploration
SAP	Strategy-as-Practice
SG&A	Selling, General and Administrative Expenses
SIFF	Systematic Intelligent Fast Failure
SLS	Space Launch System
SMS	Strategic Management Society
STS	Space Transportation System (e.g. STS-1)
TMT	Top Management Team

Acknowledgements

Pursuing the degree of a Doctor of Philosophy (PhD) has always been a lifetime goal of mine. I am therefore eternal grateful for everyone who supported me on this inspirational, strenuous, instructive, and rewarding journey.

Firstly, I would like to thank my two remarkable supervisors Professor Sotirios Paroutis and Professor Loizos Heracleous for their invaluable support, guidance, patience, flexibility, and knowledge. You were instrumental for continuous and generous funding, access to unique data as well as to a great research community. I truly could not have done it without you! I look forward to many more joint research projects to come in the future.

Secondly, I am indebted to Warwick Business School, Capgemini Consulting/ Invent, and the Strategic Management Society (SMS) for their financial support of my research and the helpful research training that I received through them. Warwick Business School's scholarship and its impact case study funding, Capgemini's coverage of travel expenses, and the SMS Strategic Research Fund allowed me to conduct exceptional longitudinal international fieldwork.

This also brings me to my third point dedicated to the organizations that kindly allowed me to collect qualitative in-depth data. On the one hand, this had been the international US-based automotive supplier AutoParts (disguised name) and on the other hand, it had been the unique Johnson Space Center (JSC) of the National Aeronautics and Space Administration (NASA) in Houston. In particular, I would like to thank all the individuals that granted me access to their meetings, documents and thoughts, took the time for interviews, introductions, and observations, and always assisted me in any possible and impossible way. I will never forget this fantastic time in my life!

Fourthly, I want to express my gratitude for the helpful suggestions on earlier versions of this thesis and its three papers that I had received during multiple occasions. This includes the anonymous reviewers for the 37th, 38th,

and 39th SMS Annual Conferences, and the 79th Annual Meeting of the Academy of Management (AoM). Further, I want to thank the participants of the 2017, 2018, and 2019 SAP-R workshops and the Strategy and International Business faculty from the University of Surrey for their comments during a research seminar.

Finally, I would like to thank my family, especially my mum Claudia, my dad Herbert, and my brother Jannik, as well as my friends for their continuous support, encouragement, and help. I am lucky to have you around and I hope to pay back your good deeds in one way or another in the future. Last but not least, I am grateful that Astro joined me halfway down the PhD road. He was precious emotional support, source of inspiration, and he always made sure I got some fresh air.

Declaration

Name and Surname: Christina Angelika Wawarta
Warwick ID: 1059821
Degree: Doctor of Philosophy
Title of thesis: Open, Temporal, and Cultural Practices in New Ways of Strategizing
Department: Warwick Business School

This thesis is submitted to the University of Warwick in support of my application for the degree of Doctor of Philosophy. I declare that it is the result of my own work including the chapters that have been co-authored for previous submissions and publications as indicated below. This thesis has not been submitted in any previous application for any degree.

A previous version of chapter 2 has been sent to the SMS Annual Conference twice before. In 2017, it was submitted as a single-authored proposal entitled “Unintended Affordances of Strategy Knowledge Artifacts and their Implications for the Development of Dynamic Capabilities” and in 2019 as a co-authored piece with Professor Sotirios Paroutis (second author) as “The Role of Strategy Tools in Open Strategy: A Waltz with Deductive and Inductive Practices”. Both times, the proposal was accepted for inclusion in the conference program and invited to participate in the SMS Best (PhD) Paper competitions. Following this request, a full paper was submitted for the Best PhD Paper and the Best Conference Paper competitions in 2019. The decision of the award committee had still been pending at the time of the submission of the thesis. Further to these conference-wide competitions, the full paper was also named the winner of the inaugural Best Paper award from the SMS Strategy Practice Interest Group in 2019.

Additionally to the conference submission for SMS, an earlier version of chapter 2 had also been sent to the Academy of Management for inclusion in its Annual Meeting in Boston 2019. Thereafter, the paper not only appeared in the conference program but it was also recognized as one of the best papers of the conference. It was published as “Strategy tools in open strategizing: blessing or curse for making strategy more actionable?” in *G Atinc (ed.). Proceedings of the Seventy-ninth Annual Meeting of the Academy of Management*. Online ISSN: 2151-6561. I was the first author of the paper with my doctoral supervisor Professor Sotirios Paroutis having been its second author.

As for chapter 3, an earlier version of it had been sent to the SMS Annual Conference in 2019. It was submitted as a co-authored proposal entitled “Three, Two, One, Liftoff: NASA’s Practices for Managing Temporal Tensions of Human Space Exploration”. I served as the lead author of the proposal and my supervisors Professor Loizos Heracleous and Professor Sotirios Paroutis as second and third authors. The submission was accepted for the 39th SMS Annual Conference 2019. It was also invited to participate in the SMS Best Conference Paper Competition. For the latter we had consequently sent an earlier version of chapter 3 in July 2019. At the time of the submission of the thesis, the award committee’s decision was still pending.

A draft version of chapter 4 had also been submitted to the SMS Annual Conference before. In 2018, it was sent to SMS as a co-authored proposal entitled “Culturizing in Ambidextrous Organizations: A Historic Case of NASA’s Rebels”. Again, I was the lead author of the paper and my supervisors Professor Loizos Heracleous and Professor Sotirios Paroutis were second and third authors. Back then, the proposal had also been invited to participate in the SMS Best PhD Paper Competition. We did not submit a full version though due to pressing data collection obligations at the time. In addition to the above conference submission, this chapter had also been sent to a top-tier management journal in 2018 with the same order of authors as above. The journal submission was called “Cultural Oscillation as an Enabler of Ambidexterity: The Case of NASA’s Pirates”. Finally, a practitioner-oriented

article had been produced for the Sloan Management Review from the chapter called “The NASA Renegades: Transformation from Within”. The order of authors was as follows: Professor Loizos Heracleous, Christina Wawarta, Steven González, and Professor Sotirios Paroutis. The article was published on 5th of April 2019 with the title “How a Group of NASA Renegades Transformed Mission Control”. The article is available from <https://sloanreview.mit.edu/article/how-a-group-of-nasa-renegades-transformed-mission-control/>.

Due to the collaboration with my doctoral supervisors Professor Sotirios Paroutis and Professor Loizos Heracleous on all three papers, this thesis uses a plural voice in chapter 2 to 4 [inclusive].

Abstract

Organizations operate in a changing environment due to new market dynamics, technological and societal demands. This thesis follows a strategy-as-practice approach to investigate the micro processes and practices that organizations adopt over time to develop dynamic capabilities for dealing with the above challenges. In line with this approach, I conducted three studies: one at a large international automotive supplier (AutoParts – disguised name), and two at NASA’s Johnson Space Center in Houston. I relied on inductive reasoning and grounded theory to analyze the in-depth qualitative case study data that I collected between January 2016 and April 2019.

The first study investigates the practices that AutoParts enacted in its open strategy process. My findings suggest a new typology of strategy tools based on their affordances and consequently the type of strategizing practices they favor or constrain - either deductive top-down strategizing or inductive bottom-up strategy-making. Further, I discovered the central role that the interplay of these two types of strategy tools play for gradually reaching strategic consensus and for developing a corresponding dynamic capability.

The second study is a longitudinal account of NASA’s human space exploration activities and its related management of temporal tensions. I identified two types of temporal strategizing practices in the context of long-term strategic change. Change-related temporal practices are purposefully executed to facilitate change initiatives, while vision-related temporal practices either facilitate or inhibit change in an overt or covert way. I suggest a process model that can be associated with a dynamic capability for managing temporal tensions in long-term strategic change.

The third study focuses on an incumbent firm’s ability to adapt to environmental changes by becoming more ambidextrous. I studied the innovative subculture of the Pirates within the large organization of NASA. My findings reveal that the interaction between the Pirates’ subcultural practices and the practices from the dominant organizational culture fostered ambidexterity. Through a process, which I term cultural oscillation; these practices produced direct and residual effects for the organization.

Chapter 1:

Introduction

1.1 Introducing the topic

The world is changing. Therefore, organizations have to adapt the way they operate and eventually how they are strategically managed. In recent years terms such as platforms (e.g. Barlow, Verhaal, and Angus, 2019; Wen and Zhu, 2019), disruptive technological change (e.g. Roy, Lampert, and Stoyneva, 2018), design thinking (Knight, Daymond, and Paroutis, 2020), and openness (e.g. Dobusch, Dobusch, and Müller-Seitz, 2019; Whittington, Cailluet, and Yakis-Douglas, 2011) have increasingly entered the vocabulary of practitioners and the strategic management literature. They represent new market dynamics, technologies, and societal demands, which arguably require firms to engage in novel strategy practices and consequently the development of new (dynamic) capabilities. My research examined three of such instances and identified as well as theorized different open, temporal, and cultural practices as underlying mechanisms for novel dynamic strategic management capabilities. Focusing on the practices of the actual intended and unintended doing of strategy-making across all levels of an organization, as advocated by strategy-as-practice (SAP) scholars, prove essential to this research project. Before providing an overview of the three main chapters that comprise this thesis, I locate my research more thoroughly in the existing strategic management literature and outline the knowledge gaps it addresses. I will then continue with a summary of my methodological approach before I introduce the structure of the thesis in detail.

1.1.1 Evolution of strategic management scholarship and avenues for further research

Strategic management as a subject of study has come a long way from its beginnings in the 1960s. Back then, Harvard University started teaching courses on business policy (Greiner, Bhambri, and Cummings, 2003) while at the same time the need for strategic planning emerged more widely due to a sharp acceleration of environmental change and firms' corresponding need to manage their operations in a more effective and longitudinal way (Cummings and Wilson, 2003; Heracleous, 2003). Both parallel developments arguably

depicted the starting point for a plurality of scholarly perspectives and theories on strategic management to evolve (Johnson, Scholes, and Whittington, 2008) with Henry Mintzberg even arguing that “the field of strategic management cannot afford to rely on a single definition of strategy” (Mintzberg, 1987:11). It is therefore not surprising that Mintzberg together with other prominent figures like Andrew Pettigrew was instrumental in developing a more behavioral process approach to strategy, which starkly contrasted the often rather static research on strategy content, which dominated the field early on (Chakravarthy and Doz, 1992; Pettigrew, 1992). Strategy content research until then had mostly focused on strategic positions and competitive advantage in relation to industry structures (e.g. Porter, 1980) or available resources (e.g. Wernerfelt, 1984). Growing dissatisfaction with this made scholars explore new directions, which often built upon the works from the American Carnegie School that rejected the rational economic man and replaced this concept with the theory of bounded rationality (Simon, 1978). Scholars nowadays largely recognize that the above distinction between content and process is unduly limiting, as are other labels and conceptual boundaries that emerged over time. Therefore, Volberda noted that the field of strategic management is “replete with competing prescriptions and directives” (2004:35) and argued that scholars should stop trying to develop a single paradigm that covers the entire field but instead synthesize in few clusters of strategic management problems. By that, the disillusion with the value of strategic management research could be overcome in his opinion.

One of the key clusters that Volberda identified in his review concerns the development of dynamic capabilities while at the same time he proposed strategizing as a promising avenue for synthesizing the field (2004). A similar call for further research at the intersection of dynamic capabilities and strategizing was repeated by Regnér in 2008 and most recently by Burgelman *et al.*¹ (2018) and thereby frames my research as relevant and topical.

¹ In their review article, Burgelman *et al.* (2018) specifically call for more combined strategy-as-practice and strategy process research in six themes, namely 1) temporality, 2) actors and

1.1.2 Strategizing – practices of strategy-making

Following a wider contemporary practice turn in the social sciences based on e.g. Giddens and Bourdieu (Jarzabkowski, Balogun, and Seidl, 2007; Whittington, 2006) and more current work by Schatzki, Knorr Cetina, and Von Savigny (2001) as well as Reckwitz (2002), strategic management scholars have drawn from practice theory to advance the field further. In the last twenty years, the so-called strategy-as-practice community extended the topical domain of strategic scholarship by focusing on the triad of practices, praxis, and practitioners (Vaara and Whittington, 2012; Whittington, 2006). Its focus on the social and organizational practices of strategy-making arguably depicts the core of the SAP research agenda (Burgelman *et al.*, 2018) and highlights a gap between the mainstream theory of strategic management, which has traditionally been more concerned with what strategies organizations *have*, in contrast to the strategy work that practitioners actually *do* (Jarzabkowski, 2004). To highlight such strategic management in action – following a similar claim about knowledge management from Cook and Brown (1999) – it requires “going into the process” (Brown and Duguid, 2001) and thereby the praxis of strategy-making instead of only appreciating it from the far.

To highlight bespoke focus on activities, the term “strategizing” was coined and juxtaposed as a new research focus with the traditional research on strategies (Whittington, 1996). Following Reckwitz’s (2002) definition of practices it can be defined as “routinized types of behaviour which consist of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, ‘things’ and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge” (2002:249) in the context of strategy (Jarzabkowski *et al.*, 2007). This definition highlights another important aspect of SAP research, namely

agency, 3) cognition and emotionality, 4) materiality and tools, 5) structures and systems, as well as 6) language and meaning. However, at the same time, the authors acknowledge that their list is necessarily limited and incomplete. They argue that any topic that so far has only been on the research agenda of either the SAP or the strategy process tradition, lends itself to cross-fertilization and exchange. The topic of dynamic capabilities is one such case.

that it deliberately extends its focus to aspects of strategy-making that had not been in the limelight of traditional strategic management scholarship in the past. Examples include (socio-)materiality and tools (e.g. Dameron, Lê, and LeBaron, 2015; Friesl, Larty, and Jacobs, 2018; Heracleous and Jacobs, 2008; Kaplan, 2011), as well as emotions (e.g. Liu and Maitlis, 2014). The same is true for organizational actors. While traditionally strategy scholarship had mostly been concerned with managerial elites and middle managers, SAP research is not limited to them but also includes ordinary employees and consultants, to name just few (e.g. Angwin, Paroutis, and Mitson, 2009; Mantere and Vaara, 2008). The SAP research agenda and its focus on strategizing is therefore suitable for advancing our knowledge about strategic management and to overcome the aforementioned disillusionment with past strategic management research. Previous work in this vein has already shown that it is capable of producing relevant contributions. SAP research has been published in top-tier academic journals of strategic, organization, and management studies, such the Strategic Management Journal (e.g. see the special issue by Burgelman *et al.*, 2018), Organization Science (e.g. Kaplan, 2011), and the Academy of Management Annals (Vaara *et al.*, 2012).

Research on the practices of strategy-making has also triggered some methodological discussions. Especially at the beginning, SAP research had mostly focused on the “close understanding of the myriad, micro activities” of strategic management (Johnson, Melin, and Whittington, 2003). This called for a shift of focus from the macro analyses of traditional empirical strategy scholarship to the micro, e.g. by means of in-depth case studies and ethnographies (Balogun, Huff, and Johnson, 2003; Whittington, 1996). Over time, however, the SAP research agenda was enlarged and moved beyond “micro-isolationism” (Seidl and Whittington, 2014:1407), meaning the mere explanation of local activities in their own rights and terms without connecting them to larger social phenomena. Shifting the unit of analysis of SAP research onto the meso or macro level as well as connecting multiple levels with each other (e.g. Jarzabkowski, Bednarek, and Cabantous, 2015; Smets, Morris, and

Greenwood, 2012) required the introduction of new methodologies to the traditional repertoire of strategic management research methods. For this purpose some methods, like discourse analysis (e.g. Hardy and Thomas, 2014; Paroutis and Heracleous, 2013) and video-ethnography (e.g. Gylfe *et al.*, 2015; Jarzabkowski, Burke, and Spee, 2015) were transferred from other research traditions. Additional methods were proposed as SAP innovations, such as interactive discussion groups, self-reports, and practitioner-led research (Balogun *et al.*, 2003), which may yield benefits for the wider strategic management field including process studies.

Following the above credo to synthesize instead of drawing even more borders between subfields and research agendas in strategic management scholarship, a recent special issue entitled “strategy processes and practices: dialogues and intersections” identified great opportunities of cross-fertilization and exchange between SAP scholars and more traditional strategic management researchers, especially from the strategy process tradition. This potential arises from topics that have only been prominent in one or the other research tradition, methodological advancements, as well as from the joint investigation of novel phenomena. Such a combinatory view of SAP and strategy process research then likely advances the field of strategic management as a whole (Burgelman *et al.*, 2018). One area that has been explored mostly by only one of the two subfields so far concerns the concept of dynamic capabilities. The latter has mostly been a focus of the strategy process community. Therefore, dynamic capabilities and their evolution depict a promising area for further combined research as I will outline next.

1.1.3 Dynamic capabilities and their link to strategizing

The resource-based view, which had been built on initial work by Penrose (1959) and which was further developed and popularized by Wernerfelt (1984) and Barney (1991) laid the ground works for the notion of dynamic capabilities. The latter also drew from earlier work on, e.g. organizational routines (Nelson and Winter, 1982) and core competences (Prahalad and Hamel, 1990). In their

original definition, Teece, Pisano, and Shuen (1997) specified dynamic capabilities as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. Dynamic capabilities thus reflect an organization’s ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions” (1997:516). The concept developed as a response to increasing pressures on organizations since the 1990s (Wang and Ahmed, 2007) to constantly sense, seize, and reconfigure due to a relentlessly changing business environment (Teece, 2007). Until today, the need for constant change is persisting as outlined earlier; some scholars even argue that today’s hypercompetition (D’Aveni, 1994) and high-velocity environments (Bourgeois and Eisenhardt, 1988) with their rapid competitive and technological changes pose unprecedented challenges for organizations.

Following this demand, research on dynamic capabilities and related concepts has flourished but not without criticism. Examples of such criticism concern the mixed use and interpretation of terminologies in the dynamic capabilities domain (Thomas and Pollock, 1999) as well as the fact that research has been conducted on a piecemeal basis, meaning specific to certain firm or industry processes and without integrating and synthesizing the obtained findings (Wang *et al.*, 2007). Furthermore, research on dynamic capabilities has for long remained silent on the detailed processes, activities, and practices that lead to their development (Bromiley, 2005; Regnér, 2008). This has meant a significant gap in the literature since the development of (dynamic) capabilities “implies that in order for the performance of an activity to constitute a capability, the capability must have reached some threshold level of practiced or routine activity” (Helfat and Peteraf, 2003:999).

Early work on dynamic capabilities had mostly emphasized organizational processes but not the behavioral, cognitive, and social activities that they entail (e.g. Daneels, 2010; Eisenhardt and Martin, 2000; Ford and Fries, 2019; Regnér, 2003). Yet in recent years, a turn to the microfoundations literature (e.g. Helfat and Peteraf, 2015; Teece, 2007) has started to address the

above criticism. Significant progress has been made since, e.g. by Helfat and Peteraf (2015) on the underpinnings of dynamic managerial capabilities and their impact on strategic change and firm performance or by Argote and Ren (2012) who identified transactive memory as a microfoundation of dynamic capabilities and how it can facilitate the combinative integration and renovation of knowledge assets. However, words of caution have also been put forward regarding this relatively novel research tradition, especially related to methodological individualism that some microfoundation scholars advocate for (Foss, 2011). In their view, the unit of analysis is the individual while their idiosyncratic decisions and actions constitute organizations (e.g. Felin and Foss, 2005). Such a methodological perception arguably provides an undue bias “toward searching for micro explanations of heterogeneous macro outcomes, tending to focus on bottom-up influence, aggregation, and different forms of emergence” (Felin, Foos, and Ployhart, 2015:588). Since SAP research struggled with similar criticism at the beginning and managed to methodologically and thematically extend its research agenda, it could contribute and complement the microfoundations research on dynamic capabilities as well as other related approaches (Vaara *et al.*, 2012), e.g. the behavioral strategy one (e.g. Gavetti, 2012; Powell, Lovallo, and Fox, 2011).

While such increased synthesis of different research traditions would doubtlessly yield great benefits for our knowledge production on dynamic capabilities and strategic management as a whole, caution has to be exercised as well. The reason lies in potentially incompatible ontologies. Whittington (2017) for example noted that “the psychological microfoundational and behavioral traditions have labels that sound reassuringly similar to practice theory: microfoundations evoke micropractices, while behavior and activity are nearly synonymous, (...) [however,] [t]his difference matters” (2017:349). In case of a more contextual approach to microfoundations, this is not a problem, as it would allow for a layering of social life in addition to offering important and complementary insights from cognition and behavior. Scholars that follow such a more compatible approach to microfoundations have proposed recent variants

of behavioral strategy (Gavetti, 2012; Powell *et al.*, 2011) and acknowledged the limitations and imperfections of individual cognition as to overcome the aforementioned risk of methodological individualism and to benefit from a closer link with SAP (Balogun and Johnson, 2005; Kaplan, 2008). Contrasting this, if a reductionist approach is being adopted, mental processes of individuals are being solely seen as the origin of strategy, which is in stark contrast to practice theorists' view that strategy is grounded in practices. Reductionists – albeit there are variations in how far they go with their level of regress (in extreme cases calls have been made to go even as far back as the laws of physics and chemistry) – argue that all explanations should originate from the individual, as only by understanding and carefully specifying this level as the initial condition of an organization, rigorous scientific explanation is possible (Barney & Felin, 2013; Felin *et al.*, 2015; Popper, 1959; Winter, 2013). For such a view of microfoundations, the methodological repertoire would immensely contrast the one of SAP (e.g. experimental laboratory and brain scanners), which makes a theoretical and empirical integration for joint research as well as the transfer of learning from SAP to microfoundations to advance dynamic capabilities research difficult (Vaara *et al.*, 2012; Whittington, 2017).

Despite the manifold opportunities that SAP with its theoretical and methodological advancements could offer for the research of dynamic capabilities, surprisingly little attempts in this direction have been made so far. One notable exception is Regnér's (2008) article that called for a more dynamic view of strategy by using the practice approach with its distinct features for investigating dynamic capabilities further. Specifically, he noted that SAP's concern with activity configurations, its holistic view that takes socio-cultural embeddedness, co-evolution, and social interactions into consideration while including multiple strategists, is advantageous for further advancing the field of dynamic capabilities. In line with Regnér's (2008) view to bring the theme of dynamic capabilities, which has originally been closely linked with the strategy process tradition, onto the SAP research agenda are also the following calls. Firstly, Volberda (2004) already argued in 2004 for a synthesis of strategic

management research in this regard while Burgelman *et al.* (2018) recently indicted several options for further combining strategy practice and process research in a corresponding special issue of the Strategic Management Journal.

1.2 Knowledge gaps

In the following, I list eight specific knowledge gaps in four categories that relate to dynamic capabilities and describe how SAP research in general and my research project specifically can contribute to closing them. For that, I draw on a recent comprehensive review by Schilke, Hu, and Helfat (2018) in the Academy of Management Annals, in which they took stock of the research on dynamic capabilities to date. Their review not only synthesized the vast amount of prior research on dynamic capabilities but also produced a comprehensive framework of the most frequently studied dynamic capability constructs and their interrelationships. Further to that, their systematic content analysis of 298 articles from the top 100 management journals yielded significant knowledge gaps in the literature as well as unresolved issues and promising future avenues of inquiry (Schilke *et al.*, 2018).

My PhD research project with its SAP approach addresses eight out of the numerous opportunities for further research that were outlined by Schilke *et al.* (2018) with either a primary interest or touching the topic at the periphery. The opportunities span across all primary layers of Schilke *et al.*'s (2018) coding framework from the *What* (e.g. the unit of analysis) and the *How* (e.g. the antecedent of organizational culture) to the *Why* (e.g. the underlying theoretical assumptions of bounded rationality and managerial agency), the *Who/Where/When* (e.g. the organizational factors of the industry under investigation), and finally to the used *methods* (e.g. longitudinal data). Table 1.1 draws from the aforementioned coding framework to structure the eight knowledge gaps and to highlight how SAP research in general and my PhD project in particular relates to them. Those research gaps that are highlighted with a bold font are such that inductively emerged to be at the heart of my research project, while the others are only touched upon at the periphery.

Table 1.1. Knowledge gaps, the value of SAP research, and consideration in own research²

Gap category	Specification of knowledge gap	Value of adopting an SAP perspective	Consideration in PhD research project
1) Theoretical assumptions	<p>A) Assumptions about managers' <i>bounded rationality</i></p> <p>B) Role of <i>managerial agency</i></p>	<p>With its focus on practitioners and their actual praxis of strategy-making, SAP research explicitly acknowledges and investigates bounded rationality.</p> <p>Views managerial agency as constituted in a web of social practices and thereby makes it a prime concern of SAP research.</p>	<p>I adopted a SAP perspective with its theoretical implications, which requires sensitivity to bounded rationality and managerial agency in all of my papers. Both, managerial agency and bounded rationality, gained special importance for my case study in chapter 2 due to its focus on openness and strategy tools.</p>
2) Research methods	C) <i>Multiple units of analysis</i> to uncover cross-level dynamics	SAP brought several methodological advancements into traditional strategic management research. Those methods that connect multiple levels of analysis can help to surface interrelations of different units (individual, group, firm, beyond the firm, e.g. ecosystem).	Across all three case studies of my PhD research, I collected data from multiple levels of the organization and paid attention to their interdependencies. For example in chapter 4, I connected and compared the practices of a subculture to the overall organization and drew conclusions from their oscillation.

² The knowledge gaps and their assignment to certain categories of Schilke *et al.*'s (2018) coding framework have been consolidated for clarity. **Bold** font indicates that the PhD research project had the outlined knowledge gap at the heart of the research instead of only touching it at the periphery. *Italic* font summarizes the specific knowledge gap.

	D) <i>Longitudinal research on the temporal aspects of dynamic capability development</i>	Among SAP researchers, it has become good practice to trace phenomena over long time spans and to draw from diverse historic data sources. Hence, the community developed ways to analyze and integrate longitudinal data and even came up with innovative methods, which could be used for dynamic capabilities.	My fieldwork at both research settings spread over a multi-year timeframe and drew on archival data for triangulation. Chapter 3 specifically traces the development of a dynamic capability related to temporal tensions over 60 years. Chapter 4 rests largely on archival data as it concerns a past subculture.
3) Dynamics	E) <i>Development of dynamic capabilities over time</i>	All practice theories that underlie SAP research take time seriously and call for its explicit consideration over longer timeframes.	As noted before, all three case studies covered longer timeframes and thereby enabled me to trace dynamic capability lifecycle stages (specifically in chapters 3 and 4).
	F) <i>Tensions and resulting contradictions of dynamic capabilities</i>	SAP research has gathered empirical and methodological experience in coding, analyzing, and theorizing tensions, which is useful for research on dynamic capabilities.	Tensions played an important role in my research project. In chapter 3, I investigated temporal tensions, while in chapter 4 my focus was on the opposing pressures of ambidexterity.
4) Antecedent or mechanism/moderator	G) <i>Effects of dynamic capabilities on organizational culture</i>	SAP's focus on the social context of practices and practitioners as well as its strong qualitative research tradition, which is suitable to shed light on all	Chapter 4 identifies the role of organizational culture for ambidexterity and a resulting dynamic capability called cultural oscillation. It also specifically

H) *Environmental dynamism as a source and/ or supporting factor of dynamic capabilities*

levels of organizational culture, could help uncover feedback loops of dynamic capabilities onto organizational culture.

SAP's interest in topics that have not traditionally, or not yet, entered the main body of strategic management literature could shed light on environmental dynamism as an antecedent or a mechanism/ moderator in ways that have so far been largely unexplored.

highlights its residual effects onto the organization and therefore directly addresses the outlined gap.

My three case studies all have in common that they attended to environments that are dynamically changing in novel ways. Chapter 2 investigates an open strategy process, chapter 3 temporal tensions due to an increasingly fast-changing and uncertain world, and chapter 4 incumbents' need to be adaptive and innovative, e.g. through ambidexterity.

By investigating these diverse contexts, my PhD project contributes empirically and theoretically to a better understanding of environmental dynamism as a source and/or supporting factor of dynamic capabilities.

The first knowledge gap category outlined in Table 1.1 refers to the *theoretical assumptions* that the research on dynamic capabilities so far implicitly or explicitly has rested on. Although there has been some scholarly attention on these before, e.g. on *bounded rationality* (Augier and Teece, 2009; MacLean, MacIntosh, and Seidl, 2015) or *managerial agency* (Di Stefano, Peteraf, and Verona, 2014; Helfat *et al.*, 2015), a significant portion of papers from Schilke *et al.*'s (2018) review still indicated that more theoretical depth could be gained from further research into the above (e.g. Augier *et al.*, 2009; Barreto, 2010; Capron and Mitchell, 2009). By adopting a SAP perspective, my research contributes to closing this gap. Both theoretical assumptions have been natural concerns of SAP research in the past, as its focus is on what managers actually *do* in practice (e.g. Cabantous and Gond, 2011; Smets, Greenwood, and Lounsbury, 2015; Whittington, 2015). Since strategizing often involves the use of tools, a lot of research on bounded rationality and managerial agency has been conducted in this vein. For example, Jarzabkowski and Kaplan (2015) explicitly included bounded rationality and managerial agency in their framework on strategy tools-in-use. The advancements that SAP has made in this area as well as its underlying practice theory's focus on above assumptions can benefit this knowledge gap within the dynamic capabilities literature.

The second knowledge gap category concerns two aspects related to the *research methods* that have predominantly been used to study dynamic capabilities in the past. I start with the topic of *multiple units of analysis*. As outlined earlier, research on dynamic capabilities initially concentrated on the organizational level and its consequences, such as firm-level performance, growth, and survival (e.g. Helfat *et al.*, 2007; Shamsie, Martin, and Miller, 2009). Following that, an orientation towards the microfoundations of dynamic capabilities investigated micro-processes and individual decision-making (e.g. Felin *et al.*, 2015). Both focus areas however remained largely detached from each other which led to calls for additional cross-level analyses (Salvato and Rerup, 2011; Schilke *et al.*, 2018). This is where SAP research with its

methodological advancements from the last couple of years can help alleviate this sustained weakness by helping to connect multiple levels of analysis.

In addition to suggestions regarding the unit of analysis, the *use of longitudinal data* has been encouraged for studying the temporal processes behind the development of dynamic capabilities (Heimeriks, Schijven, and Gates, 2012). Such longer timeframes are specifically advocated for as they may strengthen the internal validity of findings (Schilke *et al.*, 2018). This call is not limited to research on dynamic capabilities, but applies to the wider field of strategic management research. As a response, SAP researchers had incorporated longitudinal (and especially archival and historic data) early on into their methodologies and even developed innovative research methods for doing so. Leveraging longitudinal data by drawing from SAP's methodological advancements could therefore be a promising avenue for research on dynamic capabilities and other strategic management topics (Burgelman *et al.*, 2018).

Thirdly and somewhat related to the above methodological considerations, is the urge of scholars to take the *dynamics*, specifically their temporal aspects and their associated tensions, seriously (Langley *et al.*, 2013). As for the issue of *time*, although lots of potential for closing this gap naturally has been attributed to strategy process research, temporal aspects also play an important role for practice studies and – it goes without saying – for research at the intersection of practices and processes as outlined before. The topic of temporality therefore has been identified as one of six key themes for future combinatory research (Burgelman *et al.*, 2018). Time and temporality have been of interest and relevance to SAP research due to the philosophical underpinnings in which its practice theories are grounded in. For example, the Heideggerian phenomenology is one onto-epistemological framework that SAP research has been drawing from in the past and which can advance research on dynamic capabilities, too (Tsoukas, 2015). The Heideggerian view does not simply perceive time, and especially the present, as a series of now-points, instead it argues that the present should always be linked with the anticipation of the future, ideally by relating the future, past, and present (Heidegger, 2008).

Such a perception allows and even requires to view dynamic capabilities as part of a longer process, e.g. in order to consider how they evolve, grow and ultimately decline during a lifecycle (Davies and Brady, 2016; Helfat *et al.*, 2003), which fits with the previous call for more longitudinal data.

As another area for further investigation of dynamics, *tensions* are listed in Schilke *et al.*'s review (2018). Coding for, analyzing, and theorizing tensions lies again at the intersection of strategy process (e.g. Langley *et al.*, 2013) and SAP research. The latter for example has already investigated the tensions between recursive and adaptive forms of strategic practices in-use (Jarzabkowski, 2004) as well as paradoxes (Dameron and Torset, 2014; Lê and Bednarek, 2018; Statler, Heracleous, and Jacobs, 2011) in multiple studies.

Finally, organizational culture and environmental dynamism have both been considered as *antecedents* as well as *mechanisms* or *moderators* to support the development of dynamic capabilities. This is because firms that operate in changing environments are in need of developing dynamic capabilities. Driven by this need, they are also more likely to experience effects on their firm performance (Piening, 2013; Schilke, 2014). The same goes for organizational culture, which can be a source for the development of dynamic capabilities (Bock *et al.*, 2012), e.g. at firms whose culture can be characterized as very innovative like 3M or Google, but also an accelerator (O'Connor, 2008). However, what has not yet been investigated sufficiently are the *recursive effects* that dynamic capabilities may have *on antecedents and mechanisms/moderators like organizational culture* (Schilke *et al.*, 2018). SAP with its traditional strength in qualitative research and its attention to the social context of practices and practitioners, provides a promising way forward to uncover not only the observable level of organizational culture but also its underlying basic assumptions and values (Schein, 1985; 1996), which may be impacted by dynamic capabilities.

As for *environmental dynamism*, even though a multitude of studies have previously explored the origins of dynamic capabilities, more research is suggested in this vein as it is an important however not a necessary (Helfat and

Winter, 2011; Schilke, 2014) *antecedent of dynamic capabilities as well as moderator* of their effects (Teece *et al.*, 1997). In the review by Schilke *et al.* (2018), further research in this area has been rated among the top three gaps, e.g. in relation to putting more analytical focus on the different stages of the dynamic capability lifecycle. This is not surprising as the world is continuously changing and firms need to develop novel practices and hence dynamic capabilities to deal with them. This is especially true for new phenomena that disrupt industries or organizations and their traditional ways of doing business. SAP researchers already started to investigate such new topics that have not reached mainstream strategic management concern yet, like participatory and open strategy (e.g. Dobusch *et al.*, 2019; Whittington *et al.*, 2011) or digitalization (Volberda *et al.*, 2018). Their work could help alleviate the further need to investigate environmental dynamism as an antecedent and a mechanism/ moderator of dynamic capabilities. As I will outline next, my research exactly falls into this category and thereby aims to help close the previously outlined knowledge gaps through its SAP approach. At the end of this thesis, I will directly refer back to the above therefore. In Table 5.1, I list the key findings of my three papers and the contributions that they make to theory as well as to practice. Further to this, I outline the limitations of my PhD research project and suggest avenues for future research that directly build upon the above knowledge gaps while taking into consideration the advances that my research project made in their regard.

1.3 Research agenda

I started my PhD research with a general interest in how organizations today actually do strategy in light of the rapidly changing and increasingly uncertain world and how they have to change due to current and future challenges. SAP's focus on the practices of strategy-making and its interest in novel phenomena, as outlined above, seemed suitable and guided my research from the beginning. I started my research with the following two objectives in mind:

- 1) *Empirically examine the strategizing practices that organizations enact to cope with today's dynamically changing environments, e.g. which are characterized by new societal demands or disruptive technologies.*
- 2) *Develop a theoretical understanding of the development and the consequences of these novel strategizing practices.*

The first research objective directly corresponds to the final knowledge gap mentioned above. Environmental dynamism runs as a common theme through all of my three papers and depicted the starting point for the inductive emergence of more specific research questions (see Table 1.2). I chose my research settings based on the novel challenges that they entailed which have recently or will likely become broader phenomena in the future.

The first paper (chapter 2) concerns the societal claim for more openness and participation (Tkacz, 2012). Increasingly not only private but also public organizations have to rethink how they strategize under greater levels of transparency and/ or inclusion (Whittington *et al.*, 2011). This often fundamentally changes their organizing principle with implications on their practices, wider processes, governing bodies including accountability, as well as their interactions with the environment. Further, openness contrasts the dominant logic of traditional strategic management and its focus on confidentiality, competitive advantage and its notions of authority and power. So far the numbers of organizations that have opened up their strategy processes are few but growing. Scholars who have conducted research in this vein expect openness to spread more widely (Dobusch *et al.*, 2019; Hautz, Seidl, and Whittington, 2017). They therefore recently called for further investigation of this matter due to its relevance and topicality and put together a call for a forthcoming special issue in Organization Studies (Dobusch *et al.*, 2019).

My second (chapter 3) and my third paper (chapter 4) were both conducted at a research setting which has seen tremendous environmental change in the past – ranging from the inception of a new government-led

industry to its recent private commercialization. While such radical dynamic forces on an industry level (from birth to privatization) may not be of relevance to a vast majority of firms, the two specific topics that I investigated within this context are. The first deals with the notion of ambidexterity, especially in the context of incumbents, and the second relates to temporal tensions.

Ambidexterity has increasingly become a key concern of organizations since the millennium (Birkinshaw and Gupta, 2013) as consumer preferences and market demands change at faster rates, firms need to adapt and therefore resolve the tension between exploration and exploitation with higher priority (March, 1991). Especially incumbents face tremendous problems with this. Although there is a stream in the ambidexterity literature that deals with sequencing exploration and exploitation (Duncan, 1976; Siggelkow and Levinthal, 2003; Tushman and Romanelli, 1985), the topic of temporal tensions is not exclusive to it. Instead, temporal tensions have become a much wider concern. In today's fast-paced world with high levels of uncertainty, the question how organizations can effectively deal with and use time in strategic management remains elusive. One example concerns strategic planning, which has been depicted a waste of time by many (Simpson, 1998) but still remains among one of the top ten most widely used tools among practitioners (Rigby and Bilodeau, 2015). Research has to investigate how time and temporal tensions in fast-paced and therefore highly dynamic environments can be effectively dealt with (Bansal *et al.*, 2019) by adapting existing tools and concepts, such as strategic planning, or by finding new means.

This also brings me to my second research objective. While the first objective concerned the empirical investigation of novel phenomena and organizations' dealing with them via new strategizing practices, the second objective relates to corresponding theorizing. Since my research was inductive in nature, the link to dynamic capabilities and my research's contribution to the knowledge gaps outlined in Table 1.1 only emerged as a consequence of my analysis and theorizing. The organizations that I studied not only developed strategizing practices but their routinized enactment also led to new dynamic

capabilities. As the link to dynamic capabilities only emerged at a later stage of the research project, my thesis does not address all the knowledge gaps outlined in Table 1.1 directly and with a primary focus. Instead, it contributes to some gaps in a secondary way, e.g. by shedding new light on the role of bounded rationality as a theoretical assumption of dynamic capabilities, while directly addressing others. An overview of how my inductive research with its two research objectives contributes to the previously outlined gaps can be found in Table 1.1, while Table 1.2 summarizes the specific research questions that resulted from the two research objectives and the specific contexts in which I undertook the three case studies.

Table 1.2. Research objectives and research questions

Chapter	Case study (Phenomenon)	Research agenda
All		<p><i>Research objectives:</i></p> <ol style="list-style-type: none"> 1. Empirically examine novel strategizing practices that organizations enact to cope with today's dynamically changing environments. 2. Develop a theoretical understanding of the development and the consequences of these novel strategizing practices.
2	AutoParts (Openness)	<p><i>Chapter 2: Research questions:</i></p> <ol style="list-style-type: none"> 1. What practices are associated with using strategy tools during an open strategy process? 2. What implications does the use of strategy tools have on the outcomes of an open strategy process?
3	NASA – EISD (Temporal tensions)	<p><i>Chapter 3: Research question:</i></p> <ol style="list-style-type: none"> 1. How do actors deal with temporal tensions during long-term strategic change initiatives?
4	NASA– Pirates (Incumbent innovation/ change)	<p><i>Chapter 4: Research question:</i></p> <ol style="list-style-type: none"> 1. How can subcultures foster organizational ambidexterity via the practices through which they are enacted?

1.4 Research methodology

In order to achieve the research objectives set out in the previous section, I developed a corresponding methodology, which rests on the premises of practice theory and specifically SAP research. This chapter provides an overview of the underlying philosophical stance, the employed research strategy including details on the data collection for the three case studies, as well as information on the analysis and interpretation framework used. Further details on the research methodology can also be found in each of the three papers (chapters 2 to 4).

1.4.1 Philosophical stance

The practice turn in strategic management research (e.g. Johnson *et al.*, 2003; Vaara *et al.*, 2012) has challenged traditional research not only with regards to the phenomena it pays attention to but also with regards to its philosophical paradigm (Feldman and Orlikowski, 2011; Grand, von Arx, and Rüegg-Stürm, 2015b). Simultaneously with the practice turn in other social sciences, the philosophical underpinnings in the SAP community moved away from objectivism as ontology and the connected epistemology of positivism (Easterby-Smith *et al.*, 2008). The SAP community consequently does not treat strategies and the accompanying processes as defined entities but emphasizes their constructedness, heterogeneity, processuality, and fragility (Grand, Rüegg-Stürm, and von Arx, 2015a). This is because SAP places the practices of strategy-making in organizational, institutional, and societal context, which is a constituting element of its paradigm and differentiates it from other novel advances in the strategic management field, especially microfoundations (Vaara *et al.*, 2012). This also entails that SAP researchers see the world as socially constructed by its actors and their (everyday) practices of strategy-making. Although there are different practice theories and perspectives that allow for either flatter or taller ontologies (for an overview see e.g. Seidl *et al.*, 2014), they all arguably understand practices as the primary building blocks of social reality, which entails a constructionist paradigm as epistemology (Grand *et al.*,

2015a; 2015b) and an interpretative paradigm as ontology. The latter aims to “understand the world as it is, [which means] to understand the fundamental nature of the social world at the level of subjective experience” (Burrell and Morgan, 1979:28), which arguably fits well with the focus of SAP. Of the different constructivist paradigms that SAP researchers can choose from, like social constructivism, systemic constructivism, or the empirical program of constructivism (Grand *et al.*, 2015b), in my view the first fits best with SAP’s triad of practices, praxis, and practices as well as the interpretative ontology above.

I made the decision to use SAP and consequently practice theory as my main theoretical perspective consciously and early on in my doctoral studies, as I view social reality as fundamentally made up of practices (Feldman *et al.*, 2011). This followed from a thorough theoretical engagement with the broad spectrum of available ontologies and the experiences that I had made as a strategy consultant in the past. During my professional career, I had experienced firsthand that not only top or middle management decisions and actions are critical for strategy-making but the everyday, sometimes mundane activities of all kinds of organizational actors may also yield significant intended or unintended effects. A practice lens is also especially suitable for the complex, dynamic, uncertain, and distributed world in which contemporary strategy-making takes place and in which my research is located. This is because it opposes approaches to simplify. Instead, it provides researchers with analytical tools that help investigate the dynamics, relations, materialities, enactments and so forth of its social context. Consequently, the three principles that Feldman and Orlikowski (2011) outlined before to position the practice lens as a specific approach to understanding the world resonate well with my doctoral research. These are firstly that situated actions are consequential in the production of social life, secondly, that dualisms are rejected as a way of theorizing and thirdly, that relations are mutually constructive. I will address each of the three principles shortly below, before I present my research strategy

next. I do so because these principles with their corresponding philosophical stance naturally influenced the latter.

The first principle revolves around *everyday actions and their consequentiality* for strategy-making. As mentioned above, I have experienced this as a practitioner myself and I therefore found the emphasis and relevance of human agency for the development of organizational activity from practice theory more generally, e.g. as offered by Schatzki (2002) and Giddens (1984), as well as from SAP more specifically appealing. For the latter, this not only implies putting a research focus on the everyday doings within organizations but also to create links between micro activities and macro level changes, e.g. across time and space on the organizational level and beyond (Vaara *et al.*, 2012). During the data collection and analysis for this doctoral thesis, I have come to a similar conclusion. For example, in the case study of the Exploration, Integration and Science Directorate of the Johnson Space Center (chapter 3) I have uncovered everyday temporal practices that had facilitating and inhibiting implications on long-term agency-wide space missions, such as the asteroid redirect mission.

The second principle refers to the *rejection of dualisms*. Practice theory instead calls for recognizing the inherent relationship between elements that have often been treated dichotomously, like cognition and action, structure and agency, individual and institutional (Feldman *et al.*, 2011; Reckwitz, 2002). This depicts a more realistic portraying of the complex environment in which organizations and their actors enact their social practices. In my thesis, this has been of particular relevance while I was investigating NASA and its historic subculture of the Pirates (chapter 4). The latter revealed practices that can foster organizational ambidexterity through a process called cultural oscillation, which balances the competing demands of exploration and exploitation. Specifically this means an aligned and efficient management of current business demands while being adaptive to changes in the environment by experimenting and innovating at the same time (Duncan, 1976; March, 1991; Gibson and Birkinshaw, 2004; Tushman and O'Reilly, 1996). This principle

was not only useful for the sensemaking and theorizing of my research findings but it also provided another reason for choosing SAP as my main theoretical perspective over, e.g. microfoundations. The latter exactly follows such a simplified worldview – at least the reductionist approach – and only acknowledges the mental processes of individuals and their cognition as the sole source of strategy-making, while it leaves out all the other relevant factors that SAP consciously embraces (Whittington, 2017).

Thirdly, practice theory rests on the principle of the *relationality of mutual constitution*. This implies that phenomena always exist in relation to each other and mutually constitute each other (Bradbury and Lichtenstein, 2000; Østerlund and Carlile, 2005). This for example played an important role in my first research setting where I observed how an open strategy process was enacted for the first time at an automotive supplier (chapter 2). The deductive top-down and inductive bottom-up practices that its organizational actors enacted throughout this process were a consequence of the way the open strategy process was structured, while they also reconfigured it over time. This follows the notion of mutual constitution or in other words recursion as proposed by practice theorists like Giddens (1984) and Reckwitz (2002). In SAP research, this principle has already led to relevant contributions to theory. One notable example is Jarzabkowski and Kaplan's (2005) piece on strategy tools-in-use, in which they cast a sociological eye on strategy tools and highlight the recursive dynamics between their selection, application and outcomes for the organization and the individuals that enact them. This increased our understanding of how organizational actors mobilize strategy tools and what outcomes they achieve as an important prerequisite for increasing the usefulness of strategic management scholarship for practitioners.

As this brief illustration of the three principles that underlie practice theory in general and SAP specifically shows, adopting such a philosophical stance not only followed from my own practical experiences that naturally shaped the way I see the world but it was also beneficial for making sense of the findings that my doctoral research produced. Next, I will describe in more

detail how my philosophical stance shaped the research strategy that I employed for my doctoral research project.

1.4.2 Research strategy

As a consequence of the above, a vast majority of SAP's work to date has used a qualitative approach, which starkly contrasts traditional strategic management methodologies with their strong reliance on statistics (Vaara *et al.*, 2012). This mirror image developed since qualitative research methods allow researchers to "go inside the process" (Brown *et al.*, 2001; Burgelman *et al.*, 2018) and thereby develop a detailed and holistic understanding of the multitude of micro activities and their complex social embeddedness, which lies at the core of SAP research. Over the last twenty years or so, the SAP community not only introduced qualitative research methods to strategic management more generally but also developed innovative new forms or transferred them from other research traditions. Examples include action research (Heracleous *et al.*, 2008), video-ethnography (Gylfe *et al.*, 2015), discourse analysis (Paroutis *et al.*, 2013), and shadowing (Jarzabkowski and Seidl, 2008). Nevertheless, it still draws heavily on the use of case studies and ethnographies, with which it had largely started in the beginning (Balogun *et al.*, 2003).

For my own research, I followed this tradition and chose a qualitative research approach, which relied on three in-depth case studies with ethnographic characteristics. Bespoke design arose from the desire to understand the complex novel phenomena, which I was interested in, holistically and meaningfully. It also allowed me to capture the enacted strategizing practices and the resulting dynamic capabilities in the natural settings in which they occurred (Eisenhardt, 1989a; Yin, 2009). Methodological fit between my research agenda and the chosen qualitative case study research strategy was given, as I met the three suitability conditions, which had been put forward by Yin (2009). This entailed that I asked "how" and "why" questions, that a controlling of behavioral events was not required or possible, and that I put a focus on contemporary events. As for the latter, there was one exception.

My third paper (chapter 4) investigated a historic subculture. However, the case study methodology was still suited for this setting, as I traced the subculture's effects on NASA's practices and organizational capabilities over time until today with its residual effects. Additionally, former members and outsiders of the subculture provided me with rich contemporary accounts via interviews.

Although my PhD research project encompasses two different settings and in total three case studies, all of them can be considered single, in-depth enquiries without an explicit cross-case comparison, as commonly suggested for such a data set e.g. by Eisenhardt (1991). I made this decision consciously and while acknowledging that such a comparison across multiple cases could have yielded important benefits. For example, it could have helped to piece together individual patterns and to identify complementary aspects of the individual cases for drawing a more complete theoretical picture. However, my research into novel phenomena, which organizations increasingly have to deal with in terms of their strategizing practices, was of exploratory nature. The common theme of dynamic capabilities and the case studies' consequent similarities only inductively emerged over time. The decisive element for the theoretical sampling of the research settings had been the novel aspect of the environmental dynamism they experienced, e.g. an open strategy process (Eisenhardt, 1989a; Glaser and Strauss, 2008). This approach and the stark differences in the research contexts made an explicit cross-case comparison and even a comparison within the same research setting not suitable. Nevertheless, the complete database informed the analysis and interpretation of all three case studies.

Although each of the three papers only focuses on a single case study, their embedded design is not inferior to a comparative one. As Dyer and Wilkins (1991) argue in a response to Eisenhardt (1991): single embedded case studies provide an in-depth understanding with deep versus surface descriptions of a single context, while telling a good story opposed to (merely) creating good constructs relevant to multiple settings. On the contrary, the embedded case study design, which means that the data collection spans across multiple

levels of analysis (organizational, team, individual) (Yin, 2009) and cross-fertilizes each other (Simsek, 2009), directly responds to a knowledge gap outlined earlier with regards to research methods. My research strategy was further characterized by a longitudinal character – another knowledge gap outlined in Table 1.1 – by drawing from the principles of ethnography. The latter requires the researcher to spend extensive periods in the research setting to gain a deep understanding of the phenomenon. It is argued that only by immersing oneself into the organizational context and its culture over a prolonged time, one can develop the required sensitivity to unravel novel and unexpected insights that allow for significant contributions to our knowledge (Langley, 1999; Suddaby, 2006). The multi-year data collection for each of the three case studies allowed me to make inferences on the development and the phases of dynamic capabilities even without an explicit comparison across cases.

1.4.3 Data collection and case descriptions

To operationalize the above research strategy, multiple qualitative and in few instances quantitative methods were used to collect data from various sources. This enabled me to gain deep insights into the social context in which the two investigated organizations enacted their strategizing practices in light of the novel environmental contexts they had to deal with. Moreover, it also allowed me to trace the lifecycle stages of the resulting dynamic capabilities over time (Yin, 2009). In terms of methods, I used semi-structured interviews, participant observation, and surveys. Further to this, I collected a large number of current and archival documents, such as reports, workshop presentations, oral histories, strategic plans, and email communication. This was supplemented with photographs of formal and informal settings, as well as physical and digital artifacts (e.g. pins, badges, logos, awards, t-shirts). During the participant observation instances, I also produced observational notes and reflective memos. The latter were also the case after my semi-structured interviews.³ All

³ All interview guides are available in the appendix.

interviews, with exception of two, relevant for chapters 3 and 4, were audio-recorded, transcribed, and complemented with oral histories, where available. Across all case studies, the interviews covered multiple hierarchical levels and individuals from different parts of the organization, which benefited data triangulation and validity aspects of my research (Yin, 2009). A quantification of the collected data per method and/ or source can be found in the individual papers (chapters 2 to 4).

I commenced my data collection in January 2016 at the first research setting – an international US-based automotive supplier, hereafter called AutoParts. My ethnographic observations lasted until January 2017 and were supplemented with 19 follow-up interviews until October 2017. The duration of my data collection at AutoParts covered the entire process of developing its new strategy in an open way and most of the implementation. Most notably were seven strategic episodes during which AutoParts' participants of the open strategy process had the opportunity to discuss and reflect without their usual hierarchical and communicative constraints (Hendry and Seidl, 2003). The case study of AutoParts was theoretically sampled due to its first-time engagement with an open strategy process and the extensive access that I was granted by the Chief Executive Officer (CEO) of the organization due to my previous background in strategy consulting. While closely examining the open strategy process of AutoParts, I paid special attention to its strategizing practices and the strategy tools that it used for facilitation and sensemaking purposes.

While access to AutoParts and its strategy process was granted due to my affiliation with Capgemini Invent, I took conscious steps to avoid any bias related to the data collection and analysis. Most notably, I did not take an active, meaning advising or influencing, role in the strategy process but only supported AutoParts and its external consultant by executing minor tasks, such as taking notes, putting up posters for group work, or documenting results. I also sought approval a priori from the CEO and the participants of the strategy process for conducting my research and thereby justified my presence during the strategic episodes of the open strategy process as well as additional formal

and informal meetings without having a formal role. As outlined in more detail in chapter “5.3.1 Research limitations and mitigation strategies”, I also took specific measures during the data analysis phase, such as open coding to stay true to the participants’ terms, or sparring my analysis results on a regular basis with my supervisors, who were not involved in the research setting nor the data collection. Further, I validated my findings with participants from the research setting as to ensure their validity. I applied the same approach and caution to the data collection at the second research setting, too, which is described next.

Besides my fieldwork at AutoParts, I got the unique opportunity to collect additional data at the Johnson Space Center of NASA in Houston. After two rather brief visits of only a couple of days in August and November 2016, I immersed myself deeply and over the duration of several months from March 2017 until December 2017 into the organization. Additional follow-up visits of several weeks each took place on multiple occasions until April 2019. Further to this, other data collection opportunities emerged outside of Texas, e.g. keynote speeches at conferences, interviews and meetings facilitated by conferencing software, as well as the exchange of documents via email. From this broad data collection effort, two specific case studies developed inductively over time. Originally, I started with a broad interest in the center’s most recent reorganization and a strategic initiative called “JSC 2.0” (Ochoa, 2012). The latter had set the goal to “lead through innovative technical and business management practices” (Ochoa, 2012:6). I was interested in these innovative strategizing practices that the JSC had to develop for advancing human space exploration further in a novel environment that was characterized by increased private commercialization. Due to these new challenges and the environmental dynamism, that the JSC experienced as an incumbent needing to change its strategizing practices to remain relevant, the setting fit my research agenda well. Additionally, the unconventional context of a public governmental agency engaged in space exploration at the brink of industry commercialization also offered another benefit for advancing strategic management knowledge.

According to Bamberger and Pratt (2010), unique and unusual settings such as this one likely lead to novel and frame-breaking findings.

After I had started my data collection at the JSC with a general interest in its innovative strategizing practices and its strategic initiative JSC 2.0, the theme of ambidexterity in the context of a historic subculture called the Pirates emerged. I was interested in the fascinating story of these “outlaws” and subsequently focused my data collection efforts on tracing the historic development of their strategizing practices and their oscillation with the broader organization to achieve what I termed *cultural ambidexterity*. Through that, I was also able to surface different lifecycle stages of a dynamic capability that was developed as a result. Its residual effects can even be sensed until today.

While investigating the Pirates and their two main projects – the development and the implementation of a new mission control center (MCC) and a new spacecraft – a second theme emerged around uncertainty and temporality. The Pirates’ second project had been cancelled on short-notice in 2002 due to budget constraints even though it had always met its requirements in terms of cost, quality, and time. What even corroborates this is the fact that the new spacecraft had been very close to operational status, as it had already completed several test flights successfully. I learned that such cancellations due to budget or political reasons had increased significantly over time and depict a constant threat to JSC’s space initiatives and workforce. One manager put it the following way: “If there is a big enough political reason to cancel something, you could cancel it, even if it's ready to fly, even if it's sitting on the launch pad” (interview data). It seems that since the cancellation of the Constellation program in 2010 every new US administration – arguably out of principle – introduces significant changes to NASA’s space exploration initiatives going from the Moon to asteroids, to Mars, and back to the Moon. As space exploration is an inherently complex endeavor, research and development horizons for such initiatives often span up to 20 and 30 years while US administrations change every four to eight years. Consequently, in my second case study, I investigated NASA’s human exploration activities at the JSC and

the novel strategizing practices, which had to be developed because of these temporal tensions and the frequent strategic changes faced. Building on archival data that dates back over 60 years, I was able to develop a process model that shows how temporal practices in settings of long-term strategic initiatives are subject to a temporal and strategic fit assessment that determines whether change is either facilitated or inhibited. At the JSC, enacting these strategizing practices has led to the consequent development of a novel dynamic capability related to managing temporal tensions.

While I am satisfied with the two case studies that I was able to investigate at the JSC in great detail, their gradual emergence during my inductive process of discovery was challenging, too. Since I started with a broad interest in the JSC 2.0 initiative and the “innovative technical and business management practices” (Ochoa, 2012:6) that it strived for, anything that I came across seemed important. It took me some time until I identified the above two themes that were both relevant and with whose investigation I could advance the existing body of knowledge in strategic management research in an original and significant way. The gradual emergence of the two case studies also led to the fact that I collected a significant amount of data that I have not used explicitly for this thesis. One example concerns the center’s attempt to change its traditionally very bureaucratic processes and its risk awareness to collaborate more intensively and effectively with private organizations. For example, I observed 30 meetings on the technology transfer from and into the space center and touched upon this topic in several of my interviews. However, this data does not depict a specific focus of the two papers enclosed in this thesis. Even though it was not feasible to cover all interesting themes that I observed during my time in the field here, I am convinced that I chose relevant and interesting ones that are also relevant beyond the context of NASA and the JSC. The case study on the Pirates is especially important for incumbents that need to adapt to a new environmental context via novel strategizing practices. The paper on temporal tensions and its strategizing practices for such an environment is specifically relevant for organizations that also deal with long

timelines in today's increasingly fast-paced world, like the pharmaceutical or construction industries.

1.4.4 Data analysis and interpretation framework

Due to the exploratory character of my research project and the inductive reasoning on which it relied, I employed Strauss's (Strauss, 1987; Strauss and Corbin, 1998) take on grounded theory as the underlying framework for data analysis and interpretation. While using this framework, I deeply grounded my theoretical insights in raw data, which has been acknowledged as a valid way for deriving generalizations and ultimately for contributing to theory (Glaser *et al.*, 2008; Payne and Williams, 2005). Further, it has also been argued that inductive reasoning from case study data likely leads to creative insights, which in turn facilitates novel theory (Eisenhardt, 1989a). My grounded theory approach with its inductive reasoning is therefore suitable for analyzing and interpreting the data that I collected and it is in line with my research objectives mentioned earlier.

While the detailed analysis of each case study was slightly different with regards to the rounds of coding and the intermediate cycling of literature (Corbin and Strauss, 1990; 2008), several communalities can be pointed out, too. Firstly, I always started the analysis by drawing from Langley's (1999) strategies for analyzing process data, usually by drawing a timeline, which I used to get an overview of the social context of the case study. I also employed it to temporally locate and bracket the strategizing practices that I identified as well as to relate them to potential other constructs, e.g. resulting dynamic capabilities. Next, I started the coding process by generating open codes as to remain faithful to informants' terms and to ensure that I would not limit the analysis unrightfully in any way (Charmaz, 2006). Then, several rounds of coding and iterations with relevant bodies of literature took place in all instances until theoretical saturation was reached (Glaser *et al.*, 2008). In this phase triangulation of different data sources and methods as well as the validation of preliminary analysis results with organizational members were

important. Especially the latter enabled me to respect the double hermeneutic of social sciences put forward by Giddens (Giddens, 1984; Hatch and Yanow, 2008).

1.5 Thesis structure

After having briefly outlined the research methodology of this thesis, I want to provide an overview of its structure. Before doing so, however, I point out some general considerations that the reader should kindly note. Firstly, this thesis was written and formatted in the spirit of the so-called *three-paper route*. For this reason, chapters 2 to 4 depict stand-alone academic papers with an introduction and a literature review as well as a methodology, findings and discussion section each. Secondly, all three papers are weaved together by my overarching research agenda and contain one of the aforementioned case studies with specific research questions in line with my overall research objectives (Table 1.2) and the knowledge gaps presented in Table 1.1. Thirdly, the language of the papers reflects that my doctoral supervisors Professor Sotirios Paroutis and Professor Loizos Heracleous supported me with their development and contributed in a way that is in line with the University of Warwick's regulations. As also outlined in the acknowledgments of this thesis, I have always been the lead author of all three papers and not only collected the empirical data in which our original contributions to knowledge have been grounded but also conducted the analysis of the data and led its interpretation.

The first paper (chapter 2) entitled *The Role of Strategy Tools in Open Strategy: A Waltz with Deductive and Inductive Practices* asks the question: "How are strategy tools employed in open strategizing?" This has remained elusive despite recent advancements in our understanding what open strategy means and what forms it takes. Drawing on a 20-month ethnographic study of a large international automotive supplier, my co-author Professor Sotirios Paroutis and I analyzed the role of six strategy tools during an open strategy process. We examined how they can be classified into two types of tools that facilitate deductive or inductive strategizing practices through their affordances.

Our findings show that an open strategy process that rests on an interplay of these two types of tools leads to strategic consensus and hence more actionable strategies. Additionally, this interplay addresses other challenges associated with opening up the strategy process, such as overcoming linguistic and conceptual boundaries or communicating to a diverse audience. Further, it may lead to the development of a novel dynamic capability related to the tool-based management of open strategizing.

The second paper (chapter 3) is called *Three, Two One, Liftoff: NASA's Practices for Managing Temporal Tensions of Human Space Exploration*. In this part of the thesis, my co-authors Professor Loizos Heracleous and Professor Sotirios Paroutis and I reveal how the Johnson Space Center built a new capability for managing temporal tensions over a 60-year timeframe. We do so through a longitudinal case study of NASA's human exploration activities. Specifically, we identify four vision-related practices of temporal management that we term capability-based compromising, temporal-based detailing, developmental pacing and strategic maneuvering. These practices can support or inhibit strategic change initiatives depending on their assessment in terms of temporal and strategic fit. We develop a process model that portrays temporal management of long-term strategic change in terms of triggers, fit assessments, temporal practices and outcomes. Further, we hint at the development of a novel dynamic capability related to the management of temporal tensions.

The third paper (chapter 4) is called *Cultural Oscillation as an Enabler of Ambidexterity: A Longitudinal Study of a Team Subculture in NASA*. It asks the question: How do teams in incumbent firms develop and employ innovative practices to achieve organizational outcomes such as ambidexterity? While ambidexterity and culture scholars have already dealt with related issues in the past, the particular question poses a notable research challenge at the intersection of these two areas that has remained largely unexplored to date. My co-authors and I address this question by examining how team subcultures emerge, develop, and eventually influence a dominant organizational culture and its strategic outcomes. The longitudinal case study of the Pirate subculture

and its interactions with the dominant organizational culture at NASA's Johnson Space Center reveal practices that can foster organizational ambidexterity. Through a process that we term cultural oscillation, we find that these practices operate in the context of a capability lifecycle, with direct and residual effects on the incumbent organization. We contribute to the culture, ambidexterity, and practice literatures by revealing a novel mechanism of cultural oscillation in the pursuit of ambidexterity and its underlying lifecycle dynamics. This mechanism can be viewed as a new dynamic capability that the Johnson Space Center developed over time.

Across all three case studies, inductively a common theme emerged, namely that the observed new ways of strategizing – open, temporal, and cultural practices – may lead to the development of novel dynamic capabilities. The order of the papers follows the lifecycle framework for the development of dynamic capabilities by Helfat and Peteraf (2003). While in paper 1, the development of a dynamic capability only started, paper 2 already traces different stages. Finally, paper 3 covers all lifecycle stages and even identifies some enduring residual effects. Following these three empirical papers, I provide a summary of their major contributions to theory and practice before I end the thesis with some concluding remarks regarding its limitations and further opportunities for future research.

Chapter 2:

The Role of Strategy Tools in Open Strategy:

A Waltz with Deductive and
Inductive Practices

2.1 Introduction

How are strategy tools employed in the strategy process? While strategy tools have been widely acknowledged as important ingredients for strategy-making (Burgelman *et al.*, 2018; Kaplan and Norton, 1996; March, 2006; Ocasio and Joseph, 2008) strategy scholars have only recently started examining the processes and practices associated with their emergence (Jalonen, Schildt, and Vaara, 2018; Kaplan, 2011; Knight, Paroutis, and Heracleous, 2018). Understanding the emergence of strategy tools is important as it can help us uncover how strategy-makers mobilize and shape tools to reach particular strategic outcomes (Jarzabkowski *et al.*, 2015). At the same time, strategy tools can be viewed as “tools in-use”; as fluid and dynamic objects that are selected and applied differently in varying contexts and which are socially embedded in organizational practices (Jarzabkowski *et al.*, 2015). By adapting such a notion and by applying a “sociological eye” (Whittington, 2007) when observing them, strategy scholars have the potential to understand how strategy tools are aiding and guiding managerial decision-making (Paroutis, Heracleous, and Angwin, 2016) as well as facilitating learning, testing, alignment and communication (Chesley and Wenger, 1999; Kaplan *et al.*, 1996). We argue that an important but yet unexplored area of research specifically relates to the emergence and use of strategy tools in the context of open strategy settings.

Open strategy stems from the notion of open innovation (Chesbrough and Appleyard, 2007; Whittington *et al.*, 2011) and examines the practices and processes through which firms become more inclusive and transparent in their strategy-making (Dobusch *et al.*, 2018; Hautz *et al.*, 2017). Yet, transparency and inclusion also bring about contradictions, unintended consequences, negative effects, and new challenges. For example, Hautz *et al.* (2017) identified five central dilemmas, such as compromising speed, flexibility and control over the strategy development process or burdening wider audiences with the pressures of strategy. For overcoming these challenges, among other things, they call for future research that examines the benefits of different technologies. Subsequent work so far has concentrated on the use of

information technology (IT) to facilitate the open strategy process, especially social software such as social media and blogs (Baptista *et al.*, 2017, Haeffliger *et al.*, 2011; Whittington *et al.*, 2011) as well as online platforms (Malhotra, Majchrzak, and Niemiec, 2017). Traditional strategy tools (e.g. the Balanced Scorecard, Porter's Five Forces), which can be considered "technologies of rationality" (March, 2006:201) and their use during an open strategy process have received much less attention. This is surprising considering that previous studies revealed that, independent of whether a firm relies on an open or a closed strategy process, its organizational actors often still use multiple strategy tools besides IT to achieve particular strategic outcomes (Jarzabkowski *et al.*, 2015), such as strategic consensus (Priem, 1990). Managers' preference for the use of multiple strategy tools has been found to guide their thinking process by enabling peripheral vision and connected thinking (Wright, Paroutis, and Blettner, 2013).

Despite the above, our understanding of how multiple strategy tools emerge and get enacted in the strategy process remains limited, particularly how their meaning evolves over time (Werle and Seidl, 2015). This research gap is important for strategy scholars to address, independent of whether a closed or an open strategy context is at hand, as it answers to previous calls for more research on the processes and practices related to the creation and the use of strategy tools (Burgelman *et al.*, 2018; Jarzabkowski *et al.*, 2015). Further research in this vein could lead to a more comprehensive view of how strategists and their tools influence strategy processes (Jalonen *et al.*, 2018; Knight *et al.*, 2018). Specifically, understanding how multiple strategy tools facilitate an open strategy process can provide new insights for their design and use within the process as well as their implications for strategic thinking and acting (Wright *et al.*, 2013).

In light of the above, our study examines the emergence and use of multiple strategy tools and investigates their implications for open strategy by answering the following research questions: *What practices are associated with using strategy tools during an open strategy process? What implications does*

the use of strategy tools have on the outcomes of an open strategy process? To address these questions, we draw on empirical results from an ethnographic study of a US-based international automotive supplier, hereinafter called AutoParts. During a period of 20 months, a rich data set was collected comprising of 400 hours of observations, most notably during seven strategy episodes, and 19 interviews with key informants. AutoParts used six different and increasingly evolving strategy tools to support its open strategy process from which we make the following contributions to the existing literature on strategy tools and open strategy. Firstly, we generate a new typology of strategy tools based on the type of strategy-making their affordances favor or restrict – either deductive or inductive strategizing practices. Secondly, we develop a process model to show, how these two types of strategy tools and their associated strategizing practices successively influence each other in a positive way until strategic consensus is reached. In our case study of AutoParts, several iterations between inductive and deductive practices were needed during which the distance between inductive and deductive tools and their outcomes gradually narrowed. We find the metaphor of dancing a waltz quite fitting to describe the observed phenomenon. Finally, we suggest that organizations that engage in a tool-based open strategy process may develop a corresponding dynamic capability over time.

Our findings extend existing knowledge on strategy tools and open strategy by showing the benefits that traditional technologies of rationality can yield for an open context. Further, we contribute to the detailed understanding of strategizing practices by unpacking the mediating role that multiple strategy tools-in-use play in reaching strategic consensus over time. Lastly, we show how the routinized interplay between different types of strategy tools and their practices may enable organizations to develop a dynamic capability that allows them to deal with environmental dynamism in such a way that it leverages the benefits of openness while overcoming some of its negative effects.

This paper is structured as follows: First, we provide an overview of the literature on strategy processes and practices as well as its recent evolution

towards increased openness before we link it with previous work on strategy tools and important aspects of their (socio-) materiality. Secondly, we briefly outline our research design before we present and discuss our findings. We conclude with our contributions and call for future research in this realm.

2.2 Theoretical background

2.2.1 The evolution of strategy process and practice research

Until the nineteenth century, strategic thinking had been limited in organizations due to the prevailing belief that firms cannot influence market forces. This view of an invisible hand gradually changed as firms grew to sizes, which allowed them to alter and replace market mechanisms (Chandler, 1977; Ghemawat, 2002). Such large corporations usually evolved into multidivisional firms with new dimensions of complexity (Heracleous, 2003). This development, initial courses on business policy (Greiner *et al.*, 2003) together with a sharp acceleration of environmental changes made executives soon voice their need for strategic planning as a way of managing their operations in an effective way (Cummings *et al.*, 2003; Heracleous, 2003). The earliest processes of strategy-making arguably grew out of the budgeting process (Kay, McKiernan, and Faulkner, 2003) which allowed for an objective resource allocation across firms' divisions. The strategic planning perspective or also called the rationalist or classical approach inherited the analytical element of budgeting and emphasized strategy-making as a similarly formalized process (Kay *et al.*, 2003; Whittington, 2001). Over time, different schools of thought emerged and focused on varying aspects of the process (Mintzberg, Ahlstrand, and Lampel, 2009).

Growing dissatisfaction with the aforementioned rationalist approaches to strategy made scholars soon explore new directions (Kay *et al.*, 2003). For example, Mintzberg and some others focused on a behavioral view of strategy by looking at the internal processes of organizations (e.g. Cyert and March, 1992; Mintzberg and McHugh, 1985; Weick, 1979). Their approach built upon works from the American Carnegie School, which rejected the rational

economic man and replaced this concept with the theory of bounded rationality (Simon, 1978). Other scholars, mainly from the environmental (Mintzberg and Lampel, 1999) or evolutionary school, emphasized firms' reactive behavior to external changes and the implied Darwinian selection processes (Hannan and Freeman, 1977; Whittington, 2001). Both viewpoints have in common that they consider a detailed strategy process with its planning activities as a waste of time (Simpson, 1998).

2.2.2 Strategy tools and the practice turn in strategic management scholarship

Despite the disillusionment with the role and value of strategic management mentioned above, strategic planning continues to be among the top ten most widely used tools among global management executives in praxis according to a survey by Bain & Company. It was closely tied with Benchmarking, Employee Engagement Surveys, Outsourcing, and the Balanced Scorecard (Rigby *et al.*, 2015). Similarly, other studies have also shown that strategy functions and their associated processes and practices are still well and active (e.g. Ocasio *et al.*, 2008; Breene, Nunes, and Shill, 2007; Whittington *et al.*, 2011) as are the corresponding tools – even beyond strategic planning – that practitioners use (Rigby *et al.*, 2015). The latter depict an essential part of strategy work in practice (Jarzabkowski *et al.*, 2015; Vaara *et al.*, 2011). In some cases, this may be the case because strategy tools form part of a routine behavior in a prevailing process (Jarratt and Stiles, 2010). In other cases it is because strategy tools get widely diffused through management education (Jarzabkowski *et al.*, 2013) or consulting engagements (Kipping, 1999) and thereby become adopted through reflective or imposed management practices in firms (Jarratt *et al.*, 2010).

Over time, 88 different strategy tools have been developed as identified by a 25-year review of scholarly articles in strategic management journals (Vuorinen *et al.*, 2018). They stem from various schools of thought, like the BCG Portfolio Matrix and Porter's Five Forces from the positioning school

while the notion of core competences and dynamic capabilities come from the capability-building school. Besides developing new strategy tools to reflect novel underlying theories, new tools were also developed to overcome shortcomings of prior ones as well as to address current issues. For example, McKinsey's 7S and the Delta-Model were brought forward from the high velocity school in order to address the increasingly fast changing environment, while Porter's Diamond or real options from the complex ecosystem school were meant to address the uncertain, non-linear, emergent, interconnected, and dispersed networks in which organizations more and more work (Jarzabkowski and Wilson, 2006). While differences among the multitude of strategy tools exist, they all have a common goal: to aid and guide managerial decision-making (Paroutis *et al.*, 2016). Consequently, they can be defined as the "numerous techniques, tools, methods, models, frameworks, approaches and methodologies which are available to support decision making within strategic management" (Clark, 1997:417). While strategy tools are often adopted by practitioners with problem-solving and decision-making in mind, empirical evidence shows that their instrumental purposes are not their only, sometimes not even their most important benefits (Spee and Jarzabkowski, 2009). Other advantages attributed to the use of strategy tools may lie in their visuality that facilitates communication (Eppler and Platts, 2009; Knight *et al.*, 2018; Paroutis, Franco, and Papadopoulos, 2015), their power to generate a common language among the practitioners of a strategy process (Barry and Elmes, 1997; van der Heijden, 2005), or their socio-political purposes (Hodgkinson *et al.*, 2006). Consequently, there is no sole correct way of using a strategy tool; on the contrary, it can serve the strategy process in manifold creative ways (Jarratt *et al.*, 2010). This said, a strategy tool's materiality, may very well favor, shape, or invite specific uses while constraining others at the same time (Demir, 2015; Zammuto *et al.*, 2007). Similarly, conceptual or interpretative affordances need to be considered in this vein, too (Darr and Pinch, 2013; Jarzabkowski *et al.*, 2015), as we will outline in detail later.

Our effort to study the emergence and use of multiple strategy tools in the context of open strategy follows Jarzabkowski *et al.*'s (2015) notion of "fluid objects" (2015:538), which argues that their selection and application may vary for different practitioners and thereby produce a variety of outcomes depending on the context in which the tool use is socially embedded. This also allows to consider bounded rationality given the limits of human cognitive powers (Cabantous *et al.*, 2011) as well as strategy tools' application in ambiguous and complex situations, e.g. not for purposes of analysis and decision-making but for communication and learning. Such a more realistic view of strategy tools not only helps to overcome criticism voiced on aforementioned tools (March, 2006; Moisander and Stenfors, 2009) but also such related to strategy process and strategic management research as a whole (Hutzschenreuter and Kleindienst, 2006; Volberda, 2004). This becomes possible by adopting a sociological eye onto the research of strategy (tools) by being sensitive to connections and relationships, their social embeddedness and entanglement into social problems as well as to the unexpected and unintended. Such a practice-based view of strategy-making with its close attention to micro-processes and associated practices as well as wider social aspects lies at the heart of SAP research (Whittington, 2007) and therefore especially lends itself to research on the emergence and evolution of strategy tools, e.g. when new organizational contexts, like openness, emerge (Burgelman *et al.*, 2018).

This turn in strategic management research towards practice theory follows other social sciences in their criticism of the representationalist epistemology and simplified assumptions of previous research (Reckwitz, 2002; Schatzki, *et al.*, 2001). Its beginnings can be traced back to a seminal critique by Knights and Morgan (1991) as well as Whittington's (1996) early call for a conception of "strategy as practice", focusing on the triad of practices, praxis, and practitioners (Vaara *et al.*, 2012; Whittington, 2006), and as something organizations *do* instead of *have* (Jarzabkowski, 2004). Since then, a corresponding new research stream has gained traction and produced notable new insights into the works of strategy-making and, among other things,

strategy tools. It does so by bringing topics onto the research agenda that had mostly been neglected in past traditional strategy research, such as (socio-) materiality with its notion of affordances and agency, especially in relation to tools (Burgelman *et al.*, 2018, Dameron *et al.*, 2015; Lê and Spee, 2015). For instance, Knight *et al.* (2018) demonstrated how visual semiotic models of strategy meaning-making advance practitioners' understanding of strategy. Similarly, Kaplan (2011) illustrated how the affordances of PowerPoint enable the discursive practices of collaboration and cartography to influence strategic management in practice. These examples show effectively that it is well worth to pay attention to the materiality of strategy tools, objects (Werle *et al.*, 2015) and all the other "stuff" (Whittington, 2007:1579), like strategic discourse (Paroutis *et al.*, 2013), that constitute strategizing. Another area in which SAP research has significantly advanced our knowledge of strategic management is the role of practitioners beyond the Chief Executive Officer and managerial elites (Burgelman *et al.*, 2018). Exemplary research has been conducted on middle managers and how they affect organizational strategy (e.g. Balogun and Johnson, 2004; 2005; Mantere, 2008; Rouleau, 2005; Rouleau and Balogun, 2011), ordinary employees and strategy staff (Mantere *et al.*, 2008), and the role of consultants (Whittington *et al.*, 2011). SAP's focus on a variety of strategic actors and its corresponding methodological approaches therefore fit well with our research focus on strategy tools in open strategy.

2.2.3 Opening up the strategy process

Open strategy stems from the notion of open innovation whose drivers and underlying concept have been found to be similarly applicable to the broader topic of strategy – with innovation being a subset of the latter (Chesbrough *et al.*, 2007; Whittington *et al.*, 2011). Its development has been favored by major trends in contemporary business such as an increase in business education, the availability of social media and other technologies as well as the rise of independent ecosystems (Hautz *et al.*, 2017). Additionally, it can be seen as a response to societal claims for more openness, meaning increased levels of

transparency, accountability, and inclusion (Dobusch *et al.*, 2018; Tkacz, 2012). An additional motif for organizations, such as Wikimedia and Creative Commons (Dobusch *et al.*, 2019; Dobusch and Kapeller, 2013) or governments (Janssen, Charalabidis, and Zuiderwijk, 2012) to open up are the potential benefits that may be associated with it. Examples include greater creativity by drawing on the wisdom of the crowd (Stieger *et al.*, 2012), increased commitment when developing and implementing strategies, joint sensemaking (Hutter, Nketia, and Füller, 2017; Ketokivi and Castañer, 2004), and favorable impression management (Gegenhuber and Dobusch, 2017; Yakis-Douglas *et al.*, 2017; Whittington, Yakis-Douglas, and Ahn, 2016.). Open strategy can be conceptualized as a “dynamic bundle of practices that affords internal and external actors greater strategic transparency and/or inclusion. [It also refers to] the balance and extent of which [organizations] respond to evolving contingencies derived from both within and without organizational boundaries” (Hautz *et al.*, 2017:289–299). This definition implies that different degrees of openness may be practiced by organizations along the two dimensions of transparency and inclusion (Whittington *et al.*, 2011) ranging from internal visibility of information and internal consultation to radically open forms (Luedicke *et al.*, 2017).

While recent research (Hautz *et al.*, 2017) has advanced our knowledge on open strategy significantly, a contemporary call for another Special Issue in Organization Studies (Dobusch *et al.*, 2018) argues that research on open strategy is still fragmented, diverse, and ambiguous with some areas lacking a systematic examination. One example of such a knowledge gap concerns the role of technologies in the open strategy process and their implications for associated practices (Hautz *et al.*, 2017). In our view, this claim should not only be limited to new information technologies, as formulated in the Special Issue call, but also apply to traditional technologies of rationality, namely strategy tools. Research on the latter in relation to open strategizing is still very limited, although traditional strategy tools may bring about similar advantages for open processes as they yield for traditional strategy-making. Further, such research

may even help to understand the conditions and the evolution of organizational openness better (Dobusch *et al.*, 2018). With this in mind, we address the following research questions: *What practices are associated with using strategy tools during an open strategy process? What implications does the use of strategy tools have on the outcomes of an open strategy process?* Answers to these questions are of relevance to strategy scholars and practitioners interested in the phenomenon of open strategy. The derived insights, however, may also be of interest to the wider field of strategic management, e.g. with regards to the different practices that strategy tools enable based on their materiality as explained next.

2.2.4 Materiality of strategy tools in open strategy

In order to answer the above research questions, close attention has to be paid to the role of materiality for strategy tools, as increasingly scholars from the SAP research tradition as well as more broadly within management and organization theory have come to realize (Carlile *et al.*, 2013; Jarzabkowski and Pinch, 2013; Jarzabkowski, Spee, and Smets, 2013; Leonardi and Barley, 2010; Orlikowski and Scott, 2008; Vaara *et al.*, 2012). The reason for the latter is that especially practice-based scholars acknowledge that the material and the social affect each other, therefore also the combined terminology of *sociomateriality*. More specifically for the research project at hand, this means that the material characteristics of strategy tools significantly influence the social practices by which they are selected and applied in the open context. Materiality can thereby be understood as “the arrangement of an artefact’s [or tool’s] physical and/or digital materials into particular forms that endure across differences in place and time and are important to users” (Leonardi, Nardi, and Kallinikos, 2012: 42).

While there is broad consensus on the link between the material and the social as well as its relevance, differences in ontological positions exist (Jarzabkowski *et al.*, 2013; Werle *et al.*, 2015). On the one hand, Orlikowski and Scott (2008) proposed a relational ontology, which rejects the idea of the

separation of the material and social into discrete entities. On the other hand, Leonardi's substantialist ontology builds on the more moderate views of earlier scholars like Barley (1986) and argues that the social and the material are distinct but mutually dependent aspects of the social. Their metaphor of *imbrication* describes how human and material agencies are interwoven so that they function independently. This assumes that entities have inherent properties, which mutually shape or mediate each other and become imbricated in social practices (Leonardi, 2011). In contrast to Orlikowski and Scott's (2008) relational view, the substantialist imbrication renders changes in social practices and/or the material possible independent of each other (Leonardi, 2011). This rests on the assumption that materials, similarly as humans, can have agency. The latter refers to what the material can and cannot do given its affordances (possibilities and constraints). Such a moderate stance provides flexibility and represents a more realistic worldview in our opinion. It is also more suitable to investigate strategy tools in open contexts. In such settings, a greater number of organizational actors may use strategy tools in intended and unintended ways, which may lead to changes to the materialities of the tool and/or their social practices. Their use depends on the benefits associated with the strategy tools, as outlined earlier, which may not necessarily be in line with the original purpose assigned to the strategy tool (Spee *et al.*, 2009). To be able to account for these complex relationships between extended human agency due to an increased number and inhomogeneous kinds of organizational actors, material agency and intended and unintended affordances of strategy tools in open strategy settings, we chose Leonardi's substantialist ontology for this research project. This had implications for our methodology, as explained next, as well as our findings and their theorizing.

2.3 Method

We chose an ethnographic study in a large, established firm for two reasons: First, it enabled us to gain a deep understanding of the strategic change process and the role strategy tools played in it (Gioia and Chittipeddi, 1992; Kaplan,

2011). Second, it helped us reveal the complex social interactions taking place during the open strategy process and it captured the investigated phenomenon in a holistic and meaningful way (Eisenhardt, 1989a; Yin, 2009).

2.3.1 Research context

The in-depth qualitative case study was conducted at the level of a global business unit of a large international automotive supplier headquartered in the US called *AutoParts*⁴ (disguised name). This organization depicted a suitable and interesting research setting because it had just recently completed the take-over of a similar-sized competitor. Consequently, neither AutoParts's originally defined strategy nor the one of the competitor it incorporated was suitable going forward. AutoParts needed a new internal and external strategic assessment as well as a new strategy that would integrate and leverage the combined resources and assets. AutoParts's CEO decided to pursue an open strategy process that dynamically evolved over time for several reasons. Mostly he perceived it as a knowledge transfer and organizational change management measure to form "one winning team" (interview data) out of the previously competing organizations while taking the best of the existing strategy processes of the previously independent firms. By involving members from both entities and all organizational levels, he increased the buy-in to the new strategy across the whole organization and increased his as well as the strategy's credibility. Otherwise, nobody would have believed that he and the rest of AutoParts's top management team (TMT) had the in-depth knowledge to develop a sound strategy for the combined organization on their own. Furthermore, the CEO identified key stakeholders within the acquired organization based on their contribution and performance during the open strategy process and put them subsequently into key roles.

The open strategy process kicked-off in January 2016 after the merger activities had been completed in 2014 and 2015. The strategy development

⁴ The name "AutoParts" refers to the researched global business unit and not the whole automotive supplier organization.

stage lasted from January 2016 until January 2017 while its implementation took place until AutoParts was bought itself by another automotive supplier in the first half of 2018. Table 2.1 provides an overview of AutoParts open strategy process.

Table 2.1. Open strategy process at AutoParts and the role of its strategy tools⁵

Strategic episode	Activities performed in the strategic episode	Strategy tools used	Outcomes achieved
12.- 13.01.16, physical meeting, 14 pax	<ul style="list-style-type: none"> • Kick-off the open strategy process by the CEO together with his new top management team (TMT), which consists of participants of both formerly independent firms • Explain the open strategy process and get buy-in • Set the vision for the next 5 years • Define the basic building blocks of the vision statement and its visualization • Agree on the functionality and the logic of the strategy cockpit and its role during the strategy process • Initially discuss strategic objectives 	<ol style="list-style-type: none"> 1. Vision statement 2. Visual of vision statement's basic building blocks 3. Strategy cockpit (template) 5. Strategic objectives (template and draft) 	<ul style="list-style-type: none"> • Approved high-level vision for the next five years, namely to become the “global market leader by 2020” (GML 2020) • Definition of four major building blocks for the vision and its visualization as a “house” • Approved strategy cockpit layout and functionality for tracking initiatives • Draft of strategic objectives and decision to use the structure of the “GML 2020 house” for their further detailing during the 2nd meeting

⁵ **Bold font:** First time appearance of strategy tool.

Italic font: Technically this strategic episode was not part of the open strategy process; rather it depicted the result presentation of the strategizing activities. The strategy presentation that was used for the latter was developed in the aftermath of the last open strategy development meeting in August 2016 and contained the strategic consensus that had been achieved.

18.- 19.01.16, physical meeting, 43 pax	<ul style="list-style-type: none"> • Kick off the open strategy process with the CEO, the new TMT, and the other participants from the organization • Explain the open strategy process and get buy-in • Provide the vision for the next five years as guidance • Present the roughly defined strategic objectives • Explain the four basic building blocks of the vision statement, its visualization and the associated responsibilities • Jointly develop a more fine-grained structure of the four building blocks and assign responsibilities • Explain the functionality of the strategy cockpit and its role during the strategy process • Generate strategic initiatives for all building blocks while considering the 2016 budget target 	<ol style="list-style-type: none"> 1. Vision statement 2. Visual of vision statement's building blocks 3. Strategy cockpit 4. Visual of vision statement's refined building blocks and subcategories (final "GML 2020 house") 5. Strategic objectives 	<ul style="list-style-type: none"> • Buy-in for the high-level vision to become the "global market leader by 2020" • Joint detailing of the four building blocks of the vision into twelve subcategories • Agreed use of final "GML 2020 house" as a tracker and key visual for all communication • Assignment of budget targets (top and bottom line) and responsibilities to all four building blocks and subcategories • Joint detailing of strategy cockpit with 20 strategic initiatives across all four building blocks • Agreed communication package for the whole organization
02.03.16, virtual meeting, 14 pax	<ul style="list-style-type: none"> • Follow up to share information relevant to the open strategy process • Review the progress of the strategic initiatives and decide on next steps • Discuss the changes made to the strategy cockpit based on initial feedback from the participants • Define agenda for next physical meeting 	<ol style="list-style-type: none"> 1. Vision statement 3. Strategy cockpit 4. Final GML 2020 house (as a tracker) 6. New cockpit functionality #1: Aggregated views 	<ul style="list-style-type: none"> • Defined next steps for strategic initiatives • Updated strategy cockpit to facilitate its use and to gain a quicker overview by filtering options for aggregated views • Agreed agenda for next physical meeting

			<ul style="list-style-type: none"> • Agreed communication package for all participants of the open strategy process
<p>28.- 29.04.16, physical meeting, 14 pax (+7 pax for specific topics)</p>	<ul style="list-style-type: none"> • Follow up to share information relevant to the open strategy process • Review the progress of the strategic initiatives and decide on next steps • Specify the vision statement per product category • Define agenda for next physical meeting with all participants 	<ol style="list-style-type: none"> 1. Vision statement 3. Strategy cockpit 4. Final GML 2020 house (as tracker) 6. New cockpit functionality #1: Aggregated views 7. Target pictures for product categories (template) 	<ul style="list-style-type: none"> • Defined next steps for strategic initiatives • Agreed approach for breaking down the vision statement per product category via target pictures and development of a corresponding template including six categories such as markets, customers, KPIs • Agreed agenda for next physical meeting • Agreed communication package for all participants of the open strategy process
<p>13.05.16, virtual meeting, 42 pax</p>	<ul style="list-style-type: none"> • Follow up to share information relevant to the open strategy process • Review the progress of the strategic initiatives and decide on next steps • Present the idea of a target picture per product category and stimulate corresponding data collection and thinking • Define agenda for next meeting with all participants 	<ol style="list-style-type: none"> 1. Vision statement 3. Strategy cockpit 4. Final GML 2020 house (as tracker) 6. New cockpit functionality #1: Aggregated views 7. Target pictures (template) 	<ul style="list-style-type: none"> • Defined next steps for strategic initiatives • Approved approach for breaking down the vision statement per product category via target pictures including the corresponding template • Approved agenda for next physical meeting

<p>30.- 31.08.16, physical meeting, 42 pax</p>	<ul style="list-style-type: none"> • Follow up to share information relevant to the open strategy process • Review the progress of the strategic initiatives and decide on next steps • Discuss the changes made to the strategy cockpit based on the feedback from the responsible participants for the product categories (draft list of top 15 initiatives) • Develop the target pictures for the three different product categories of AutoParts • Define the next steps for finalizing the strategy 	<ol style="list-style-type: none"> 1. Vision statement 3. Strategy cockpit 4. Final GML 2020 house (as tracker) 6. New cockpit functionality #1: Aggregated views 7. Target pictures 8. New cockpit functionality #2: Top 15 initiatives 	<ul style="list-style-type: none"> • Completed target pictures for the three product categories of AutoParts • Defined next steps for strategic initiatives and generation of 24 new ones based on new information and insights from the target picture development • Prioritization of top 15 strategic initiatives and agreed separate tracking in strategy cockpit • Defined next steps for strategy finalization (consensus) • Agreed communication package for the whole organization
<p>10.10.16, physical meeting at corporate HQ</p>	<ul style="list-style-type: none"> • Present newly developed AutoParts strategy and get approval from corporate headquarter 	<ol style="list-style-type: none"> 1. Vision statement 4. Final GML 2020 house 5. Strategic objectives 7. Target pictures 9. Strategy presentation 	<ul style="list-style-type: none"> • Approved strategy (consensus) • Distribution of AutoParts strategy as a best practice example for a detailed and comprehensive business unit strategy

Apart from one external consultant, who mainly served in a Project Management Office function for the strategy process, the open strategizing activities were limited to internal actors that the CEO together with his new top management team selected from all organizational levels. The main selection criterion was to cover detailed expertise from all functions and regions from both of the formally independent organizational entities. In some cases, an invitation also took place because someone had decade-long experience, was an influential opinion leader within the organization, showed promising future leadership qualities, or simply for political reasons, e.g. to satisfy claims from the corporate headquarter. All participants in the process had full access to relevant information needed to develop the strategy (e.g. financial performance, progress of initiatives) as well as on the final strategy presentation itself.

Even though the open strategy process was a conscious effort, not all details, especially with regards to the tools used in the process, were defined from the beginning. Instead, the process evolved over time starting off with quarterly physical and virtual meetings and a bold vision statement that read “global market leader by 2020” or short ”GML 2020” (internal document). In a next step, the vision statement was specified by adding four so called “building blocks” to it that were inspired from the balanced scorecard (Kaplan *et al.*, 1992). Based on these four building blocks, the 43 participants of the strategy process then came up with strategic initiatives that were captured in an Excel list for documentation, progress tracking, and analytical purposes. During each of the meetings, an update on the implementation status of the initiatives was provided, which served as a starting point for further specifying the strategy. The latter was done by revising initiatives, using the acquired new knowledge from them to develop new initiatives and to uncover underlying drivers, trends, and interdependencies as well as to specify the initially very broad vision more and more until finally strategic consensus in form of a strategy presentation was reached. The corresponding strategy deck was then presented to the corporate headquarter of AutoParts, which approved it and praised it as a role-model strategy for the other business units of the corporation.

Over the course of this process, we identified six different strategy tools and three refinements that AutoParts used to support its open strategizing activities over time. Their analysis showed that they improved the quality of the developed strategy content by facilitating and integrating deductive top-down and inductive bottom-up strategizing that moved the other successively forward and helped in developing strategic consensus (Priem, 1990). It also allowed us to develop a new typology of strategy tools, which draws from the existent work of deductive and inductive strategy-making (Regnér, 2003). Our findings extend existing knowledge on strategy tools and on open strategy by showing the benefits that traditional technologies of rationality, namely strategy tools, yield in such a context. The resulting more fine-grained understanding of strategizing practices and how they relate to each other is likely of relevance to strategy scholars and to practitioners interested or involved in open and closed strategy processes. The same is true for the potential development of a corresponding dynamic capability for tool-based open strategizing.

2.3.2 Data collection

The data collection at AutoParts covered the complete process of the strategy development phase as well as most of its implementation. The ethnographic observations commenced in January 2016 and ended in January 2017, while 19 follow-up interviews via telephone were conducted until October that year. During the duration of the data collection, especially seven strategy meetings can be considered key for the open strategy process. These workshops depict strategic episodes with a dedicated beginning and ending, which provided a mechanism for AutoParts to discuss and reflect strategic issues without its regular hierarchical and communicative constraints or processual routines (Hendry *et al.*, 2003). Instead, these so called “GML 2020 meetings” (internal document) treated everybody equally and served the purpose of developing and reviewing strategic initiatives, strategic decision-making, distributing responsibilities for implementation, and deciding on the communicative messages to the remaining organization. In addition to these strategic episodes,

one of the authors observed more than 112 formal and informal meetings and interactions (physical and virtual) before and after them (in total over 400 hours). The 19 complementary interviews were conducted each lasting an average of 55 minutes, which we audio-taped and transcribed. All of the interviewees had participated in the complete or significant parts of the open strategy process. They were selected in such a way that they covered perspectives from all functions and geographies of AutoParts as well as all involved hierarchical levels – from the top management team, including the CEO at the time, to its middle managers and regular employees. The strategy consultant that supported AutoParts in its strategy-making was also interviewed. Finally, around 1,800 pages of archival data, 2,745 pages of current presentations as well as 280 pages of fieldnotes, and 697 photos were collected among other data sources. Table 2.2 provides a full overview of our empirical data set and its use in our analysis.

Table 2.2. Overview of the empirical data and their use in the analysis

Data source	Type of data	Case context	Use in analysis
Archival data	<ul style="list-style-type: none"> • <i>Company information</i> (e.g. annual reports) • <i>Presentations</i>: especially historic strategic plans for the global business unit and for its sub-sets: a) functions, e.g. Engineering; b) regions, e.g. Europe, Middle East and Asia 	<ul style="list-style-type: none"> • 14 annual reports and financial statements (1,402 pages) • Eight presentations (387 pages) 	<ul style="list-style-type: none"> • Familiarize with AutoParts organizational context • Put the observed strategy process in perspective of past strategic work and developments (e.g. M&A)
Current files	<ul style="list-style-type: none"> • <i>Presentations</i>: workshop agendas and slides, workshop briefings and documentations • <i>Tables and databases</i>: Progress reporting on the budget and strategic initiatives, survey raw data • <i>Company information</i> (e.g. annual reports, press releases) • <i>E-mails</i> (e.g. input for the strategy development process, TMT exchange) 	<ul style="list-style-type: none"> • 32 distinct presentations, not counting different versions (2,745 pages) • The strategy cockpit was updated for each of the seven strategic episodes. The Excel-based tool contained on average 120 initiatives, each with a separate sheet and 15 aggregated ones • Three surveys (80 responses) • Six annual reports, financial statements and press releases (424 pages) • 1,290 e-mails from all hierarchical 	<ul style="list-style-type: none"> • Identify the way strategy tools emerged, were presented and populated with information – in preparation or following a workshop (deductive and inductive practices) • Observe material changes in the strategy tools over time • Integrate and triangulate evidence from observations and track actions of organizational actors beyond

	<ul style="list-style-type: none"> • <i>Artifacts</i>: Awards, T-shirts, stickers/ trackers, sketches, notes on flipcharts etc. 	<p>levels and functions of the organization</p> <ul style="list-style-type: none"> • 87 different artifacts in total including two T-shirts, twelve stickers/ trackers, five awards 	<p>the observed interactions</p> <ul style="list-style-type: none"> • Familiarize with AutoParts evolving organizational context
Observations	<ul style="list-style-type: none"> • <i>Meetings</i>: Formal and informal meetings (including strategic episodes), conference calls • <i>Field notes</i>: Records of social interaction, conversations and descriptions, e.g. of artifacts • <i>Photos</i>: Visual representations of meeting situations, manufacturing plants, team building events, award ceremonies, etc. 	<ul style="list-style-type: none"> • Seven strategy workshops and 112 additional formal and informal meetings (e.g. preparatory calls) • 280 pages of fieldnotes and memos • Photos taken at ten different instances throughout the strategy process, which amounted to 697 photos 	<ul style="list-style-type: none"> • Observe the open strategy process unfold over time with its social interactions associated with the tool use and for reaching a consensus • Recognize the outcomes of each strategy episode
Interviews	<ul style="list-style-type: none"> • <i>Interviews</i>: Semi-structured questionnaire on strategy process after the strategy had been developed across all hierarchies and functions 	<ul style="list-style-type: none"> • 19 interviews with an average of 55 minutes; eight with the TMT, eleven with member of all other hierarchies, and one with the external consultant 	<ul style="list-style-type: none"> • Validate preliminary results and collect specific additional information to close gaps

2.3.3 Analytical approach

Our analytical approach to analyzing the data set relied on inductive theory building. Further, it was built and guided by Strauss's take on grounded theory (Strauss, 1987; Strauss *et al.*, 1998). Consequently, the data collection and the data analysis were largely executed in parallel to focus the other progressively (Bryant and Charmaz, 2007). The approach can be considered inductive, despite iterations with the literature, as categories have initially been developed based solely on the data. Only later the results were compared with the existent literature before the next informed data collection round took place. The latter acknowledged that some theoretical knowledge during the data analysis process is beneficial for the interpretation of the data, e.g. to better link one's research with existent work (Strauss 1987; Strauss *et al.*, 1998).

We started the detailed analysis of the data by drawing from Langley's (1999) strategies for analyzing process data. As a result, we developed a timeline of the open strategy process that outlined the subsequent strategic episodes, the strategy tools used, and their corresponding outcomes (see Table 2.1). While we had a broad interest in the open strategy process and strategy tools including their materiality from the outset of the data collection, the relevance of the latter as an important theme became even more prevailing through this processual analysis. Similarly, the link to dynamic capabilities only gradually emerged over time.

The coding process was commenced by producing a first round of open codes as to not limit or bias the analysis in any way (Charmaz, 2006). We then started iterating between the literature on strategy tools and open strategy and the preliminary codes. During this iteration round, we found previous work on the materiality of strategy tools and their affordances (Jarzabkowski *et al.*, 2015; Werle *et al.*, 2015) especially helpful. As for the open strategy process, Regnér's (2003) work on the strategy creation in the periphery and the corresponding different characters of strategy creation – inductive and deductive – was influential in recognizing the different ways in which the strategy tools, which AutoParts used, aided the process.

In a corresponding second round of selective coding (Corbin *et al.*, 1990, 2008), we then paid special attention to the tools' affordances and their associated practices including their implications for strategizing as the different tools emerged and changed over time. With our substantialist ontology in mind, we especially considered the sociomaterial aspects of the strategy tools in our open strategy context and how these enabled or constrained deductive or inductive practices therein (Paroutis *et al.*, 2015). We not only focused on human agency, with this we mean human actions based on the material and conceptual affordances of strategy tools. Instead, we also looked and coded for material agency – exercised without explicit human intention (Leonardi, 2011). This allowed us to identify what the strategy tools themselves *could do* based on their affordances, which sometimes led to outcomes and practices that originally had not been anticipated or explicitly pursued. One example that illustrates the benefit of such a differentiated coding for human and material agency well is the one of the strategy cockpit from AutoParts's open strategy process. This particular strategy tool was created to summarize all strategic initiatives that formed part of the open strategy process and to track their progress and performance. All strategic initiatives were allocated to strategy clusters, so called building blocks, like "Growth" or "Operational Excellence". The cockpit exhibited material agency by indicating how many strategic initiatives were listed in each cluster and thereby showed an imbalance, especially a significantly lower number of initiatives for the cluster "Winning Culture". The affordances of the tool, namely the links of strategic initiatives to building blocks, enabled the cockpit to have agency and thereby create transparency on the imbalanced distribution of strategic action items (cf. Cooren, 2004). In the following, the strategy tool became also an analytical instrument in the open strategy process as its affordances emphasized thinking along the various building blocks – something that had originally not been intended and that we would not have uncovered, if we had not specifically coded for material agency.

The above example illustrates well how our conscious choice of a substantialist ontology aided the analysis process. However, it also highlights the social aspect in *sociomateriality* and consequently the value of imbrication, as the human and the material ultimately have to interact in a synergistic way. For the above example, this means that even though the strategy cockpit indicated an imbalance of strategic initiatives through its material agency and corresponding affordances, it still took the organizational actors to increase the relative low number of initiatives to build a winning culture (Cooren, 2004). It is exactly due to this tight link between the social and the material, why we do not specifically distinguish in our results presentation below between human and material agencies that enact social practices based on the strategy tools' affordances (see Table 2.4).

Finally, we looked for data that showed how strategic consensus and thereby an actionable strategy was reached over time and related it to the strategy tools and their associated practices. The axial codes for inductive and deductive strategy development then emerged from them (see Table 2.3). We observed the repetition of the previously described pattern on a functional level of the organization, which led us to Helfat and Peteraf's (2003) capability lifecycle. While iterating between their work and our data, we concluded that AutoParts might be at the brink of developing a novel dynamic capability, namely related to tool-based open strategizing.

Table 2.3. Coding structure for an open strategizing tool typology

Open codes	Axial codes	Aggregate constructs
<p>“We took a lot of time at the beginning of the process to generate a shared understanding of the situation and the problem, a shared understanding why certain things are necessary and how we want to make sure that they get done. That was key. We spent a lot of time to generate this common view, alignment, and commitment.” (CEO)</p> <p>“One benefit of the strategy process was change management. It required alignment of the two cultures that looked identical on paper but whose [strategy] processes were nevertheless different. Identifying and showing this to get an understanding and learn from both worlds, was important. The [new, more sophisticated and open] process is not yet 100% accepted, because those people who have worked in one of the two organizations for more than 10 years, they need time, but it helped a lot.” (Senior Manager, Engineering)</p>	<p>Educate about strategic management and its process</p>	
<p>“Well, the vision statement for us was a communication tool which we could use to cascade our objectives to the team and then downwards and among ourselves certainly as well. It was a tool for all of us to get aligned to a certain strategy and top-line.” (Senior Manager, Sales)</p> <p>“The process in my opinion was quite participative because we really started from the objective which defined the direction where we wanted to go. All the strategy definition and strategy realization were bound to this market leader objective. So, the individual strategic initiatives – the commercial initiatives, the IT initiatives, the HR initiatives – they, in my opinion, became all part of an overall strategy. I don’t know how else to describe it but I think the vision and especially the target pictures enabled us to drive in the same direction.” (Sales Representative, Europe)</p> <p>“The [GML 2020] house with its building blocks, with priority topics within those four building blocks, was a sustained framework to which the team related and which was then, over the course of the process, underpinned by specific projects which were defined, reprioritized, accomplished, and newly added. They could all be related to this overarching GML 2020 concept. So, it was a framework that provided direction with steady consistence more than a single initiative could do.” (Consultant)</p>	<p>Give direction and guide/ control strategic thinking</p>	<p>Deductive strategizing</p>

<p>“So from a discussion standpoint, having all that information combined in the target pictures in front of us was very helpful because we could look at our piece of the discussion in the context of the bigger picture. I think what that did was to provide the context to keep us focused, if you will. So I thought that that was pretty effective.” (Employee, Finance)</p>	<p>Integrate discrete parts into the bigger picture</p>	<p>Communicate results and facilitate change (control)</p>
<p>“Well, the biggest benefit was that we had one consolidated deck which defined the overall vision and the objectives and ways to get there. We could align not just us in that tool [strategy presentation] but we could also transparently provide an outlook to our corporate management. So it was a good communication tool on one side, and on the other side, something which linked us and everything we do and gave us one common document, which outlined the [overall and product category] strategies, the measures, and the objectives.” (Senior Manager, Sales)</p>		
<p>“In terms of communication, it helped to not only know one’s own area but to see the bigger picture and how one can support other functions, think outside of the box to achieve the vision. Communication helps to identify, if a project, for example, has a completely different priority. I need to communicate so that everyone has the same knowledge, so that all work into the same direction.” (Middle Manager, Supply Chain Management)</p>	<p>Communicate results and facilitate change (control)</p>	<p>Generate ideas Inductive strategizing</p>
<p>“The cockpit, while it was cumbersome to manage, I thought that it had some very good reporting tools. It was very easy to pull out an initiative and then to see all the activities under it and see exactly where we were on that. So yeah, it was kind of a monster to use but if it is used properly it actually gave us very good data that we could to see where we were on track or not on track.” (Employee, Finance)</p>		
<p>“It is extremely important to come together, to communicate, to brainstorm: ‘What are you doing, what are we doing?’ and so forth. Throughout the process and though the tools, we got a lot done and clarified. They increased our mutual understanding for example: the topic of investments. If I would not have learned in the process why we are so restricted in our investments, I would have gotten depressed cause I don’t get any money to build up our business in China. Now I know and we can together think of new creative ways.” (Sales Representative, Asia)</p>	<p>Generate ideas</p>	<p>Inductive strategizing</p>
<p>“With Andreas (pseudonym) we had an excellent leader who for me, never really micromanaged anything. He kind of set a high-level strategy and then he let the people go on to it. For instance, we had to reduce our SG&A and Andreas basically said: ‘I need 10 million or 11 million in SG&A savings, you guys can tell me how you're going to do it.’ And we got in the room and sorted it out. Andreas was very good about setting objectives and then just letting the people execute to meet those objectives. And with that, he developed a culture where everybody wanted him to succeed.” (Middle Manager, Engineering)</p>		

“At the end of the day our cross-functional strategy said: ‘We want to be the global market leader by 2020.’ Throughout the various sessions, we specified that further. I think in the end, we reduced it to profit and not to revenues. That was based on some limitations that emerged. We recognized that we had to limit ourselves in terms of our sales ambition, our forecast etc. We had to focus on the really relevant stuff because we didn’t have that much investments and capital anymore.” (Middle Manager, Supply Chain Management)

Detail,
specify, and
prioritize

“Based on the building blocks and the subcategories of the [GML 2020] house, we were able to come up with lots of different initiatives that brought light into the darkness. Everyone, independent of the function or the level, contributed something and that helped to specify what needed to be done, who does it, and whether it’s on the top 15 list or not.” (Consultant)

“Well, so far, whenever we made strategies, we had laid out the strategy and everybody was working on it with his own tools, with his own ways to dealing with the subject – more or less successfully. GML 2020 was the first time we had a tool [the strategy cockpit] which more or less let us link each other. It made it much more productive because we could always see what the others were doing to ensure that we were all aligned. At the end of the day, whenever we had the reviews, we could make sure that we refocus on the key objectives, which became clearer over the course of the last several months. So, it was not just a tool that laid out a strategy. It was, as well, a tool that helped to maintain track and focus on the implementation.” (Senior Manager, Sales)

Implement
strategic
change and
reflect

“For GML2020 we developed two different initiatives for Business Development. The first one was to improve our strategic business relationship with a German Premium car manufacturer. Today, we are one of its top-2 suppliers. The other initiative was about conducting a pricing analysis for rear axle products. The information we gathered showed that we are not competitive in that segment, so the decision was to not pursue that direction. For both, we updated our information and tracked our progress in the cockpit.” (Employee, Business Development)

2.4 Analysis and findings

This section starts by giving an overview of the open strategy process at AutoParts with its strategic episodes and the use of six different strategy tools, which emerged over time. Next, we show how the material and conceptual affordances of AutoParts' technologies of rationality and their interplay favored inductive and deductive strategizing practices that successively converged to strategic consensus and hence an actionable strategy that was well received by its corporate headquarter and got implemented with positive results. For the first time in several years, AutoParts "made the budget" (interview data) instead of being non-profitable. Based on this, we suggest that strategy tools can leverage an open strategy process in a way that strategic consensus, meaning a specific and realizable strategy with wide support among organizational actors, is created, which may be superior to an open strategy process without such technologies of rationality or a traditional "closed" strategy process. This requires that the open strategy tools are selected and used in such a way that they support interplay and a successive convergence of deductive and inductive strategizing practices to a point where an effective balance of the two may be reached and strategic consensus may be generated. When such a tool-based open strategizing process is then conducted in a routinized way, the organization and its actors likely develop a corresponding dynamic capability that leverages the benefits of openness while mitigating its negative effects at the same time.

2.4.1 The role of strategy tools in the open strategy process

The CEO of AutoParts consciously started an open strategy process in January 2016 to develop a strategy for the next five years that took into consideration the newly acquired competitor of a similar size. Within a year, he had to present this strategy to the corporate headquarter, a large automotive supplier conglomerate, and get it approved. For this reason, he initiated the open strategy process whose timeline of strategic episodes is detailed in Table 2.1.

The CEO gave the following account of the necessity for the open strategy process:

When I took over the business [of AutoParts], we made an acquisition for significant growth and to stabilize our profitability further. We set up a five-year strategic program [GML 2020] to grow and gain global market leadership. Our strategy process was to align the whole organization, focus it, and to have a clear strategy approved by everyone that we could pragmatically implement afterwards.

The process was kick-off with two meetings in January 2016. The first one was with the top management team and the second one, which immediately followed thereon with a larger number of 43 participants. The participants were purposefully chosen to cover all organizational levels, regions, and functions as well as for strategic reasons. Their prior knowledge of strategic management was very diverse ranging from senior managers with MBA education, middle managers with finance degrees to plant managers, IT coordinators, and sales staff without formal strategy background or any other prior touch points with strategic topics. While in the first meeting, the CEO with the rest of the TMT had set the vision and decided on its four building blocks (deductive strategizing practices), the extended team helped to break this high-level starting point into more concrete 12 subcategories and strategic objectives (inductive strategizing practices). This was done in the following way: During the second strategy meeting, the extended team was divided up into four groups, each of them covering one building block of the vision. The four groups then generated ideas for strategic initiatives that would help to reach the vision of global market leadership within five years and exchanged them in the mutual report back session. In a next step, the 20 strategic initiatives that they had come up with were clustered by the TMT into 12 subcategories of the vision statement. These then also formed part of the final version of its visualization – the GML2020 house –, which served structuring, integrating, and communicative purposes throughout the entire onward process (deductive strategizing practice). Similarly, the strategic objectives – as another strategy tool served as an incentivisation mechanism for the whole organization throughout the annual

performance review – were set deductively by the TMT from the inductively generated 20 strategic initiatives and their qualitative targets and quantitative key performance indicators (KPIs). For this purpose, the consultant had prepared large posters with a table structure – one per breakout group – with which the extended team was then probed to assign objectives to any strategic initiative they would come up with. Their output was then transferred into the shape of the GML 2020 house as to integrate the four building blocks visually again. Additionally, the information was copied into an Excel tool called strategy cockpit, which was used throughout the entire open strategy process for tracking and analysis purposes. It enabled regular reviews of the implementation process and uncovered underlying drivers, interdependencies, and potential challenges that had to be addresses, e.g. through adding new initiatives or revising existing ones. While each of the strategic initiatives had a sheet by itself, it was always highlighted by a small version of the GML 2020 house in the top right corner of the sheet to which building block and subcategory the initiative belonged to. This was done by coloring the corresponding part of the visual. Similarly, the CEO enforced that all documents produced after the initial two strategy meetings should include the visualization of the GML 2020 house on the very first page. It should also be highlighted which building block and subcategory it supports as to channel and control the strategic thinking of the organization, to integrate seemingly discrete elements into the bigger picture and to communicate the vision continuously and thereby facilitating change (deductive strategizing practices). The Chief Financial Officer (CFO) of AutoParts put it as follows:

Well, I believe the strategy process was all about utilizing the different tools [we had]. First of all, they helped in drawing out from each of us where we thought the strategy should be in the different areas, and what was important in the organization, and what it was that we felt we needed to focus on – especially we, from the senior management team. And once these initial building blocks of the strategy were kind of outlined, then other tools - like the cockpit - came into play to guide us, to see if we were on the right path or if we were not heading towards a useful strategy anymore.

The CEO further demanded regular updates and reviews of the decentralized implementation progress of the strategic initiatives. Some of the initiative owners found it difficult to elaborate on how the different initiatives related to each other and how they progressed since all initiatives were distributed on different Excel sheets. They therefore voiced criticism on the strategy cockpit and demanded aggregated views, e.g. by subcategory, that would better allow them to detail, specify, and prioritize (inductive strategizing practices). The strategy cockpit was amended in the requested way going forward.


At the beginning of the second half of the year, the CEO and the TMT had gotten the impression from the regular reviews that the extended team had progressed enough with their initiatives. They assumed that sufficient expertise and progress for jointly developing the strategy content further had been obtained. Consequently, they organized the next set of meetings in which they would work towards a strategic consensus. Together with the external strategy consultant, the TMT developed the idea of creating target pictures per product category as to break the strategic thinking further down onto a more detailed level. They developed a template with six categories, like market, competition, and customers. These deductively provided templates, which guided and controlled further strategic thinking, were to be completed by the extended strategy team in an inductive way during the next strategic episode. On this occasion, they also prioritized their strategic initiatives and created a top 15 list. This was helpful because the number of strategic initiatives had steadily grown over time due to the regular reviews. The strategy cockpit was amended once more to create an aggregated view of the top 15 initiatives as to focus AutoParts's resource allocation and implementation efforts.

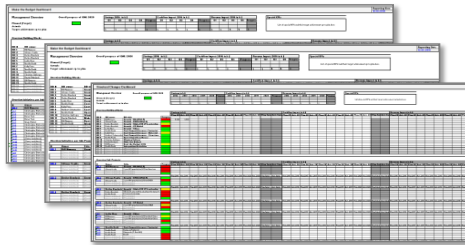
All of the outlined outputs were integrated in a strategy presentation, which the CEO gave in October 2016 at the corporate headquarter of the automotive supplier conglomerate. It was well received, approved, and sent to the other business units as a best practice example for a coherent and actionable strategy with a useful level of detail.

2.4.2 Tool-based successive convergence of deductive and inductive practices in open strategizing

Drawing from the theory of affordances, we were able to uncover how the material and conceptual action possibilities of the six strategy tools in AutoParts's open strategy process invited and constrained certain deductive and inductive practices in intended and unintended ways (Burke and Wolf, 2017). AutoParts's six strategy tools are described in Table 2.4 including their affordances and the subsequent strategizing practices they favored or restricted.

Table 2.4. Strategy tools' affordances and associated practices for strategizing

Strategy tool	Description	Affordances	Associated practices
<div style="border: 1px solid black; border-radius: 10px; padding: 10px; margin-bottom: 10px;"> <p style="text-align: center;">AutoParts will be the global market leader by 2020</p> </div> <div style="border: 1px solid black; border-radius: 10px; padding: 10px;"> <p>AutoParts will be the global market leader in the market segments that we choose to participate simultaneously achieving a profitability level of 15% EBITDA full channel</p> </div>	<p>1. Vision statement</p> <p>The vision statement describes AutoParts desired future state in the market in a single sentence. Its timeframe is five years.</p> <p>The vision statement started high-level (see illustration) and became more specific in the final strategy presentation.</p>	<ul style="list-style-type: none"> • Invites to think into a specific direction of business development • Motivates to work for the joint organizational success 	<ul style="list-style-type: none"> • <i>Deductive</i>: Educate about strategic management and its process • <i>Deductive</i>: Give direction and guide/ control strategic thinking
	<p>2./ 4. Visualization of vision</p> <p>The visualization of the vision statement consists of the shape of a house; therefore, it is also called the “GML 2020 house”. The latter consists of four building blocks inspired by the balanced scorecard.</p> <p>In its refined 2nd version, the building blocks were further detailed into 12 subcategories.</p>	<ul style="list-style-type: none"> • Structures the vision statement in a mutually exclusive and comprehensively exhaustive way • Implies that all four building blocks and the 12 subcategories are required for the successful realization of the vision • Provides visual cues for the vision and increases its memorability • Lends itself to materialization (e.g. glass awards or stickers) 	<ul style="list-style-type: none"> • <i>Deductive</i>: Educate about strategic management, its process as well as content categories • <i>Deductive</i>: Give direction and guide/ control strategic thinking • <i>Deductive</i>: Integrate discrete parts into the bigger picture • <i>Deductive</i>: Communicate results and facilitate change (control)



3./ 6./ 8. Strategy cockpit

An internally developed Excel tool with macros, which contained information about all strategic initiatives and analyzed it.

It was continuously updated content-wise and with new functions, e.g. new views.

- Invites to capture information in a specific way due to its pre-defined cells and automatic calculations
- Emphasizes thinking along the dimensions of the GML 2020 house as it aggregates information accordingly

- *Inductive*: Generate ideas
- *Inductive*: Detail, specify, and prioritize
- *Inductive*: Implement strategic change



5. Strategic objectives

The objectives specified the vision statement's building blocks and subcategories further by means of qualitative targets and quantitative KPIs.

The visualization followed the structure of the GML 2020 house.

- Provides goals to work towards and thereby prioritizes activities
- Allows to measure the progress and the performance of the implementation of the strategic initiatives

- *Deductive*: Educate about strategic management and its process
- *Deductive*: Give direction and guide/ control strategic thinking
- *Deductive*: Communicate results and facilitate change
- *Inductive*: Implement strategic change

7. Target Pictures

The target pictures broke the vision statement, its building blocks and subcategories as well as the associated objectives down to a product category level. It contained six elements and also followed a timeline of five years.



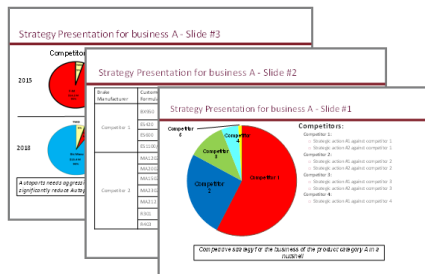
- Invites to think on the level of product categories and in six specific areas, such as customers
- Prioritizes due to its single-page consolidation of information
- Provides a quick overview of the content and its interdependencies

- *Deductive:* Educate about strategic management and its process
- *Deductive:* Give direction and guide/ control strategic thinking
- *Deductive:* Integrate discrete parts into the bigger picture
- *Deductive:* Communicate results and facilitate change (control)
- *Inductive:* Generate ideas
- *Inductive:* Detail, specify, and prioritize
- *Inductive:* Implement strategic change

9. Strategy presentation

The strategy presentation was created in PowerPoint and summarized all the information from the open strategy process and the achieved strategic consensus.

It was presented to the Corporate CEO at the headquarter of the automotive supplier conglomerate.



- Invites to view everything in context of the “big picture”
- Lends itself to communicating and creating buy-in

- *Deductive:* Educate about strategy and its process
- *Deductive:* Give direction and guide/ control thinking
- *Deductive:* Integrate discrete parts into the bigger picture
- *Deductive:* Communicate results and facilitate change (control)
- *Inductive:* Implement strategic change

Some of AutoParts's tools were inspired by past research from the field of strategic management. For example, the vision statement and its (visual) translation into four building blocks related to Kaplan and Norton's Balance Scorecard (1992). Other strategy tools were developed by AutoParts itself based on its needs for the specification or concentration of information (Werle *et al.*, 2015), such as the target pictures per product category. The tools were not all clear or existent at the outset of the open strategy process; instead, they developed dynamically over time based on AutoParts's evolving needs. As in closed strategy-making – especially at the beginning of the open strategy process – tools that favor classical top-down deductive strategizing practices, such as giving direction or guiding and controlling strategic thinking, dominated. This was an important prerequisite to opening up the process as it allowed the CEO and his TMT to still determine the “big picture” but to then use the wisdom and creativity of the crowd inductively. The clear direction that aligned both originally independent organizations to one common ambitious goal was perceived positively by the rest of the firm as the following quote from a member of the top management team illustrates.

The guidance from the top was very valuable. The past year was the first time ever in my career that I actually had a vision, objectives and so forth that were handed down and that then I could build upon and then my team built upon. Where almost everywhere in the past, even during my first time with AutoParts, I created objectives myself to where I thought the company was going and what I needed to do to help the company achieve it. (interview, TMT member)

However, the CEO and his TMT were not able to specify all elements of the strategy specifically enough themselves, so that they were ready for approval through the corporate CEO or for implementation. Reasons for the latter were for one that the strategy development process was differently strongly formalized in each of the originally separate organizational entities, meaning that the level of strategy competences varied widely among the participants. Secondly, for change management reasons, the CEO did not simply want to turn the “stronger” strategy process of the acquired firm into the

approach for the combined organization. Instead, finding a process that worked for both parties and which jointly developed the corresponding tools and practices was one of the major objectives of the CEO. Thirdly, since each of the originally separate entities was half the size of the newly formed firm (each approx. 3,500 employees), the strategic arena had to be re-evaluated completely anew internally and externally and the corresponding strategy knowledge had to be built up among all participants of the organization, including the CEO and the rest of the TMT. One of the Sales middle managers made the following corresponding comment:

I think our CEO was really clever. He originally came from Sales – Sales Aftermarket in Europe, but then he became responsible for the whole organization and that means, it is not just about Sales anymore but there is also Technical Engineering, Logistics, Quality, Operations etc. These are areas in which he, and probably also the rest of the senior leadership team after the merger, had little or only fragmented expertise. So, he always took all of his direct reports into meetings and extended the circle even beyond them to have all the data, all the information. That was pretty smart in my opinion.

As a consequence, the open strategy process and the strategy tools that facilitated it were set up in such a way that iterations between deductive practices from the top down and inductive practices from the bottom up could take place and successively influence the other (see Figure 2.1).

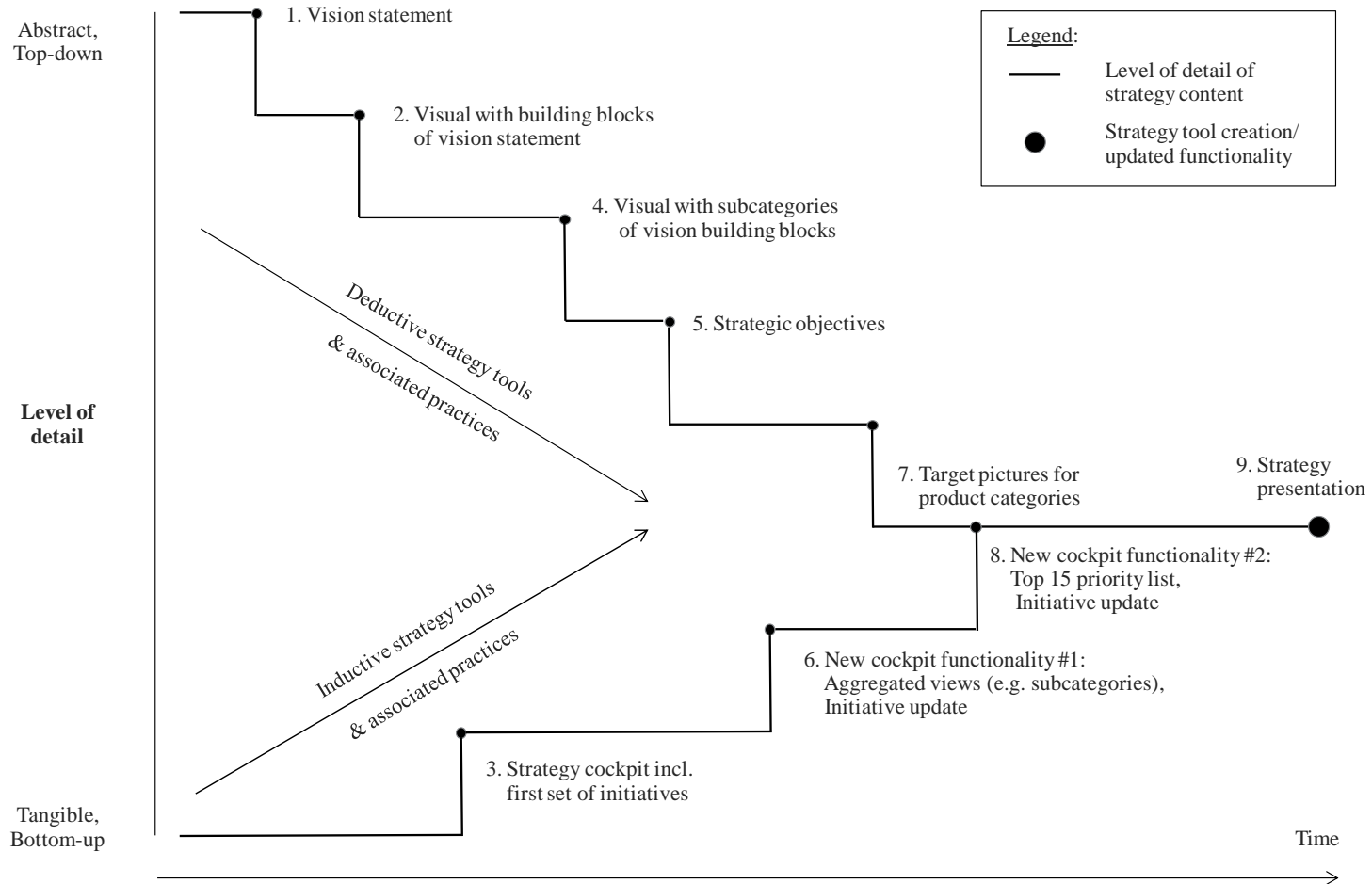


Figure 2.1. Interplay of strategy tools and their inductive and deductive strategizing practices

The above example from the member of the top management team already gave an example for deductive strategizing, which positively influenced inductive strategizing thereafter, as it directed the it in a specific direction. Below quote from a non-managerial participant of the strategy process illustrates the other way around.

I'll say it this way: I have a problem with the way the vision read before it was specified further. It only said "global market leader by 2020". We asked 100 times what that relates to: In terms of revenues? In terms of what-ever? It doesn't matter but it needed to be specified. (Staff member, Business Development)

The example concerns the vision statement that was formulated initially at a high level, as it was not possible in any other way at the very outset of the open strategy process. However, through the creation of many ideas for strategic initiatives on how to reach the global market leadership, through their gradual implementation and thereby acquisition of additional knowledge, and through other inductive bottom-up practices such as detailing, specifying, and prioritizing, it read as following in the final strategy presentation: "AutoParts will be the global market leader in the market segments that we choose to participate in while simultaneously achieving a profitability level of 15% EBITDA full channel" (internal document). These examples show how the strategy content produced in an open way and by means of strategy tools with their affordances, which may favor a successive interplay between deductive and inductive strategy-making, was made specific, led to strategic consensus in form of a strategy presentation, and was thereby more actionable. We illustrate the successive convergence of tool-based deductive and inductive practices in open strategizing in a schematic way in Figure 2.2.

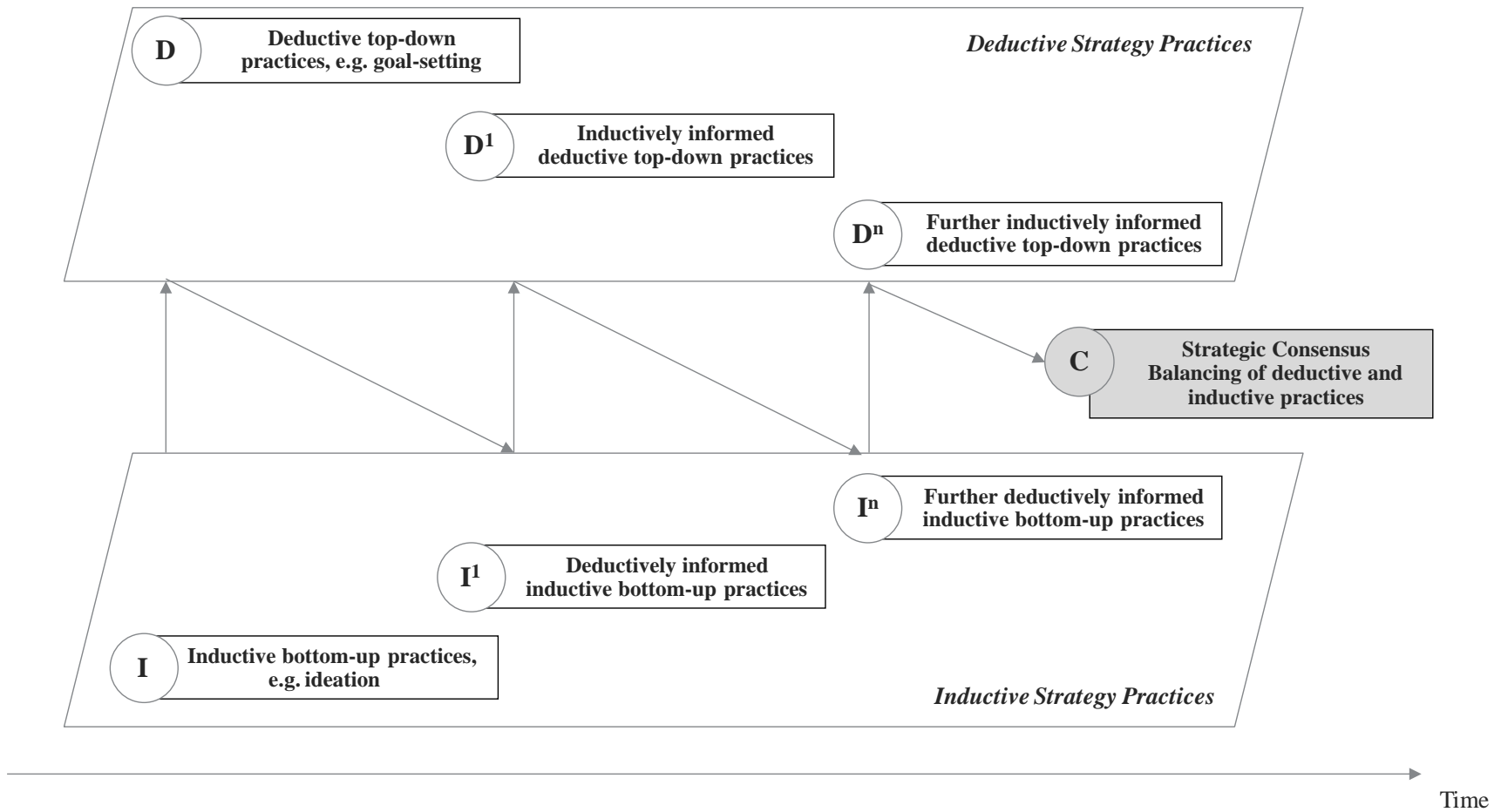


Figure 2.2. Tool-based successive convergence of deductive and inductive practices in open strategizing

The schematic figure shows that deductive practices, such as giving direction or integrating discrete pieces into the bigger picture, lead to a concentration or a more focused creation of information, ideas etc. The distance between the output of the deductive and inductive practices thereby limits. The same is true the other way round. Through the level of detail and the creativity of the inductive practices, the deductively generated content can be specified further. These iterations between inductive and deductive tool-based strategizing practices are performed as often as it is necessary to reach strategic consensus and the desired level of detail of the strategy content. If the existent tools do not support these iterations anymore, they have to be adapted or new ones have to be selected or created (Werle *et al.*, 2015).

2.4.3 Tool-based open strategizing – birth of a novel dynamic capability

After having observed and theorized the process outlined in Figure 2.2 with its tool-based successive convergence of deductive top-down and inductive bottom-up practices in AutoParts's open strategy process, we came across another interesting development, namely the repetition of the same process on the functional level. The Engineering department used the same and slightly adapted strategy tools from the process on the wider organizational level and started to engage in a similar interplay of deductive and inductive practices. Although the data collection only covered the initial steps of the routinization of the above tool-based open strategizing process, we cautiously argue that it depicted the birth of a new dynamic capability, as described by Helfat *et al.* (2003) in their capability lifecycle framework.

The Engineering department was one of two departments that had to change most radically after the M&A activities and due to the new strategic objective of becoming the global market leader by 2020. The development and implementation of a new product development process, investment and divestment decisions related to manufacturing technologies and R&D centers, as well as the restructuring of its organizational set-up were some of the challenges it had to deal with. In total, Engineering had been assigned ten large-

scale strategic initiatives during the open strategy process on the organizational level with an annual operational cash flow of 51.1 m USD. Due to this quantity and the extensive changes they brought about, the Vice President of Engineering launched a similar dedicated open strategy process as outlined before for his department.

The functional open strategy process started in January 2017 with a kick-off workshop, whose agenda and the interplay of its strategy tools mirrored the process detailed in Figure 2.1. It started with the deductively top-down provided vision statement. Since the functional strategy had to link with the overall one from AutoParts, Engineering used the same vision statement as in the wider process. It also kept the vision's visualization with its house-like shape and its structuring building blocks. The latter also already had the ten strategic initiatives pre-allocated to them. Further, and differently to the overall process, the functional objectives for the department were provided top-down from the beginning, as they had already been made available for the kick-off workshop as a result from the wider strategy process.

During the first strategic episode, the participants of the Engineering open strategy process inductively generated 31 initiatives bottom-up, which aligned with the vision statement, Engineering's functional objectives, and the initial ten strategic initiatives. These initiatives were transferred into a simplified version of the strategy cockpit next. The latter was a single Excel sheet that provided a high-level overview of the initiatives. It only tracked the most important information in seven columns, instead of having a single sheet with detailed information per initiative and their aggregation in different slices, e.g. per building block. Another adaptation of the process was that the responsibilities for the initiatives remained on the top management level of Engineering instead of distributing responsibilities across the organizational hierarchy. In the view of the Engineering Vice President, the lower levels sometimes just do not have enough assertiveness as to create change (interview data). Following the functional kick-off workshop, the first steps of the more fine-grained and augmented Engineering initiatives were executed before the

participants of the Engineering open strategy process reconvened again. The first results that the execution of the strategic initiatives had yielded were similarly used for the overall open strategy process, e.g. when Engineering gave an update on the progress of its ten major initiatives or when product-specific target pictures were further specified, as they were used for the more functional open strategy process. The Vice President of Engineering acknowledged the benefits of the initial stages of the functional open strategy process as follows:

Our [open strategy] process helped to align the organization and to reconcile the two different cultures we have within Engineering – Engineering of original parts and Engineering for the aftermarket. On paper, both look identical but we have operated very differently in the past. The [open strategy] process generated appreciation and understanding for each other as well as collaboration [across the whole Engineering organization]. This helped us to make progress in our strategy definition and with our tangible results. For example, our original part design is clearly leading the market now.

Albeit we were not able to observe the open strategy process of AutoParts's Engineering department until the ultimate strategic consensus was reached, it was interesting to witness the initial steps of the consciously replicated process. By drawing on Helfat *et al.*'s (2003) capability lifecycle framework, we cautiously suggest subsequently that AutoParts started to routinize the open strategy process following the positive results that the organizational-wide efforts had yielded. The latter not only had led to strategic consensus and global market leadership even before the targeted year of 2020 but also convinced AutoParts's corporate headquarter and earned its appraisal.

By using the same strategy tools of the original process or in a slightly adapted version and by sequencing their interplay of deductive top-down and inductive bottom-up strategizing practices in a way that they started to move towards strategic consensus, suggests the development of a tool-based open strategizing capability. This is because routine activities (Helfat *et al.*, 2003) emerged and led to the ability to integrate, build, and reconfigure internal and external competences (...) to achieve new and innovative forms of competitive

advantage (Teece *et al.*, 1997). The tool-based open strategy process had leveraged the advantages that are commonly associated with openness while it was able to overcome several of the challenges that it usually yields. The outcome was an improved competitive position in the market and superior performance, which cumulated in global market leadership even before the targeted year of 2020 by successfully and dynamically executing strategic change.

2.5 Discussion and conclusion

In this paper, we investigated the emergence and role of multiple strategy tools in the context of open strategizing. Our findings from AutoParts, helped us uncover how the use of six strategy tools, which developed over time and successively favored deductive and inductive strategizing practices through their affordances, may lead to strategic consensus and an actionable strategy. This shows that the use of traditional technologies of rationality is beneficial and consequently should be investigated further in relation to open strategy. We even argue that it should more prominently be included in the research agenda on open strategizing. We thereby extend the currently prevailing focus on new information technology, such as social media (Hautz *et al.*, 2017). This is the case because traditional strategy tools can help overcome dilemmas that have previously been associated with (IT-)based open strategizing, such as losing control over the strategy development process, undermining commitment due to unmet expectations, or creating escalating expectations about increasing openness (Hautz *et al.*, 2017)

Our findings also suggest a new typology of strategy tools, namely such whose affordances favor deductive top-down strategizing practices and those that favor inductive bottom-up strategizing practices. This complements and contrasts other strategy tool classifications, e.g. the one by Vuorinen *et al.* (2018) who lean more towards a processual distinction, namely architecture, adaption, and action. While the six strategy tools used in AutoParts's open process could certainly also be classified in Vuorinen *et al.*'s (2018) way, our

dual structure has several advantages, especially in the context of open strategizing. Firstly, it fits better with the actual practices that we observed. Trying to sort them into one of the three processual categories by Vuorinen *et al.* (2018) proved difficult based on the messy reality of their intended and unintended affordances (Burke *et al.*, 2017). The strategy cockpit, for example, was originally designed to capture the inductively generated ideas for strategic initiatives and to track their progress based on the GML 2020 house. This already would tick the boxes “action” and “adaption” from Vuorinen *et al.*’s classification. Additionally, the actors of the open strategy process also used the strategy cockpit in an originally unintended way, namely to create aggregated views for strategic analysis. This would fall into Vuorinen’s last category “architecture” (2018). The ambiguity that this processual view brings about would have made it difficult to draw meaningful conclusions from our findings, such as the iteration between the two types of strategy-making practices and how they relate to each other.

Our findings, however, confirm earlier conceptual work on strategy tools as boundary objects, e.g. by Spee and Jarzabkowski (2009). We provide empirical evidence for strategy tools serving as such. Our data shows that this is true for both types of strategy tools. Equally, those that favor deductive strategizing and those that favor inductive strategizing serve as boundary objects. Both types help to overcome differences in strategic competences (e.g. between hierarchical levels or education), knowledge gaps (such as financial and performance knowledge in contrast to specific product- or market-expertise), and different foci in thinking (strategic, big picture vs. operational, role/ function-oriented). They further also bridge the gap between deductively and inductively created strategy content. As such, our research extends the semantic focus of Spee and Jarzabkowski’s work and shows how strategy tools can also serve as boundary objects for content-creation and the implementation of strategic change in an open strategy process.

Next, we bring inductive and deductive strategizing related to strategy tools into the arena of an open strategy process. We thereby build on Regnér’s

work (2003) on strategy creation in the periphery, which already identified the two fundamental characters of strategy-making, namely inductive and deductive. He related them to the periphery and the center of strategy-making drawing from the location, where they are executed and socially embedded in. This, however, is different in our context of open strategizing since all participants were equally involved, socially embedded and physically located in the open strategy process. However, it is true that the deductive practices were mostly executed from the CEO and the TMT. Their exploitation of prevailing resources, e.g. reports, industry experience, took place at the start of the successive interplay between deductive and inductive practices by giving a high-level vision statement based on the existing knowledge. Once the strategic initiatives had been created, the newly and creatively generated body of knowledge associated with them was exploited according to established strategy interpretation patterns and structures. Similarly, the description of the inductive strategy-making practices by Regnér resembles the ones we observed: When strategy tools with affordances that favor this character of strategizing were used – by all participants of the process including the TMT – creativity, the generation of new interpretations as well as trial and error dominated while new knowledge structures were established. Our empirical findings therefore not only extend Regnér's (2003) work by relating the two characters of strategy-making to strategy tools and their affordances but also by analyzing their interplay. Regnér (2003) himself had outlined the latter as an important future avenue for research.

Finally, we suggested that a new dynamic capability related to the use of strategy tools during an open strategy process might emerge, if the interplay between deductive top-down and inductive bottom-up strategizing becomes routinized. Albeit this contribution is somewhat limited in its validity, as we were not able to observe the entire open strategy process of the Engineering department to unfold, we nevertheless contribute to advancing the scarce number of empirical and theoretical works at the intersection of strategy-as-practice research and the domain of dynamic capabilities. While there is

arguably great potential for research that bridges these two strategic management topics, little has been done so far, although several scholars have called for more research in this vein (e.g. Volberda, 2004; Regnér, 2008). Consequently, this depicts one potential avenue for further research that we outline below.

In conclusion, our research set out to investigate the gradual emergence and role of multiple strategy tools – so called traditional technologies of rationality – in the context of open strategy. The empirical findings from our in-depth case study of an international automotive supplier suggest that strategy tools with their material and conceptual affordances favor deductive and inductive strategizing practices in a convergent way during an open strategy process – like when dancing a waltz. They successively influence each other until they reach strategic consensus and hence produce an actionable strategy. The use of both types of strategy tools over the course of an open strategy process thereby may improve the quality of strategies. This is because they benefit from the advantages commonly associated with openness while the two types of strategizing practices also help overcome several challenges related to openness, as identified earlier, such as bridging boundaries between actors of the open strategy process, who are naturally characterized by different levels of strategic competences, or losing control over the strategy development process. We therefore call for further research in this area and extend previously set research agendas, e.g. by Hautz *et al.* (2017). The latter often put a heavy focus on new information technologies and their effects on open strategy practices. However, as our research shows, traditional technologies of rationality, namely strategy tools, clearly also hold benefits for organizations and practitioners in an open context and should therefore not be forgotten. Value also lies in better understanding the link between open strategizing practices and the development of dynamic capabilities. As our limited data set only allowed us to cautiously suggest a link between the two, we strongly encourage further research in this regard. The latter could, for example, collect data in an even more longitudinal way as to see whether the initial routinization of open strategizing practices

related to different types of strategy tools and their interplay actually lead to a corresponding novel dynamic capability.

In addition to the aforementioned limitation of our study with regards to the link that we established between open strategizing practices and the development of dynamic capabilities, our findings are also subject to boundary conditions due to our single case study methodology. In this regard, we firstly want to discuss the new typology of strategy tools that we suggested above and the extent it is contingent on the context of open strategy. Secondly, we elaborate further on the boundary conditions that relate to the tool-based convergence that we proposed. As for the first, we acknowledge that inductive and deductive strategizing practices may not necessarily be limited to the context of an open strategy process. Especially the deductive strategizing practices are such that are naturally assigned to the CEO and his TMT, who are traditionally involved in closed strategy processes. However, the inductive strategizing practices, such as detailing, specifying, and implementing usually lie beyond this elite circle; for example as the detailed knowledge about production technologies, market potentials, and product features lies with the operational staff in the trenches. Only they can provide the specifics for detailing strategic actions, implementing the latter in the right way and providing ideas through collective intelligence. This observation is also important for our second set of findings regarding the tool-based convergence. The latter naturally can only take place, when both types of strategizing practices are present and successively influence each other. Consequently, the following boundary conditions apply to our empirical findings and theorizing: The use of strategy tools can facilitate a strategy process and improve the quality of its outcome when 1) their affordances or otherwise technology- or process-wise inductive bottom-up strategizing practices are enabled and benefit the traditional strategists (e.g. CEO, Chief Strategist, TMT) of the organization (Whittington *et al.*, 2011). 2) For tool-based convergence and consequently strategic consensus, deductive and inductive practices have to successively and mutually influence each other during the strategy process.

These boundary conditions are arguably met best by an open strategy process. This is because the transparency and inclusion practices of such open approaches naturally aim for bringing multiple stakeholders with their diverse and independent inputs together and mediate them. They do so by meaningfully engaging the organizational actors with each other in a way that challenges them, involves them deeply with the complex problem and fosters consensus as well as ownership. This goes beyond simply drawing on the required personnel when needed, e.g. during the implementation phase of a strategy, as proclaimed in traditional strategy processes with their top-down, closed, and often secretive strategy-making practices (Heracleous, Gößwein, and Beaudette, 2017; Whittington *et al.*, 2011). However, even in such instances the aforementioned boundary condition may be met partially or completely through means like technology or process mediation. Previous studies on middle managers also indicate that they may hold the potential to satisfy the aforementioned boundary conditions. More research on traditional strategy tools and their deductive and inductive practices is therefore encouraged independent of whether an open or a closed traditional strategy process is pursued.

Chapter 3:

Three, Two, One, Liftoff:

NASA's Practices for Managing Temporal Tensions of Human Space Exploration

3.1 Introduction

*“Imagination will often carry us to worlds that never were.
But without it we go nowhere.”*

Carl Sagan (2016), Holder of the NASA Distinguished Public Service Medal

How do actors deal with temporal tensions during long-term strategic change initiatives? This question remains elusive despite recent advancements in our understanding of the role of time for strategic management. This is surprising since understanding the interactions between strategic change and its temporal context can help explain how managers perceive and use time as a key resource (Kunisch *et al.*, 2017). Especially industries that are characterized by traditionally long research and development as well as implementation timelines, such as pharmaceuticals, construction, and space, could benefit from such a scholarly focus. Their managers not only have to sense change, seize it and reconfigure their firm’s tangible and intangible assets accordingly over time (e.g. Eisenhardt *et al.*, 2000; Teece *et al.*, 1997) but they also have to ensure continuity in their strategic change efforts. Deciding when to adapt existing long-term strategic change initiatives and when to keep them stable following an environmental change is challenging. This is especially true when the existing and the new strategic initiatives are in temporal tension with each other.

Time with its many forms and facets, evident in planning horizons, sustainable competitive advantages, and decision speeds, has always played a significant role in strategic management (Mosakowski and Earley, 2000). Previous research that explicitly focused on time, has mostly investigated different perceptions of it, especially by contrasting clock-time and event-time (e.g. Brown and Eisenhardt, 1997; Dougherty *et al.*, 2013). This became possible by adopting a subjectivist or practice-based perspective that placed human action and cognition at the center (Crilly, 2017; Kunisch *et al.*, 2017). There are still considerable opportunities for investigation of how actors perceive and deal with time within strategic management (Kunisch *et al.*, 2017), especially by adopting a practice perspective (Burgelman *et al.*, 2018;

Orlikowski and Yates, 2002). Kaplan and Orlikowski (2013) for example studied how social practices that connect interpretations of past, present, and future for constructing strategic action shed new light on the mechanisms underlying organizational inertia and change. Such a practice perspective (Reckwitz, 2002; Schatzki *et al.*, 2001) and the adoption of a societal eye (Whittington, 2007), that perceives time not as something an organization *has* but something organizational actors actively experience and *use*, can therefore uncover what organizational actors can do with time to achieve strategic outcomes such as managing conflicts from competing temporal structures (McGivern *et al.*, 2018; Reinecke and Ansari, 2015).

Competing temporal structures have become a pivotal challenge for organizations that increasingly operate in high-velocity environments (Eisenhardt, 1989a) and under heightened levels of uncertainty (Chen and Miller, 1994). Temporal practices, such as mutually appreciating goal interdependencies between conflicting temporal goals and reflecting on their underlying assumptions with iterative sensemaking, serve actors in such an environment as important mechanisms to negotiate temporalities and enable strategic change (Reinecke *et al.*, 2015). Despite past research in this realm, there is still a dire need for broadening and deepening our understanding of the temporal context, in which strategic change and temporal tensions take place. As Kunisch *et al.* (2017) highlight, temporal tensions observed during long timeframes could yield the unique potential to inform our knowledge about the underlying processual dynamics. Our research question is therefore: *How do actors deal with temporal tensions during long-term strategic change initiatives?*

To answer this question, we conducted an in-depth case study on NASA's Exploration, Integration, and Science Directorate (EISD) based at the Johnson Space Center in Houston. NASA (via EISD and other parts of its organization) needs to effectively reconcile mission time horizons of 20-30 years with US presidential elections occurring every four years with each new administration potentially imposing differing policy objectives and priorities on

the agency. This may lead to fundamentally shifted budgets between space initiatives and to redirected or even cancelled missions. The historical evolution of NASA and the current context of EISD – with the recently imposed target of a new manned Moon landing by 2024 – illustrate the challenge of temporal tensions well and were well suited for our exploratory study therefore. We aim to add to scarce previous work (e.g. McGivern *et al.* 2018) that has shed initial light on temporal tensions of long-term strategic change initiatives as well as their management via social practices.

Our empirical data allowed us to identify two types of temporal practices following environmental changes that occasion particular long-term strategic initiatives. These were change-related practices and long-term vision-related practices, with the latter depending on a temporal and strategic fit assessment of the change with the organization's existing projects and vision. Based on the degree of fit, new initiatives are facilitated or inhibited. We found unintended consequences of such inhibiting practices underneath the surface of long-term strategic change as potential sources for implementation failures. Consequently, the conscious management of temporal tensions and especially of such underlying inhibiting practices is important. Based on our findings that span 60 years of NASA's history, we theorize a process model for the temporal management of long-term strategic change initiatives, which may lead to the development of a corresponding dynamic capability, if formalized and routinized.

We proceed by providing an overview of the existing literature on time and temporal practices and highlight the challenge of temporal tensions. We then outline our research design before we present and discuss our findings. We describe the temporal context in which NASA and EISD have had to operate by detailing their three phases of temporal tensions over the last 60 years. Next, we provide empirical examples for the change- and vision-related temporal practices, which we observed in our case study and that formed the basis for our theorizing. We then integrate our findings and theorize a process model for managing temporal tensions during long-term strategic change initiatives. We

conclude by discussing our findings in light of the existing literature and some final remarks.

3.2 Theoretical background

3.2.1 Different views of time in management studies

Time has always been present in management studies. For instance, mass production in the early 20th century optimized organizations for speed because *faster* was associated with *cheaper* and, hence, increased competitiveness (Orlikowski *et al.*, 2002). Explicitly, temporal aspects have received only scarce theoretical attention in the past (Langley *et al.*, 2013). If they were directly addressed, it was for example in terms of control variables or a lag effect, with the assumption that time is independent of human action, quantifiable, linear and therefore objective like a clock. However, work in anthropology, psychology, sociology, and management gradually uncovered in recent years, that concepts of time across contexts vary greatly and suggested that research could give more centrality to subjective views of time, such as those that arise from differing mentalities (Mosakowski *et al.*, 2000; Reinecke *et al.*, 2015). Different temporal views and associated temporal structures significantly influence what we pay attention to, how we interpret things, or how we instigate change processes and consequently hold the potential to be of significant relevance to organizational lives and outcomes (Huy, 2001; Langley *et al.*, 2013; Orlikowski *et al.*, 2002). Such perceptions influence how organizational actors make firm choices to match industry conditions and environmental changes or anticipate and react to competitors' strategic choices (Mosakowski *et al.*, 2000). In such a subjective perspective, time is understood as contextual and socially constructed through human action based on norms, beliefs, and customs of individuals or groups (Clark, 1985). The notion of entrainment traditionally has been tightly linked with this view as it describes the "adjustment of the pace or cycle of an activity to match or synchronize with that of another activity" (Ancona and Chong, 1996:258), such as institutional or external pressures, e.g. major trade shows or budgeting cycles. According to

this, human activity over time matches such a primary rhythm and gets intertwined with it (Standifer and Bluedorn, 2006).

As more research in this vein has advanced knowledge, scholars have begun to recognize that human action (e.g. in the form of practices) not only is shaped by, but also shapes temporal structures (Granqvist and Gustafsson, 2016). The corresponding practice-based perspective on time by Orlikowski *et al.* (2002) attempts to bridge the dichotomy between subjective and objective views. By integrating social practices with Giddens' (1984) structuration theory, they argue that “temporal structures (...) are understood as both shaping and being shaped by ongoing human action, and thus as neither independent of human action (because shaped in action), nor fully determined by human action (because shaping that action)” (Orlikowski *et al.*, 2002:684). Gradually, the repeated reinforcement of certain temporal structures through social practices leads to objectification, which means that they become taken for granted. Despite apparent objectivity, temporal structures may also be changed through social practices (again) or constitute the basis for what Nowotny (1992) termed “pluritemporalism” (1992:424). The latter refers to the parallel existence of multiple temporal structures, which allow organizational actors to experience different temporal rhythms and speeds, such as long- and short-term time horizons, at the same time (Granqvist *et al.*, 2016). As a negative consequence of pluritemporalism, organizational actors may have to find ways to grapple with tensions resulting from opposing temporal structures (Orlikowski *et al.*, 2002).

Since all organizations' internal and external contexts are embedded in time, understanding and actively managing temporal tensions is important. Recognizing the interactions between an organization's temporal context and strategic change initiatives may even enable managers to use time as a key resource (Kunisch *et al.*, 2017) and eventually even as a dynamic capability via routinized temporal social practices (Helfat *et al.*, 2003).

3.2.2 Social practices for temporal tension management over time

As a consequence of past research, that highlights the above, explicit considerations of time and temporal tensions have received more momentum during the last decade or so (Langley *et al.*, 2013). Time has been conceptualized and juxtaposed along various dimensions such as objective, subjective, and practice-based (e.g. Orlikowski *et al.*, 2002), East and West (e.g. Chen and Miller, 2011), as well as short-present and long-present (Kim, Bansal, and Haugh, 2019). While untangling and comparing these various perceptions of time, social practices for their management and implications for strategic change initiatives were also brought to the surface (e.g. Reinecke *et al.*, 2015; Slawinski and Bansal, 2015), especially when a practice-based perspective was adopted.

Such a practice-based perspective of time is in line with a wider practice turn in the social sciences (Reckwitz, 2002; Schatzki *et al.*, 2001). Motivated by criticism of the representationalist epistemology and simplified assumptions of prior strategy research, scholars in strategy have turned towards practice theory and created the field of strategy-as-practice (Jarzabkowski *et al.*, 2007; Johnson *et al.*, 2003; Vaara *et al.*, 2012; Whittington, 2006). Its focus on practitioners including their bounded rationality, micro activities and practices that make up strategy work, as well as its breaking with linear and objective assumptions of processes have fostered the study of topics that have been marginalized in the past, such as an explicit focus on time and temporal structures (Burgelman *et al.*, 2018). Multiple scholars have called for further strategy-as-practice research on the matter of time. Langley *et al.* (2013) noted that “how the past is drawn upon and made relevant to the present [or clock time is related to event time etc.] is not an atomistic or random exercise but crucially depends on the social practices in which actors are embedded” (2013:5). Further, Bansal *et al.* (2019:1) argued that “more work is needed on what managers and others actually *do* or *can do* to intervene with respect to important time-related phenomena, and on how their temporally-oriented practices and activities accomplish strategic outcomes” (emphasis in original). One area they highlight

specifically are temporal tensions, since managing the resulting conflicts directly relates to key (long-term) strategic decisions, e.g. regarding innovation and sustainability (e.g. Crilly, 2017; Flammer and Bansal, 2017; Slawinski *et al.*, 2015). Previous work by Gersick (1994), for example, showed the importance of managing different temporal orientations of managers towards deadlines and venture capitalists towards events for the development of inertia or change. Dougherty *et al.* (2013) revealed several negative effects of unaddressed conflicts between clock time pacing and event time pacing such as fragmentation between inherently interactive activities, suboptimal resource allocation, and the inability to recognize future possibilities within and across projects and interest groups. Ravasi, Rindova, and Stigliani (2019) have drawn on the concept of materiality to show how organizational actors manage temporal tensions between innovative future offerings while preserving past traditions. They uncovered three practices related to historical artifacts that helped organizational actors to make sense of the past, present, and future while defining useful lines of action. Table 3.1 summarizes the above examples and further research on temporal tensions including social practices for their management.

Table 3.1. Research on temporal tensions and practices for their management

Authors	Temporal tension	Practices for managing the tension	Findings and contribution
Gersick (1994)	Why, how, and when do managers use temporal pacing and what relationships exist with organizational adaptiveness and inertia?	<ul style="list-style-type: none"> • Short term pacing • Long term pacing • Integrating short term and long term pacing 	Different time pacing mechanisms and their integration over time foster different patterns of adaption and inertia.
Dougherty <i>et al.</i> (2013)	How can different temporal orientations between clock time and event time be managed?	<ul style="list-style-type: none"> • Develop a mutual understanding of milestones and progress • Focus on the development of resources and capabilities to support learning more productively • Develop strategic priorities 	<p>Negative effects arise if tensions between clock time and event time pacing are not addressed. Clock time pacing will likely dominate.</p> <p>Three pacing mechanisms should be used in an integrated fashion.</p> <p>Clock time should focus on strategic issues and event time on project level issues.</p>
Kaplan <i>et al.</i> (2013)	How can organizational actors effectively deal with competing interpretations of the past, the present, and the future, to produce change?	<ul style="list-style-type: none"> • Reimagine future possibilities • Rethink past routines • Reconsider present concerns 	Managers settle on particular strategic accounts via temporal work practices that link interpretations of the past, present, and future in ways that

		<ul style="list-style-type: none"> • Reconstruct strategic accounts that link interpretations together 	appear coherent, plausible, and acceptable.
Maguire and Hardy (2013)	How can organizational actors relate the past with the present for risk assessment and management process purposes?	<ul style="list-style-type: none"> • <i>Normalizing</i>: referencing, anchoring, categorizing, sequencing • <i>Problematizing</i>: particularizing, innovating, questioning, pluralizing 	Practices order the discursive work of actors by relating the past with the present to achieve different outcomes.
Reinecke <i>et al.</i> (2015)	How can the competing temporal structures between clock time and process time be bridged?	<ul style="list-style-type: none"> • Contestation • Temporal reflexivity • Interpretive shifts • Mutual appreciation of interdependencies 	Temporal brokerage, meaning negotiating temporalities, may enable organizations to adopt an ambitemporal approach.
Slawinski <i>et al.</i> (2015)	How can firms attend to intertemporal tensions between the short term and long term that are inherent in business sustainability?	<ul style="list-style-type: none"> • Juxtapose • Polarize • Involvement of multidimensional data • Preservation of issue attributes • Broadening of the solution pace to tackle the issues 	Firms that juxtapose the long-term and the short-term perceive the resulting tension as a complex issue and apply mechanisms (e.g. involvement of multi-dimensional data) to deal with it. Firms that polarize the short-term and the long-term do not resolve or manage tensions but only see the world through a short-term lens.

Comi and Whyte (2018)	How can an uncertain future be translated into a realizable course of action with time being subject to endless reconstruction?	<ul style="list-style-type: none"> • Imagining • Testing • Stabilizing • Reifying 	<p><i>Future making</i> as an alternative perspective for practitioners to orient themselves towards the future.</p> <p>The role of visual artifacts and their performativity for future making.</p>
Kim <i>et al.</i> (2019)	How are organizations that are under severe resource constraints in the present able to act for sustainable future development?	<ul style="list-style-type: none"> • Perceiving present as a moment in time with stocks for trade-off • Perceiving present as a duration (long-present) with connections such as resource flows 	<p>Deeper understanding of the present time perspective, especially its duration.</p> <p>Differentiation between short-present and long-present with associated practices. Flow thinking as an alternative to traditional trade-off thinking between present and the future.</p>
Ravasi <i>et al.</i> (2019)	How can an ongoing engagement with the past afforded by the historical artifacts displayed in corporate museums influence how members make sense of their organizations' identities and define useful lines of action for the future?	<ul style="list-style-type: none"> • Identity stewardship • Identity evangelizing • Heritage mining 	<p>Use of material memory to construct situated task-relevant understandings of what distinguishes an organization from its competitors and what would consequently be a useful path going forward.</p>

Time-related research often did not focus specifically on the mechanisms for managing temporal tensions but rather presented the latter as by-products, remained high level, or only provided hypotheses for further investigation of these tensions and related practices. Studies that explicitly examine practices for managing competing temporal structures and frames is therefore still scarce and has largely focused on tensions between clock time and event time, especially between different groups such as managers and venture capitalists (Gersick, 1994) or culturally based organizational mentalities such as West and East (Reinecke *et al.*, 2015). Consequently, more research is needed due to its relevance for key strategic decisions (e.g. Crilly, 2017; Flammer *et al.*, 2017; Slawinski *et al.*, 2015), especially for long-term strategic initiatives which have barely been in focus so far (Kunisch *et al.*, 2017).

Longitudinal studies on temporal tensions and their management may increase our understanding of their processual dynamics since longer timeframes allow scholars to examine the effects of temporal practices – the social practices that enact and manage temporal tensions occasioned by strategic initiatives (Burgelman *et al.*, 2018; Kaplan *et al.*, 2013; Kunisch *et al.*, 2017). This is of special relevance to firms in industries that are characterized by long research and development as well as implementation timelines, for example oil sand reserves that require up to 50 years (Kim *et al.*, 2019). Other such contexts are pharmaceuticals, mega projects in construction, as well as space, with decades-long mission horizons. Longitudinal studies in strategy-as-practice include Jarzabkowski *et al.* (2008) who tracked strategy meetings over seven years and explained how their associated practices stabilized or destabilized strategic orientations over time. Mirabeau and Maguire (2014) investigated individual strategy projects over a ten year period and thereby established connections between them to suggest a view of strategy as patterned action. Kaplan *et al.* (2013) have shown that managers engage in temporal work practices that link interpretations of the past, present and future to deal with temporal tensions due to uncertainty. However, we do not yet have a clear idea of how organizational actors engage in social practices for managing temporal

tensions with the past and future in mind during longer time horizons and what interdependencies may exist. We therefore formulated our research question as follows: “*How do actors deal with temporal tensions during long-term strategic change initiatives?*”

3.3 Method

3.3.1 Methodological overview

To answer our research question, we conducted a longitudinal case study at the NASA Johnson Space Center in Houston, Texas. Space exploration is a suitable context for our research because its development and implementation timelines go well beyond typical change initiatives. The agency has to grapple with competing timeframes of long-term missions while satisfying simultaneous accountability and policy requirements from new administrations. We therefore studied interactions between long-term strategic change initiatives with timelines of up to 30 years, the temporal tensions they provoked especially related to frequent changes in US administrations, as well their outcomes in a broadened and deepened temporal context.

Our data collection at the JSC started in 2016 with a broad interest in the center’s ongoing reorganization and strategic initiative called “JSC 2.0” (Ochoa, 2012). While we allowed interesting themes to emerge through our interviews and observations from all areas of the center, we gradually developed a special interest in the Exploration, Integration, and Science Directorate and its focus on human space exploration. We were intrigued by its mission of “Making Human Space Exploration Happen” (EISD, 2017) that traces its roots back to NASA’s vision, which is to “reach for new heights and to reveal the unknown for the benefit of human kind” (NASA, 2018a). EISD’s scope of operations is challenging and it fit our research question well, since it had to manage the temporal tensions resulting from NASA’s long-term strategic objectives with frequently changing space programs and missions occasioned by new administrations taking office every four to eight years.

Our research approach was inductive, seeking to generate new insights and to support theory building based on the detection of patterns that had emerged from our qualitative longitudinal data (Eisenhardt, 1989b; Eisenhardt and Graebner, 2007; Yin, 2009). We collected data from EISD, whose services and “solutions align and enable the expansion of human presence deeper into the solar system (...) [e.g. as it] define[s] the priorities and align[s] [the] development [of current and future space projects] to meet exploration needs” (EISD, 2017). The directorate had been newly created in 2014 to bundle and lead human exploration activities. In doing so, it has to deal with the temporal tensions that result from the long timelines that human exploration projects, such as a manned journey to Mars, naturally exhibit and balance them with new political priorities from a change in US administrations every four to eight years. Before EISD’s inception, we collected data related to temporal tensions from the entire agency. This was necessary because the responsibility for human space exploration originally was distributed across various entities. Therefore, we first investigated NASA as a whole from 1958 until EISD was formed in 2014. Thereafter, we focused on bespoke directorate as a unit of analysis until the end of our data collection in April 2019 due to its consolidating role.

3.3.2 Case study description: Human space exploration at the Johnson Space Center

The Johnson Space Center in Houston has been leading human space exploration for more than half a century (NASA, 2016). During 2014, the center director at the time, former astronaut Dr. Ellen Ochoa, reorganized JSC by integrating five originally independent units (Strategic Opportunities & Partnership Development, Performance Management and Integration, Extra-Vehicular Activity, Human Exploration Development and Support, as well as Astromaterials Research & Exploration Science) into a single directorate, EISD. The rationale behind this step was to create a unified organization entirely focused on (human) space exploration as well as to aggregate

complementary exploration capabilities, as already mentioned (NASA, 2014). EISD's leadership defined the unit's purpose as follows: "With the future in mind EISD's primary function is to enable, promote, and ensure integration and alignment of anticipated Exploration capabilities and needs of NASA (...). EISD provides the vision for human space exploration" (EISD, 2017). EISD plays an important role for defining NASA's exploration strategy including the anticipation and development of corresponding long-term capabilities, in collaboration with the central headquarter directorate for Human Exploration and Operations Mission (HEOMD) (NASA, 2018b). EISD's strategy work is therefore pivotal for the entire agency as well as for the Johnson Space Center, as it ensures adequate resource allocation and recognition in the ongoing competition with NASA's nine other field centers for federal funds.

EISD has to "shape the direction of human exploration architectures and concepts" looking as far ahead as 20 - 30 years for missions such as a manned journey to Mars. Further, it has to "develop [specific] exploration strategies (technical and programmatic) that are sustainable and adaptable to change" (EISD, 2017). These goals are challenging since there are several unsolved technological challenges involved, such as the need for propulsion engines that move beyond fossil fuels, which require decades of intense research and development activities. However, this need is in stark contrast to NASA's continuously shrinking funding and the shifting policy objectives of each new administration. While NASA's budget during the era of the space race accounted for 4.5% of the US federal budget, it has now declined to less than 0.5% (Heracleous, Terrier, and González, 2018; forthcoming). Temporal tensions thus arise between long technology/mission timelines and shorter U.S. administrative periods (Heracleous, Yniguez, and González, 2019). The case of EISD in the context of NASA is therefore well suited to uncovering how actors manage temporal tensions during long-term strategic change initiatives through particular temporal practices.

We observed such practices and gathered data on relevant sensemaking at all organizational levels of EISD: at the top management level during a

dedicated strategy process and at the remaining levels, middle management and staff in their everyday activities, such as work on the Orion spacecraft including schedule planning and risk assessment. To understand historic practices, we conducted interviews and collected archival data, such as documents and oral history transcripts. The strategy process resulted in EISD's vision and mission statements. Next, the leadership team created three so called "tiger teams" of top and middle managers during a retreat in September 2016 to develop a strategic roadmap for EISD, to guide resource allocation and a related communication strategy later. Initially the tiger teams consisted of top and middle managers, with regular staff members added at a later point. Our data collection covered the whole strategy process until the work of the three tiger teams was completed. We investigated temporal practices at all levels of the organization during this process. We thereby observed how EISD has dealt with temporal tensions regarding long-term strategic human exploration activities after its creation and how it has developed a corresponding dynamic capability since. These temporal tensions have become a major concern for EISD because NASA's role and relevancy in the future of human space exploration may depend on them, as the following quote from a middle manager from EISD illustrates:

Temporal conflict is created because of destination and capabilities. We [NASA] keep getting whiplashed because of the destination changing, and we can't accelerate the capabilities quick enough to meet the destination. (...) So, we have this conflict because the two continue to shift on us. But if someone [from the private space industry] can move faster and close the gap between the capabilities and the destination, then the one that can't close the gap [NASA] will find themselves no longer part of the race. And that's what I'm afraid of.

3.3.3 Data collection and data analysis

The fieldwork with NASA and EISD began in August 2016 and ended in April 2019. We performed 42 interviews, all of which were audio-recorded and transcribed except for two with interviewees who did not allow recording. We took detailed notes during the interviews and elaborated on them shortly

afterwards. The average duration of the interviews was 51 minutes. Our interviewees were selected to cover all three tiger teams, all hierarchical levels and offices as well as EISD's human resource business partners and one external consultant who supported the strategy process. This led to 38 individuals that were interviewed once, while five interviewees were interviewed twice to obtain more detail, clarify previously provided information, as well as to validate our initial sensemaking of the data. All interviews were conducted individually with the informants; however, on one occasion two interviewees were present at the same time. In addition to the interviews, more than 300 pages of observational notes of meetings (especially EISD's weekly staff meetings and EISD's strategic planning meetings) were compiled and more than 1,000 pages of archival and current documents collected. The archival data was especially important in our case, since it allowed us to trace NASA's practices for managing temporal tensions related to human space exploration before EISD's inception. Our data set consequently offers rich insights into the context in which EISD and NASA operated and the (temporal) practices its members engaged in. The focus on temporal tensions was part of a larger research project that we conducted at the JSC. During the entire research project, we conducted 70 interviews and compiled 1,500 pages of documents and observational notes. This helped us appreciate and understand the context in which NASA's and later EISD's temporal practices have taken place even more.

We began our analysis by drawing a timeline of EISD's strategizing activities starting from the directorate's inception until the end of the data collection (Langley, 1999). We analyzed EISD's entire strategy process and also drew from historic data on NASA's (human exploration) missions and programs to understand the link between US administrations and NASA's changing focus over time. By triangulating between our current and historic data sources, we were able to uncover EISD's and NASA's temporal tensions related to human space flight in a longitudinal manner. We drew a second timeline over NASA's 60 years of existence and divided it into three brackets

that show how NASA's temporal management capability developed over time (Table 3.2).

The first bracket covers the years from 1958 until 2005 and can be characterized as one of *temporal continuity*, because no space initiatives were canceled until they had achieved all or most of their objectives (e.g., the Apollo program resulted in a successful Moon landing). The environmental climate was one of stability, with broad political and public support for space exploration. The space initiatives in this phase constituted a series of linear steps towards a manned Moon landing. Once that goal was achieved, President Nixon had to determine a new focus for NASA's activities. Given the large budget required for cis-lunar and deep space exploration compared to low-earth orbit activities, and to support international diplomacy, Nixon decided to concentrate NASA's activities on developing the Space Shuttle and the International Space Station.

Phase 2 lasted from 2005 until 2010, and can be characterized as a phase of *temporal discontinuity*, as support for unitary goals evaporated. Shifting the focus from low-earth orbit, President George W. Bush had initiated the Constellation program with a renewed focus on manned space missions and the ultimate goal of reaching Mars by 2020. However, in the wake of the global financial crisis in 2008-2009, support for funding this ambitious program quickly dwindled, and for the first time in NASA's history, a major space initiative was canceled in its early stages before all or major parts of its aims were achieved.

This cancellation can be seen as the starting point of phase 3, which can be characterized as a period of *temporal uncertainty* that began in 2010 and continued through the end of the study period. During this phase, the political divide between the two largest political parties in the United States increased on nearly every issue, including space exploration. Barack Obama overturned Bush's policies; in turn, Donald Trump scrapped Obama's policies. Uncertainty, therefore, became a pattern and a major threat to human space exploration, with its long research and development timelines.

Table 3.2. Three phases of human space exploration relevant for building a temporal management capability at NASA

Description	Phase 1: 1958-2005 Temporal continuity	Phase 2: 2005 – 2010 Temporal discontinuity	Phase 3: 2010 – today Temporal uncertainty
Major space initiatives (trigger)	<ul style="list-style-type: none"> • Mercury • Gemini • Apollo • Space Shuttle • International Space Station (ISS) 	<ul style="list-style-type: none"> • International Space Station • Constellation 	<ul style="list-style-type: none"> • Orion Spacecraft • Space Launch System (SLS) • Asteroid Redirect Mission (ARM) • Lunar Gateway • Lunar Base
Major outcomes	<ul style="list-style-type: none"> • Mercury: Crewed earth orbital flight and safe return of crew • Gemini: Extended duration of crewed earth orbital flight, extravehicular activity, space rendezvous and docking • Apollo: First human landing on lunar surface and its exploration • Shuttle: Launch of satellites, interplanetary probes and experiments, assembly of Hubble space telescope, construction and servicing of ISS 	<ul style="list-style-type: none"> • ISS: Continuous human presence and scientific experiments in space since 2000 via international collaboration • Constellation: Cancelled in 2009; its program objectives were to develop a new booster system (Ares) for the ISS and beyond, to return to the Moon (lunar lander Altair) and to fly to Mars with the Orion spacecraft. Some parts of the program were reused for subsequent initiatives 	<ul style="list-style-type: none"> • Orion: Still under development, first crewed flights planned for early 2020s. • SLS: Based on integrated design of Ares I and V; still under development with a first flight currently being planned for 2020 • ARM: Cancelled in 2017; its objective was a robotic mission to retrieve a boulder from an asteroid • Lunar Gateway: Planned as an orbiting platform around the Moon with final assembly in 2026

	<ul style="list-style-type: none"> • ISS: International assembly of microgravity and space environment research laboratory 		<ul style="list-style-type: none"> • Lunar Base: Planned as a permanent presence on Moon, with return of humans to lunar surface in 2024
Environmental climate	<ul style="list-style-type: none"> • Wide support of space initiatives • Stability in duration and execution of initiatives • Shrinking budgets but growing international collaboration 	<ul style="list-style-type: none"> • Support of a unitary goal seized • First time that a major NASA initiative was cancelled in its early stages and without all or part of its aims were completed 	<ul style="list-style-type: none"> • Political divide and associated different goals for human space exploration emerged and continue • Continuously high levels of uncertainty (a pattern of cancellation has emerged whenever a new US administration takes office)
Management of temporal tensions	<ul style="list-style-type: none"> • Change-related temporal practices 	<ul style="list-style-type: none"> • Change-related temporal practices • Long-term temporal practices 	<ul style="list-style-type: none"> • Change-related temporal practices • Vision-related temporal practices based on organizational vision • Dedicated organizational unit to further develop and enact the temporal management
Phase of practice capability lifecycle	<ul style="list-style-type: none"> • Latent 	<ul style="list-style-type: none"> • Founding 	<ul style="list-style-type: none"> • Development • Maturation (ongoing)

By employing a grounded theory approach (Strauss, 1987; Strauss *et al.*, 1998), we iterated between our interviews, the timeline representations, and relevant theory to identify emergent themes (Eisenhardt *et al.*, 2007; Van Maanen, Sørensen, and Terence, 2007). While a focus on EISD's social practices had already emerged as a theme of interest during the data collection phase, others, especially the temporality aspect only surfaced later. We started firstly with open coding to remain faithful to informants' terms and to not limit our analysis too early (Charmaz, 2006). Next, we iterated between our preliminary codes and the existing literature and found previous work on practices related to time helpful, especially Kaplan *et al.*'s (2013) work on temporal work in strategy-making, Dougherty *et al.*'s study of different time pacing mechanisms (2013), and McGivern *et al.*'s findings on the silent politics of temporal work (2018). Based on existing work on temporal practices in strategy research, we moved to selective coding (Corbin *et al.*, 1990; 2008) in which we specifically focused on the temporal aspects of EISD's practices as mechanisms for managing its temporal tensions. Finally, in the third stage we undertook axial coding, where we aggregated our codes into categories and related them to each other in a process model (Figure 3.3). The importance of strategic and especially temporal fit (e.g. Miles and Snow, 1994; Venkatraman and Camillus, 1984) surfaced during this phase of our analysis as well as its implications in terms of facilitating or inhibiting originally planned outcomes. Finally, we recognized an increasing need for an active management of temporal tensions at NASA. Therefore, the agency gradually developed a corresponding dynamic capability, which was formalized within EISD. Our coding structure with illustrative open codes is summarized in Table 3.3, while our findings will be discussed next.

Table 3.3 Coding structure

Open codes	Axial Codes	Aggregate Constructs
<p>“The younger [President] Bush, he started the vision for space exploration and all of a sudden, we are moving back in that direction again. And we have the Constellation program. We're building big rockets and then Orion spacecraft. And we have all these plans to go back to the Moon.” (Middle Manager, Exploration Mission Planning Office)</p>	<p>Trigger (New strategic change initiative)</p>	
<p>“I think the agency is in transition of direction. So, the Deep Space Gateway might take off and become a big mission or we might hear in four months something different.” (Employee, Exploration Development Integration Office)</p>		
<p>“We wanted to bring a program on site [of the JSC]. For it, we just needed to know did it align with JSC’s process, its purpose and with what was allowed? If it's allowed and it aligned, then that's all.” (Employee, Strategic Business and Partnership Integration Office)</p>		<p>(1) Temporal tension</p>
<p>“Over the last 30 years, the center's identity had been closely tied to getting our astronauts into space and returning them back home safely. We could explore [other aspects of space] additionally as long as we still were the ones that had the astronauts and Mission Control and still brought the astronauts back home safely at the end of the day. And as long as you hold on to that identity, it does not allow for any of your capabilities to shift.” (Middle Manager, Exploration Technology Office)</p>	<p>Temporal and strategic fit assessment</p>	

“We are doing **roadmaps and budgets and com plans**. So, one of them is the strategy roadmap. We just finished that off this last year. So yeah we try to mirror what the center does and play our part to help them succeed [by incorporating new directions as quickly as possible].” (Senior Manager, EISD)

Change-related
temporal practices

“Since the Deep Space Gateway is still early on in the development cycle, what I’m doing now is (...) **listening and learning and trying to be ready**, so that when the project does a top level assessment of its risk, schedule and budget, we are prepared to provide inputs, like giving advice when they ask how much something will cost or how long it will take to develop.” (Employee, Cost and Schedule Analysis Office)

“There’s a small number of people who work at NASA who do sort of the top level planning. We have a whole lot of people who are the experts in the nuts and bolts of building spacecraft and all the rocket science stuff. There’s a smaller number of people who try to look at the big picture and **keep us going down a path that’s constantly moving forward**.” (Middle Manager, Exploration Mission Planning Office)

Vision-related
temporal practices

(2)
Temporal
practices

“The center director specifically asked for a strategy that took into account the very real possibility that every four to eight years, we get a new destination. He wanted a **strategy that will survive no matter what the change was**. So, the strategy focused on what would be the role [of the JSC] independent of destinations and what were the activities to maintain its leadership. We had to figure out what was consistent in the future of [human] space exploration that would underlie no matter what direction and destination came from the president. The two factors we identified were commercial and international space.” (Employee, Exploration Technology Office)

“[When a new administration comes in], we come up with all these **different options** which we call *Design Reference Missions*. Then they end up getting **narrowed down** to one or two and then that’s the one we do a more detailed design for. Like with the DSGW, there were different concepts and now they have narrowed it down to that design and architecture and that’s now what we are **working on [in terms of mission planning]**”. (Senior Manager, Exploration Mission Planning Office)

Facilitate
planned outcome

“We try to **make things faster**. No kidding, this is why we have the challenge of going back to the Moon by 2024. If they [President Trump’s administration] gets reelected, they will be in the office through 2024 and provide support through 2024.” (Middle Manager, Exploration Technology Office)

(3)
Outcome of
strategic initiative

“Space Act Agreements are a perfect example for **slow-rolling**: If the center doesn’t want to do something, a space act agreement that usually would take a month would take six to eight months until it gets through.” (Specialist, Exploration Technology Office)

Inhibit
planned outcome

“We are **not building a specific set of things** that take you to the Moon or a specific set that takes you to Mars or wherever you want to go but we are looking at the **common denominators** of all the things you like to do [and that’s what we build].” (Employee, Exploration Mission Planning Office)

3.4 Analysis and findings

In this section, firstly we detail the temporal context in which EISD operates as well as the temporal tensions it has to manage. Secondly, we discuss the temporal practices that EISD enacts for managing these temporal tensions over time. In this vein, we also show the important role that temporal and strategic fit play in this process. We extend previous work on short-term temporal practices, which facilitate the implementation of change initiatives (we term them *change-related* temporal practices). We also add a further category of temporal practices that focuses on long-term strategic outcomes, which we call *vision-related* temporal practices. These are enacted in the background and can either facilitate or inhibit originally planned outcomes. We continue by showing that those vision-related temporal practices with contradictory effects may be enacted in an intended way, even though on the surface they seem to support new change initiatives. They therefore depict a source for failure of strategic change initiatives. In the following discussion section, we then proceed by presenting our findings in terms of a process model that integrates change- and vision-related temporal practices and that locates temporal and strategic fit in it (Figure 3.3). Being aware of and following such a process can provide an organization with the capability to manage temporal tensions, especially those with contradictory effects underneath the surface. This might even be achieved despite high levels of uncertainty, for example by stabilizing long-term strategic change initiatives. Such a dynamic capability to manage temporal tensions can be developed to address an increasing need to manage these tensions or may emerge as a result of routinized practices.

3.4.1 Temporal context and tensions of human space exploration

Ever since President Eisenhower signed the National Aeronautics and Space Act into law on July 29, 1958, NASA has worked on various space programs, projects, and missions (NASA, 2008). The aim of project Mercury, also known as “first man in space” program, was to orbit a manned spacecraft around Earth, to recover it, and to investigate whether and how humans could function in

space (NASA, 2017a). This was followed by the Gemini program, which defined and tested the skills NASA needed to land on the Moon during the forthcoming Apollo program (NASA, 2018c). After Neil Armstrong left the first human footprint on the Moon in 1969, NASA focused on low-earth orbit activities. In 1972, President Nixon (1972) decided to shut down the Apollo program and to build a reusable, low-cost space shuttle. The Space Shuttle program among many things provided orbital laboratories and platforms that helped to erect the Hubble telescope and the International Space Station (Presidential Commission, 1986). The latter took 10 years and 30 missions to assemble and involved five space agencies that represented 15 different countries (ISS US National Laboratory, 2019). Currently, NASA is working on the Orion spacecraft for deep-space exploration and the corresponding Space Launch System as well as a lunar gateway (also called the Deep Space Gateway or DSGW) and a lunar base. All of these have recently been integrated in a new space program, called Artemis (NASA, 2019a).

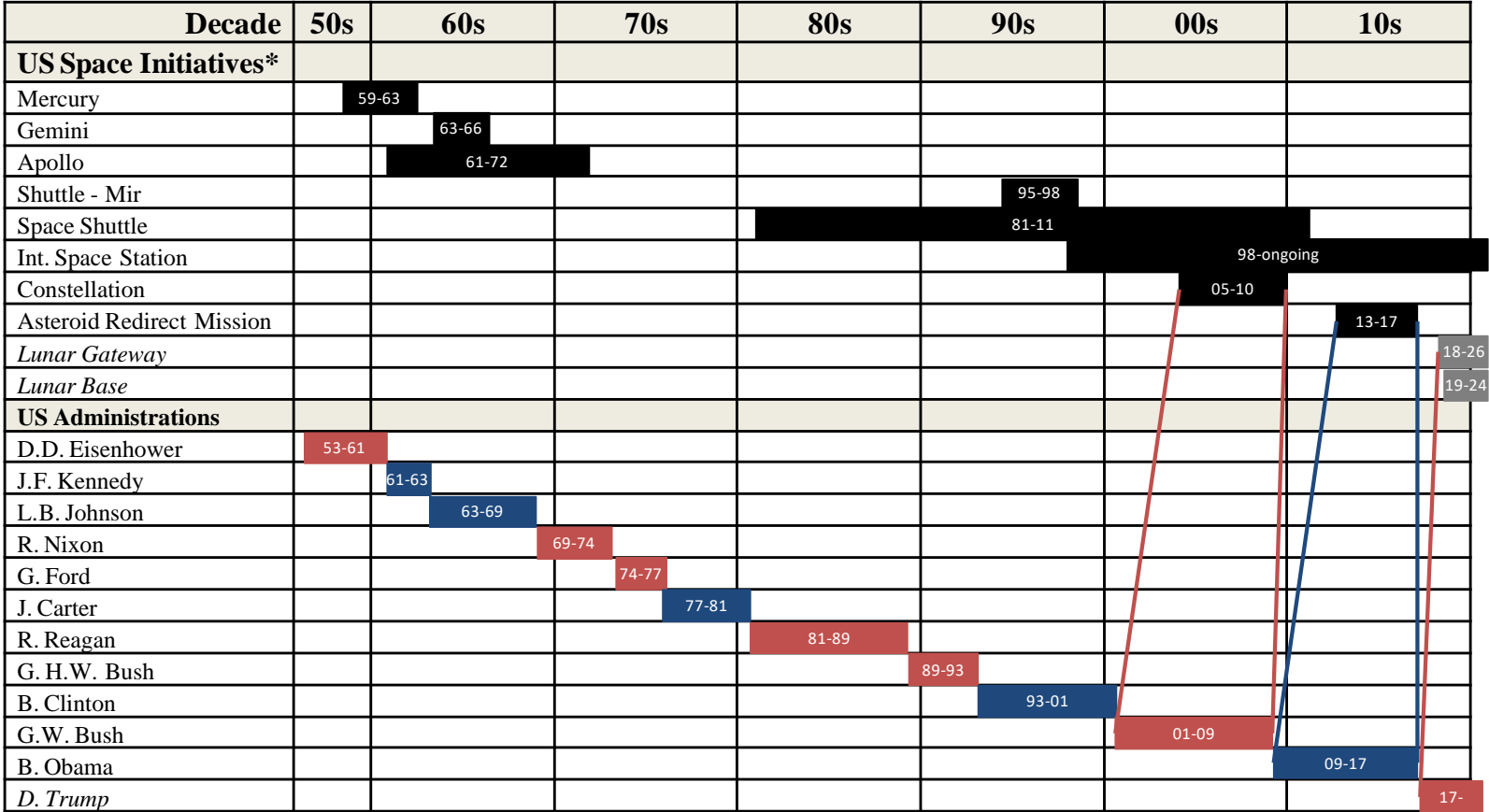
In addition to these projects and programs, several space initiatives have been disbanded before their successful completion, such as the Constellation program and the Asteroid Redirect Mission. A member of EISD's mission planning team noted:

Since NASA is a government agency, we are somewhat at the whims of the political winds. Sometimes they blow one way, sometimes they blow the other. And you only have to look at about every eight years recently, NASA has had our [EISD's and the agency's] direction changed by the new administration coming in. (...) In the early days at NASA, it wasn't that way.

This quote illustrates well the temporal context and the tensions between timelines of space initiatives and legislative terms of political administrations faced first by NASA and later by the EISD. Figure 3.1 shows that, at the beginning of human space flight and especially during the time of the space race and the aftermath of the cold war, initiatives remained stable while in recent times discontinuity prevails and creates high levels of uncertainty. As the mission manager continues:

When a new administration takes power, they look at all the government programs that they oversee and space is one that's kind of small in terms of dollars in the United States but very high in terms of visibility. And it's one that they can direct. (...) Recently it almost seems like it's become a little bit political. The Republicans like to go back to the Moon but maybe the Democrats don't. (...) What that means to the folks who actually work this is that there's a no-kidding possibility that every eight years you have to kind of set aside everything you've worked on and start working on something new. (...) It seems like we just laid the first couple of courses of stones of a cathedral and then a new pope takes over and makes us throw those stones away and start building a slightly different cathedral. It's hard to build a cathedral when you're changing the design every eight years. So that's kind of the reality of it.

Figure 3.1 visualized NASA's most important space initiatives and the corresponding US administrations over time.



* Selected NASA programs and missions ■ Democrat ■ Republican

Figure 3.1. Comparison of US space initiatives and US administrations (1959-2019)

By systematically analyzing NASA's 60-year history, we were able to uncover three different phases of temporal tensions and their management due to different environmental climates and capability evolution, as described earlier (see Table 3.2).

Phase 1 lasted from NASA's birth in 1958 until 2005. It encompassed NASA's early space initiatives Mercury, Gemini, and Apollo as well as the Space Shuttle program and its assembly of the International Space Station. All of these initiatives have been completed and enjoyed broad political support across political parties. This fostered an environment of relative stability and low levels of uncertainty mission-wise, which we call the phase of *temporal continuity*. While budgets were continuously shrinking after the Moon landing in 1969, funding was sufficient to reach major objectives. Additionally, new sources and inputs were obtained, such as those from international collaborations, especially for the ISS program (Heracleous *et al.*, 2018). Due to these changes in the funding structure and other policy developments, minor adjustments of the long-term strategic change initiatives had to take place. For example, when President Nixon decided to focus on low-earth orbit instead of a further exploration of the Moon, strategic plans and technology roadmaps had to be adjusted. The recommendations of the 1969 Space Task Group for a Post-Apollo era, such as the establishment of a lunar orbit or surface base, erecting a large 50-100 men strong earth-orbiting space base, and the manned exploration of other planets such as Mars, were no longer seen as relevant (NASA, 1969). Instead, NASA's focus was directed to the development of a low-cost, reusable space shuttle and a Skylab orbiting the earth. Due to the stability of previous space initiatives across several US administrations, NASA engaged in what we call *change-related* temporal practices. We define these change-related temporal practices as practices that directly relate to a specific strategic change initiative and facilitate the planned outcome associated with these change initiatives. In NASA's case, the temporal tensions, that they addressed, resulted from a politically-driven environmental change that led to different human space flight objectives and associated timelines.

Phase 2, from 2005 until 2010, that we call *temporal discontinuity*, contrasts with the first phase in terms of an unprecedented increase in uncertainty. During that time, NASA ran two major programs: ISS's ongoing operations and the progression of the Constellation program launched by President George W. Bush. The goal was to extend space exploration activities beyond low-earth orbit by returning to the Moon and eventually by flying to Mars. Despite major investments in the development of new vehicles (Orion spacecraft and Altair lunar lander) and propulsion designs (Ares I and V rockets), Constellation was cancelled in 2010 by President Barack Obama. A former Constellation manager and long-time NASA employee reflected:

George W. Bush's administration was really trying hard to figure out what we're going to do next. (...) So, we started Constellation and I've never worked harder in my whole life than I did in Constellation. We were working 80 hour weeks. Well, 2010 Obama cancelled it and it was costing a fortune. We were spending billions, a lot, a lot of money! And Orion is what's left of it. We [initially] thought that a part of it [Constellation] was going to be cancelled, we didn't realize the whole thing was gonna be cancelled. It turned out later that Orion survived.

This quote illustrates the surprise and disbelief that NASA employees felt at that time. Constellation was the first major program to be cancelled before achieving significant parts of its mission objectives. It marked a turning point in NASA's management of temporal tensions and for the development of a temporal management capability, that sustains long-term strategic change despite policy changes and reversals. The cancellation of the Constellation program can be considered a performative breakdown of NASA's established practice to that date, which entailed to always and solely focus on the most current space initiative via change-related practices (Sandberg and Tsoukas, 2011; Yanow and Tsoukas, 2009). The survival of the Orion spacecraft resulted from additional practices that were triggered by the performative breakdown and which related to long-term thinking, hence our terminology of *long-term temporal practices*. Such a long-term orientation already included some sort of a fit assessment. However, the latter was conducted ad-hoc and without a

formalized process or routinized activities. A middle manager of EISD explains:

The Orion crew vehicle survived the change because you need a fundamental way to get people into space. We knew that we needed that capability. So, I think what we did is we looked at all the parts of the program and asked ourselves which things do we think we could rescue based on them being good pieces to go maybe in a slightly different direction ... Cancellation is not something that happens in like a day. It's something that happens over the period of months and maybe a year. (...) You go into a sort of a planning mode where you start looking: "Well, here's where I've made my big investments. I think if we keep this that would be good for the agency. The new administration doesn't want to go to Mars anymore, the Moon or asteroids. So maybe the stuff that was very specific to that won't get picked up. But maybe there's ways to keep pieces of it."

Phase 3 of *temporal uncertainty* ranges from 2010 until today and can be characterized by frequent changes in direction and thereby high levels of uncertainty. In the context of past uncertainty occasioned by policy reversals, especially the cancellation of the Constellation program, NASA employees nowadays regularly assess new space initiatives for their temporal and strategic fit and then systematically enact *vision-related* temporal practices based on the result. Vision-related practices constitute an evolution of the previously mentioned long-term temporal practices through the conscious, formalized, and routinized inclusion of a vision-related fit assessment. One example is the Asteroid Redirect Mission instigated by the Obama administration, whose objective was to develop the first-ever robotic mission to intercept a close-by asteroid, collect a multi-ton boulder from its surface and redirect it to orbit the Moon for further investigation (NASA, 2018d). Since it was a non-manned, robotic mission and not seen as much related to NASA's (2018a) core value of "pushing the boundaries of human spaceflight farther than ever before", NASA and especially JSC as "the hub of human spaceflight" (NASA, 2019b), did not believe in the mission's durability beyond President Obama's administration. Based on this assessment only absolutely necessary change-related temporal

practices were executed, such as developing a strategic plan for ARM. Simultaneously, inhibiting vision-related temporal practices were enacted in the background, as the following quote from a member of EISD’s top management team shows:

The White House [under President Obama] said they want to go to an asteroid. Congress said: “We don’t care about asteroids.” NASA studied asteroids but we never created a program.

We portray the outlined three phases with their triggers, temporal practices and outcomes in Figure 3.2.

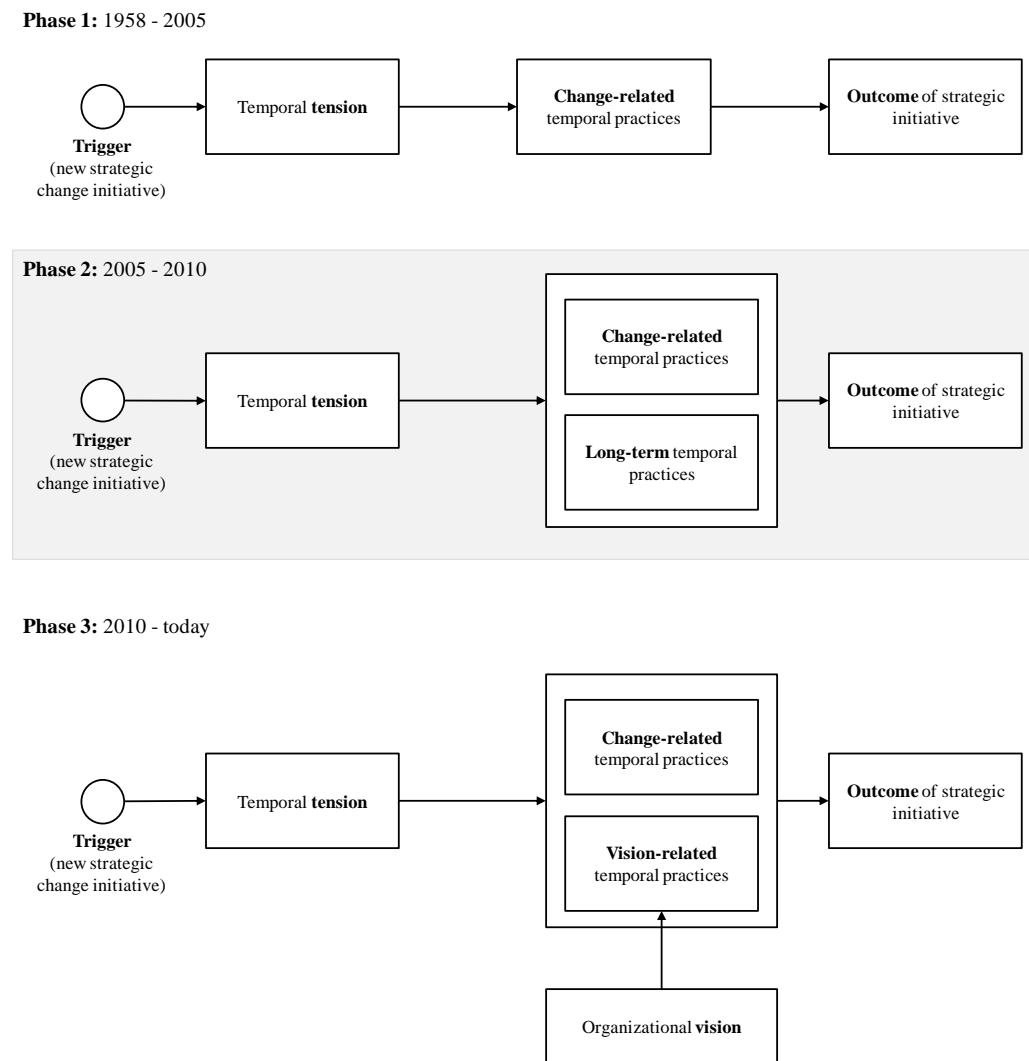


Figure 3.2. Development of NASA’s temporal practices over time

3.4.2 Temporal practices and their role for longitudinal strategic change

In the previous section, we described temporal tensions resulting from the disjuncture of decades-long mission timelines with the shifting policies of shorter-term presidential administrations. We then identified change-related and long-term temporal practices that in the third phase included fit assessments. We expand on these practices in relation to strategic change below.

3.4.2.1 Change-related temporal practices

Change-related temporal practices directly follow the announcement of new space initiatives such as Vice President Mike Pence's challenge to return to the Moon by 2024 that he put forward in the fifth meeting of the National Space Council on March 26, 2019 (NASA, 2019c). An EISD mission planner noted:

The specific outcome [of our planning] is the sustainability of the enterprise, right? In a perfect world, you could manipulate some of the variables, so that your cadence of mission or your marching towards your goal stays constant. That would be ideal. But we haven't figured that one out exactly yet [laughs]. So, yeah, the near-term goal is to get humans back beyond low-earth orbit, back to the surface of the Moon, and then to exploring interplanetary space. They [US administration and Congress] however disagree on how we go about it in the long-term direction. So, the strategic plan is renewed every four to eight years. Actually, it is worse than that, we rewrite the strategic plan every year, sometimes even sooner, which does not make it strategic by the way.

During this phase, EISD enacted planning practices to resolve the temporal tensions that it perceived as arising due to new strategic change initiatives implemented when new presidential administrations take office (see Phase 3 in Table 3.2). Sometimes such adjustments had to be made every year anew because Congress approves NASA's budget annually. We call these temporal practices *change-related* temporal practices because they relate to a specific strategic change initiative. Typically, these practices are readily observable because they align with a new strategic initiative and are intended to facilitate its planned outcomes. The second type of temporal practices can contrast these characteristics if the vision-related fit of the initiative is assessed negatively.

3.4.2.2 *Vision-related temporal practices*

In the context of decades-long mission timeframes, additional considerations and temporal practices may influence the outcomes of strategic change initiatives. Vision-related temporal practices juxtapose a new initiative against an organization's long-term strategy and vision via a temporal and strategic fit assessment. Depending on the level of fit, additional temporal practices are enacted to further facilitate (e.g. by accelerating) or inhibit the initiative (e.g. by slow-rolling). The latter helps to stabilize a pre-existing, long-term strategic initiative that had been deemed to be in line with the organizational vision in spite of policy changes and new initiatives. Since these vision-related temporal practices may inhibit new strategic change initiatives, they often take place in the background and are difficult to spot in the absence of rich, longitudinal data. Table 3.3 illustrates temporal practices in terms of our raw data. Table 3.4 provides four categories of vision-related practices with examples.

The first category of vision-related temporal practices can be called *capability-based compromising*. For actors in EISD, this entailed reducing human exploration to its basic underlying needs, such as propulsion, mission control operations, and life-support systems. Organizational capabilities were determined and compromises were made to develop these basic underlying needs. The second category is *temporal-based detailing* practices, which are implemented in parallel to the development of specific roadmaps whenever new change initiatives are introduced. Within this category, capability-based planning involves using the identified common denominators as the baseline for planning activities. Adaptive planning refers to iterative modifications of initially rough long-term plans in response to developments or changes in the environment, for example, when new technology becomes available. Third, *development pacing* practices such as flexible contracting help avoid sunk costs in case a space initiative is canceled. Accelerating and slow-rolling are comparable practices that directly oppose each other. Depending on the temporal and strategic fit assessment, strategic change initiatives are either sped up (e.g. by investing additional funds or reallocating the workforce) or stalled.

Finally, *strategic maneuvering* practices encompass path-dependency creation. This means that sunk costs are deliberately created to favor a particular scenario, which is aligned with the organizational vision that underlies the temporal and strategic fit assessment. Similarly, fashionable framing practices are attempts to develop the basic building block capabilities by framing them so they seem to be aligned with the new strategic change initiative.

Table 3.4. Empirical examples of vision-related temporal practices

Vision-related temporal practices	Description	Empirical examples from case study
Capability-based compromising	<ul style="list-style-type: none"> • Identifying common denominators: Reduce work to basic underlying needs and corresponding organizational capabilities based on organizational vision and derived scenarios 	<ul style="list-style-type: none"> • Identify “capability building blocks” of human space exploration activities, such as propulsion, crew transportation, mission control operations, life-support etc. • Design of “Advanced EVA exploration spacesuit” equally suitable for the lunar gateway orbiting the Moon with its zero-G environment as well as for the surface gravity of Mars (approx. 38% of the earth)
Temporal-based detailing	<ul style="list-style-type: none"> • Capability-based planning: Use common denominator-related capabilities as baseline for alternative planning activities • Adaptive planning: Develop detailed short-term plans and additional rough long-term plans with frequent iterations to hedge for adaption 	<ul style="list-style-type: none"> • Develop technology roadmaps beyond current strategic initiatives that rely on basic human space exploration building blocks in addition to specific mission plans, e.g. for the lunar gateway • Determine capabilities as “strategic themes” or “EISD BHAGs” (abbreviation for Big Hairy Audacious Goals, borrowed from Collins and Porras [1994]), initially without a timeline to not limit the strategic thinking process, and put them beyond specific goals that relate to current strategic initiatives, e.g. “Advanced EVA Exploration Spacesuit”, agnostic of final destination • Iterate EISD’s plans frequently ranging from weekly adjustments for the near future (e.g. EISD strategic plan for the current fiscal year) to yearly ones for the long term (EISD’s open-ended strategic roadmap, multi-year technology roadmaps “L-8” with time horizons beyond 8 years of development)

Development pacing	<ul style="list-style-type: none"> • Flexible contracting: Modularize contracts and commission contractors in tranches for flexibility • Accelerating: Increase development speed for current strategic change initiatives in line with organizational vision • Slow-rolling: Stall developments that do not fit with organizational vision 	<ul style="list-style-type: none"> • Continuously scan the technological environments inside and outside of NASA for integration into exploration designs, e.g. water-pressure based mining compared to mining with heavy machinery • Increase resource availability for manned return to Moon by asking for additional budget from Congress to speed up development timelines as to reach the Moon by 2024, which is before the end of President Trump’s potential 2nd term • Minimal resource allocation to the previous Asteroid Redirect Mission since it was regarded as non-relevant to the required long-term capabilities for human space exploration
Strategic maneuvering	<ul style="list-style-type: none"> • Path-dependency creation: Create sunk costs or contractual obligations as to favor a particular scenario or technology in line with the organizational vision • Fashionable framing: Frame capability-focused activities in line with current strategic initiatives 	<ul style="list-style-type: none"> • Include international and commercial partners in the development of technology and space initiatives in line with organizational designs as to increase the barriers for exit due to fear of potential claims for compensation or international resentment. A prominent example for the latter is the ISS and its role for overcoming the cold war and enhancing international trust and collaboration • “Piggy-back” additional functionalities onto tests that are scheduled anyway, e.g. for the international space station, to gain data points for designs that are in line with common capability denominators and may therefore become relevant in the long-run while not absolutely critical for the current space initiative in focus

3.5 Discussion

We began this research with the objective of understanding how actors deal with temporal tensions during long-term strategic change initiatives. NASA and especially EISD provided an apt case study setting for identifying different types of temporal tensions, the role of temporal and strategic fit, as well as two types of temporal practices that either facilitate or inhibit originally planned outcomes. Our findings have shown how the newly uncovered vision-related practices can stabilize long-term strategic change in spite of high levels of uncertainty, newly imposed projects, and frequent changes in the environment. In the following, we integrate our findings in a process model of temporal management, which may even serve as the basis for developing a dynamic capability for managing temporal tensions.

3.5.1 Process model for the management of long-term strategic change initiatives

Our process model, shown in Figure 3.3, emerged inductively from our data and several rounds of iteration with the literature.

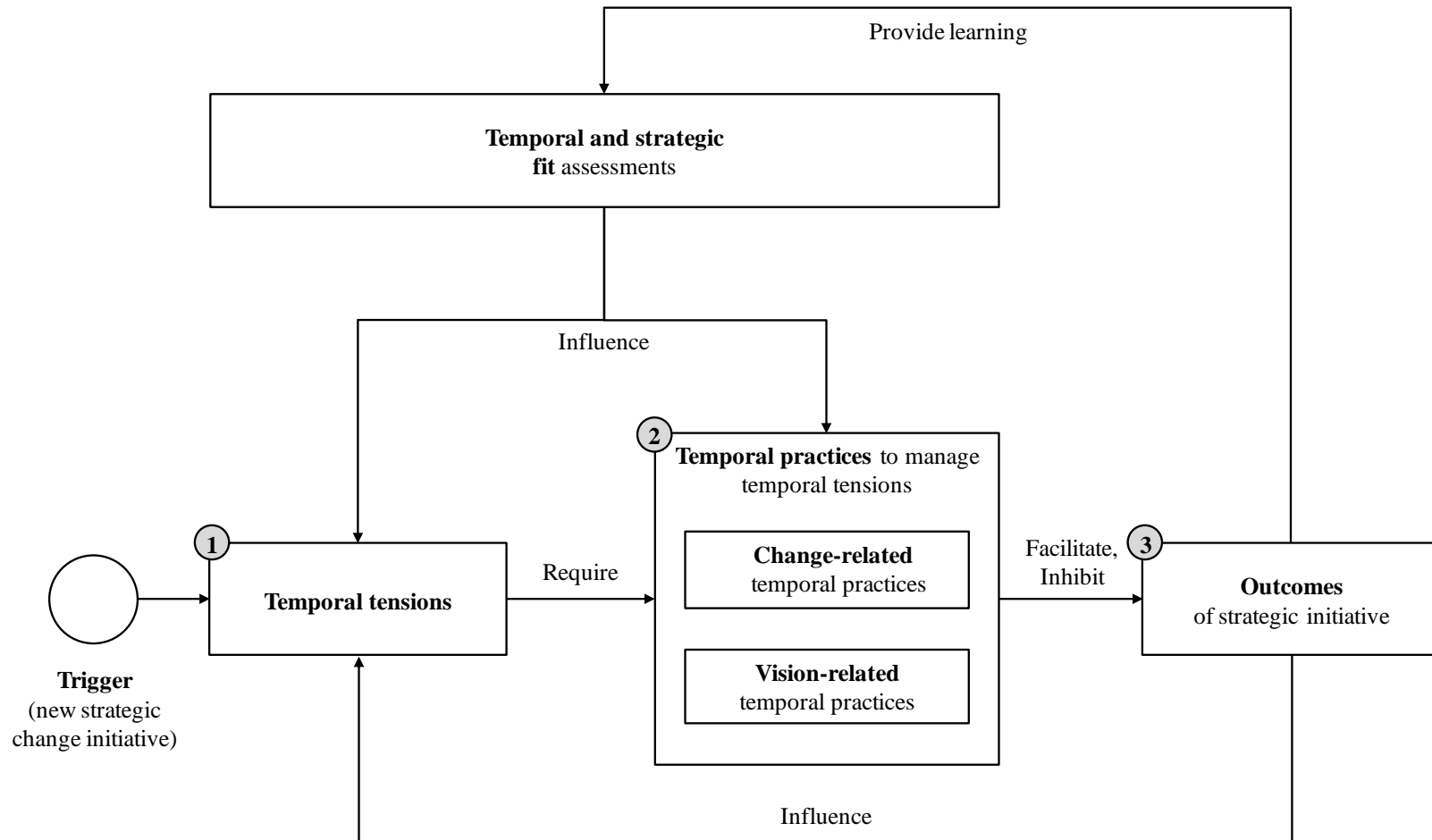


Figure 3.3. Process model for the temporal management of long-term strategic change initiatives

3.5.1.1 *Temporal tensions*

The starting point of the process model is a change in the environment. Once this trigger is sensed, seized (Teece *et al.*, 1997), or imposed, a temporal and strategic fit assessment takes place. The new change initiative that results from the environmental change, such as the creation of the Apollo program following President Kennedy's announcement of a manned Moon landing by the end of the 1960ies (NASA, 2017b), is juxtaposed against the overarching organizational vision. Temporally, an assessment is made whether the new change initiative can feasibly be completed in time given the current resource base. For long-term strategic change initiatives, which possess a timeline of more than five years, this may often not be the case, and newer initiatives may be imposed in the meantime. Consequently, temporal tensions are perceived between the timelines of the strategic change initiatives and their resource availability, e.g. due to funding cycles.

3.5.1.2 *Temporal practices*

These temporal tensions are managed by enacting two types of temporal practices that help to reconfigure available resources and capabilities (Teece *et al.*, 1997) in pursuit of the planned change. Independent of the fit assessment, change-related temporal practices are undertaken in line with the goals of the initiators of the environmental change, in our case a US administration. Depending on the result of the fit assessment, additional vision-related practices, such as development pacing or strategic maneuvering, are enacted on different levels of the organization ranging from a dedicated strategy process to everyday practices. These can be executed in an overt or covert way. The latter are difficult to spot and therefore to manage, as change-related temporal practices may be exhibited on the surface while underneath deliberately contradictory vision-related practices may be enacted, too.

3.5.1.3 *Outcomes*

The aforementioned temporal practices can facilitate the outcome that was

originally associated with the new strategic change initiative or they inhibit it, for example by slowing activities related to the initiative down or by working towards an alternative result. Based on the realized outcomes and the experiences gathered from the process of managing temporal tensions via the various temporal practices, organizational learning takes place. The latter then implicitly through experiences or explicitly via formal knowledge articulation and codification becomes an input factor for future temporal and strategic fit assessments. Thereby, it closes the loop of our process model for the temporal management of long-term strategic change initiatives.

In conclusion, the presence of potentially competing practices provides an additional explanation for why some strategic change initiatives succeed while others fail. Furthermore, our model clarifies how temporal practices can stabilize pre-existing long-term strategic change initiatives in the face of newly instituted ones, if the latter exhibit low levels of fit. It does so through its recursive nature, which takes learning via feedback loops explicitly into consideration. Thereby it focuses on the ongoing and mutually constituting nature of strategic change initiatives, temporal practices and the achieved outcomes moderated through temporal and strategic fit assessments (Cloutier and Langley, 2020).

3.5.2 Developing a temporal management capability

Drawing from our data, we theorize that organizations that routinize (Helfat *et al.*, 2003) this recursive temporal management process as a dynamic capability may benefit from superior performance (Teece, 2007). This results from a fit between their strategic change initiatives and their strategy/ vision and their temporal structures as well as through the successful implementation of these initiatives. Applying the capability lifecycle (Helfat *et al.*, 2003) to our data, we argue that during the second phase of temporal discontinuity, the founding of such a dynamic capability at NASA occurred in response to the first cancellation of a large space initiative. This cancellation engendered temporal tensions that had to be managed, leading to the enactment of relevant practices.

For the first time, actors considered long-term implications of environmental changes (e.g. what parts of the Constellation program could be salvaged). In the next phase, temporal uncertainty, we observed that this capability was further developed as EISD was established to manage all human space exploration activities, and implicitly, emergent temporal tensions. Based on these insights from our study we propose that formalizing and routinizing the process model shown in Figure 3.3 may lead to the development of a dynamic capability for managing temporal tensions in long-term strategic change initiatives, with the potential to support superior performance.

An important factor for developing such a dynamic capability for managing temporal tensions over time is learning, as already mentioned earlier. This is in line with an extensive body of work that has developed at the intersection of dynamic capabilities and organizational learning theory (Ambrosini and Bowman, 2009; Easterby-Smith and Prieto, 2008). Schilke *et al.* (2018) found in their recent review that learning has been considered an antecedent to dynamic capabilities, a dimension thereof and sometimes even one of their consequences. The diversity that the concept has exhibited over time can largely be attributed to the fact that it is a highly multi-faceted phenomenon (Argote, 1999), similarly like dynamic capabilities themselves. In our case, we found that learning facilitated the development of the dynamic capability over time as learning mechanisms, such as past experiences or codified knowledge, helped NASA and later specifically EISD to become more proficient at assessing and managing temporal tensions via temporal practices. Pisano's (2002) quote captures the role of organizational learning in this regard well: "The seeds of today's capabilities are sown in yesterday's experience" (2002:150). In their early work at the intersection of dynamic capabilities and organizational learning, Zollo and Winter (2002) identified three relevant mechanisms, namely experience accumulation, knowledge articulation, and knowledge codification, which are not always clear cut but usually mixed together in implicit and explicit organizational processes. In our case study, we observed mostly learning-by-doing, especially in the early stages of the

capability lifecycle. Only later, especially through the founding of EISD, in phase 3 knowledge and corresponding organizational processes got formalized and thereby articulated and codified in a more structured way, which represents deliberate learning. However, independent of the type of mechanism employed, the dynamic capability of managing temporal tensions in long-term strategic change initiatives at NASA developed with the help of learning.

3.5.3 Theoretical implications

By tracking NASA's temporal context over 60 years and zooming in on EISD's specific practices after its inception in 2014, we were able to uncover the evolution of long-term vision-related temporal practices in addition to more short-term change-related temporal practices explored in previous studies, e.g. by Kaplan *et al.* (2013). To our knowledge, only very few previous studies have focused on long-term strategic change and the resulting temporal tensions. McGivern *et al.* (2018) for example explained how temporal work through boundary objects achieved provisional temporal settlement with new problems emerging in the long run. They called such temporal practices *silent politics*, because backstage temporal orientations frame temporal practices via boundary objects. Silent politics align with vision-related temporal practices, which oftentimes are enacted in the background. We extend McGivern *et al.*'s (2018) work by grounding such practices in an assessment of temporal and strategic fit. Furthermore, our data reveal that inhibiting effects on the originally planned outcome of change initiatives may not only result from short-term settlements as in McGivern *et al.*'s (2018) case, but they may be intentionally pursued overtly or covertly for their long-term effects, which relates to the next point.

Gersick (1994) identified short term and long term pacing mechanisms that were specifically related to clock-time and event-time. She argued that organizations can be both inertial and adaptable and that shifts can occur between inertia and change. In our study, we show that in addition to shifts between inertia and change, these states can also co-exist simultaneously. Specifically, when change-related practices are counterbalanced by inhibiting

vision-related practices that result from an assessment of temporal and strategic misfit of a new initiative, change and inertia can co-exist.

Our findings thereby provide an additional temporal explanation for why some strategic change initiatives fail while others succeed. We also show that temporal practices may aim to stabilize long-term strategic change initiatives instead of frequently adapting them before their benefits are realized. In this vein, we draw from Helfat *et al.*'s (2011) notion of dynamic capabilities that are key for the “(n)ever-changing world” (2011:1243), by arguing that organizations may be able to develop a temporal management capability by consciously recognizing underlying long-term temporal tensions and by actively managing vision-related temporal practices and the corresponding fit assessment. We therefore extend the existing literature on dynamic capabilities by means of temporal practices.

In our study, the environmental climate changed dramatically from NASA's inception in 1958 through the end of the study period, as a performative breakdown led to the development of NASA's and later EISD's temporal management capabilities over time (Granqvist *et al.*, 2016; Sandberg *et al.*, 2011; Yanow *et al.*, 2009). Due to its central role in the organization, EISD can be viewed as the process and capability owner for temporal management and actively enacts change- and vision-related practices to pursue the organizational vision despite frequent policy changes. EISD's organizational actors actively manage temporal tensions by recognizing that apparently separate temporal goals may be mutually interdependent, and thus enabling the organization to hold multiple temporal domains at once – through what has been referred to as synthesis or transcendence of temporal poles (Bednarek, Paroutis, and Sillince, 2017; Papachroni, Heracleous, and Paroutis, 2015).

Our study has been exploratory in nature due to the scarcity of previous research on temporal tensions during long-term strategic change. Our findings and the resulting model therefore can be seen as provisional and could benefit

from further investigation in line with previous call (e.g. Bansal *et al.*, 2019; Kunisch *et al.*, 2017).

3.5.4 Limitations and conclusions

Although our longitudinal study of NASA's temporal tensions and its corresponding social practices reveals novel insights that extend existing knowledge on time, strategic change, and dynamic capabilities, it does have a few limitations. Our unconventional research context is one of them. Given the extraordinarily long timelines of initiatives associated with human space exploration and the radical political changes that NASA experiences every four to eight years, findings from our research setting may not be directly applicable to all organizations. Despite its uniqueness, we nevertheless think that other public agencies and private industries characterized by long-term strategic change initiatives and frequent changes, such as publicly listed companies in the pharmaceutical, construction, and oil and gas industries, can benefit from our findings.

Our study has been exploratory in nature due to the scarcity of previous research on temporal tensions during long-term strategic change. Our findings and the resulting model therefore require further investigation and elaboration. In line with previous calls (Bansal *et al.*, 2019; Kunisch *et al.*, 2017), we encourage future research in this realm.

Chapter 4:

Cultural Oscillation as an Enabler of Ambidexterity:

A Longitudinal Study of a Team
Subculture in NASA

4.1 Introduction

For decades, strategy scholars have sought to understand how incumbent firms deal with organizational tensions and paradoxes such as exploration and exploitation, with ambidexterity emerging as a key concept for doing so (Andriopoulos and Lewis, 2009; Gibson *et al.*, 2004; Raisch *et al.*, 2009). Despite illuminating research on how firms can pursue ambidexterity over time through various means including punctuated (Gupta, Smith, and Shalley, 2006; Siggelkow *et al.*, 2003) and dynamic equilibriums (Knight and Paroutis, 2017), there are calls for a more explicit incorporation of a temporal perspective; an area where our knowledge is still limited (Kunisch *et al.*, 2017; O'Reilly and Tushman, 2013). Further, there is emerging understanding that culture may be positively related to performance if it emphasizes adaptability, a key facet of ambidextrous organizations (Chatman *et al.*, 2014). As O'Reilly and Tushman (2013:332) note, "organizational culture ... may be an important strategic capability in hosting ambidextrous designs over time". Yet so far, there is a paucity of studies on how culture may be related to organizational ambidexterity. Therefore, in this paper we adopt a cultural lens (Barney, 1986; Giorgi, Lockwood, and Glynn, 2015; Pettigrew, 1979) to examine how subcultures may emerge and interact, via their practices, with the dominant organization culture over time to foster ambidexterity.

Organizational culture has been a central focus in the management literature since the 1970s (Barney, 1986; Pettigrew, 1985); notable early works include Van Maanen's (1975) ethnography of a police department, Barley's (1983) ethnosemantic study of a funeral home, and Schein's (1985) influential book on organizational culture and leadership. Recently, scholars have renewed calls for further research into cultural processes and practices (Giorgi *et al.*, 2015; Suddaby *et al.*, 2010). Giorgi *et al.* (2015) concluded that although scholars have investigated cognitive processes or strategic decisions related to culture, we need further research to better understand the practices through which culture is enacted and relates to organizational outcomes.

In strategic management studies, organizational culture typically has been depicted as a single, homogenous, firm-level entity; yet some scholars have highlighted the importance of subcultures that coexist, often in tension with the dominant culture, underneath the surface (Jermier, Slocum and Fry, 1991; Sackmann, 1992). Aspects of these subcultures (e.g., values, stories, frames, and the practices used to enact cultural characteristics) typically deviate from the dominant organizational culture (Giorgi *et al.*, 2015). As scholars involved in the practice turn of social science and its implementation in strategic management research have revealed (Burgelman *et al.*, 2018; Paroutis *et al.*, 2013; Reckwitz, 2002; Schatzki *et al.*, 2001), the minutiae of these subcultures, that are both embedded in as well as in tension with the dominant organizational culture, may have substantial influences on the wider organization (Snow, 1999; Whittington, 2007). Exploring the role and significance of such subcultures and their practices at the organizational level is important, because doing so could yield a more holistic explanation of how they influence an organization's evolution and contribute to specific strategic outcomes.

One such strategic outcome for incumbents is organizational ambidexterity, a concept that is receiving significant attention from both management scholars (e.g., Lavie, Stettner, and Tushman, 2010; Gibson *et al.*, 2004; Raisch and Birkinshaw, 2008) and practitioners (e.g., BCG, 2018; Capgemini Consulting, 2016). Central to the concept of ambidexterity is the notion of balancing exploration and exploitation activities, particularly in large incumbent firms confronted with rapidly changing markets and high levels of uncertainty (He and Wong, 2004; Jansen, Van Den Bosch, and Volberda, 2009; March, 1991). Strategy scholars have focused heavily on how incumbents deal with environmental change, since difficulties with adaptation usually result in decreased financial performance (e.g., Benner, 2010; Tripsas and Gavetti, 2000) and sometimes even organizational death (e.g., Devan, Millan, and Shirke, 2005; Louçã and Mendonça, 2002). Although organizational culture could be seen as an intangible resource for achieving ambidexterity (Hall, 1993;

O'Reilly *et al.*, 2013), few have examined its possible role. We aim to address these gaps by asking: *How can subcultures foster organizational ambidexterity via the practices through which they are enacted?*

Our interest in subcultures and their impacts arose inductively during an ethnographic study of NASA, a large, incumbent organization engaged in space exploration. NASA is characterized by particular stages in its evolution: the early years, when its priority was winning the space race and landing humans on the Moon; the 1980s, when its priority was developing the International Space Station; and more recently, when its focus has shifted to collaboration with private firms and the exploration of Mars (Heracleous *et al.*, 2018; forthcoming). NASA was a suitable setting for our study, as it is a large firm comprised of multiple locations/centers and many teams responsible for particular projects, thereby providing a context in which subcultures can emerge. We decided to focus our examination on the historic case of the Pirate project team; doing so enabled us to study how a subculture enacted five cultural elements – values, stories, frames, categories, and toolkits (Giorgi *et al.*, 2015) – through its practices. Some of these practices conflicted with the organizational culture and therefore created the need to develop a cultural capability, what we call *cultural oscillation*, to effectively manage these conflicts. Our data reveal practices that facilitated cultural oscillation, and by extension, organizational ambidexterity. This is in line with previous research that considers integrative capabilities, such as cultural oscillation, as an important enabler for organizational ambidexterity (Helfat and Campo-Rembado, 2010; Helfat *et al.*, 2011). Cultural oscillation can result in two effects based on the stage of the subculture's lifecycle: a direct effect with immediate impacts during the growth and maturity stages, and a residual effect that unfolds over time during the subculture's decline, even after it ceases to exist. These findings enable new insights for our understanding of processual dynamics at the team level that enable strategic change to emerge at the organizational level.

4.2 Theoretical background

4.2.1 *Incumbents and ambidexterity*

Previous research shows that incumbent firms, with few exceptions (cf. Ansari and Krop, 2012; Hill and Rothaermel, 2003), face strategic challenges and decreasing performance, especially in the context of rapid technological change (e.g., Benner, 2010; Tripsas *et al.*, 2000). Previous studies have offered several explanations for incumbents' struggles to deal with change (Bettis and Prahalad, 1986; Leonard-Barton, 1992; Sorensen and Stuart, 2000). Yet some incumbent firms have managed to adapt successfully over many decades. For example, an incumbent in the typesetter industry survived three technological evolutions during a period of over 100 years (Tripsas, 1997). Strategy scholars have had a long-standing interest in examining the precise mechanisms that enable such adaptation. One such mechanism is ambidexterity, defined as the ability to innovate through both exploitation (e.g., process optimization) and exploration (e.g., new product development) to address significant changes in the internal and external environment (O'Reilly and Tushman, 2008).

Ambidexterity seems especially suitable for incumbent organizations, because it enables them to adhere to their original focus and strategy while allocating some resources to novel endeavors to gain experience, learn how to address challenges, and eventually find ways to implement changes sustainably and on a large-scale at the organizational level (March, 1991). Scholars have examined the link between organizational ambidexterity and firm performance (e.g., Jansen, Simsek, and Cao, 2012; Wassmer, Li, and Madhok, 2017) and identified several processes and practices used to manage competing tensions and conflicts (Papachroni *et al.*, 2015): *structural ambidexterity* involves spatial separation between explorative and exploitative organizational units (Duncan, 1976; Tushman *et al.*, 1996); *sequential ambidexterity* involves a shift in organizational alignment either towards exploitation or exploration at any given point in time, depending on its needs (Duncan, 1976; Siggelkow *et al.*, 2003; Tushman *et al.*, 1985); and *contextual ambidexterity* involves providing support for opposing business goals through the temporal separation of tasks, but at the

individual level as opposed to the organizational level (Ghoshal and Bartlett, 1994; Gibson *et al.*, 2004; Papachroni *et al.*, 2015).

Scholars have argued that within the contextual ambidexterity approach, the ability to align and adapt is a function of the firm's organizational culture (Gibson *et al.*, 2004; Khazanchi, Lewis, and Boyer, 2007; Simsek *et al.*, 2009; Tushman *et al.*, 1996; Wang and Rafiq, 2014). In contextually ambidextrous units, individuals would be allowed to make their own decisions about how to allocate their time and other resources between exploitation and exploration. Expanding this line of thinking, Simsek *et al.* (2009) created a typology of ambidexterity by theoretically grounding it in organizational culture. Empirical evidence shows that when implemented through individual involvement and participation, an organizational culture can have a positive, bottom-up effect on ambidexterity and new product innovation (Wang *et al.*, 2014).

4.2.2 Ambidexterity, culture, and subcultures

We employ Schein's (1985, 1996) conceptualization that culture can be thought of as a pattern of basic assumptions that underlie values and eventually artifacts, which become observable through practices. At the intersection of organizational ambidexterity and culture, Khazanchi *et al.* (2007) examined paradoxical organizational values and their implications for creativity and control. Their results suggest that values related to flexibility positively impact creativity and create a culture of experimentation and empowerment, while values related to control may be perceived as inhibiting exploration, but spurring efficiency and implementation. Similarly, Chatman *et al.* (2014) provided empirical evidence for a positive association of organizational performance and a strong culture that promotes adaptability through norms, even in times of frequent and radical change.

Although these studies show that culture is integral to the pursuit of ambidexterity, our understanding of the processes through which firms can employ organizational culture in the pursuit of ambidexterity remains limited for a number of reasons. First, scholars traditionally view contextual

ambidexterity as an individual-level phenomenon, even though lower-level employees often cannot make resource allocation or investment decisions, and may not have the technical and managerial capabilities or authority to do so (O'Reilly *et al.*, 2013). Second, only certain aspects of culture, such as organizational values (Kang and Snell, 2009) or organizational norms (Chatman *et al.*, 2014), have been linked with ambidexterity so far. As a consequence, researchers have not taken a fine-grained view of how different “faces of culture” (Giorgi *et al.*, 2015) influence organizational ambidexterity or associated practices, which would require a nuanced understanding of myriad underlying micro activities (Johnson *et al.*, 2003). Third, using subcultures as the unit of analysis could facilitate a better understanding of how large incumbent firms manage their co-existence (Sackmann, 1992).

Moreover, subcultures are likely to cause conflicts because they challenge and modify the overall organizational culture (Jermier *et al.*, 1991). Organizational subcultures may form for many reasons, such as personal characteristics and experiences, social histories, and departmental allocation (Jermier *et al.*, 1991). They may be independent from the overall organizational culture and may even have a stronger influence on employee commitment, if the organizational culture is not well articulated and practiced (Brewer, 1993). For example, findings show that subcultures influence employee motivation to transfer learning (Egan, 2008), and that innovative and supportive subcultures increase employee commitment, and hence overall organizational performance (Krausz *et al.*, 1995; Lok and Crawford, 1999). Thus, subcultures likely influence organizational ambidexterity because they provide a mechanism to operationalize the extent to which an organizational culture is tight or loose (Danneels, 2003), and facilitate appropriate variation within business units, functions, and/or teams to balance exploration and exploitation (Tushman *et al.*, 1996).

Using subcultures as our unit of analysis also responds to calls for this kind of research (Suddaby *et al.*, 2010). Consistent with our focus on the practices used to enact a (sub)culture (Smircich, 1983), we focus on how

observable activities and artifacts (Reckwitz, 2002; Schatzki *et al.*, 2001; Whittington, 2006) facilitate organizational ambidexterity. Our longitudinal in-depth case study of the Pirates within NASA, a large, incumbent organization, is based on the following research question: *How can subcultures foster organizational ambidexterity via the practices through which they are enacted?* Answering this question is important, since incumbent firms typically have different subcultures with different capacities to cope with environmental changes (Benner, 2010; Tripsas *et al.*, 2000). Moreover, subcultures may have positive effects, given empirical evidence of the relationship between ambidexterity and performance (He *et al.*, 2004).

4.3 Method

Our interest in the Pirates emerged inductively while collecting data for our in-depth case study at NASA after several interviewees independently described the distinctiveness of the subculture. We were intrigued that NASA's Johnson Space Center would have allowed a subculture with practices and cultural characteristics that differed so starkly from the dominant organizational culture to exist. After identifying former Pirates and their team leader, as well as organizational members not associated with the team, we conducted semi-structured interviews and collected supplementary archival data. These activities were part of a larger data collection effort between 2016 and 2019 at the JSC in Houston, Texas. We took an inductive approach to the research project, enabling themes to emerge before iterating between data and theory (Eisenhardt, 1989a), while acknowledging that some theoretical pre-knowledge is beneficial for further data collection and interpretation (Strauss 1987; Strauss *et al.*, 1998; Van Maanen *et al.*, 2007). Adopting an in-depth case study approach enabled us to gain a deep understanding of the Pirates' subculture, including their enacted cultural characteristics, associated practices, and ultimately, a corresponding cultural capability. Our methodology thus enabled us to uncover the complex social themes and phenomena at the subculture and

organization levels in a holistic and meaningful way (Eisenhardt, 1989a; Schein, 1985; Yin, 2009) beyond mere observable characteristics.

4.3.1 Research context

NASA is a large, incumbent organization traditionally comprised of different subcultures, thus making it an interesting and appropriate setting for our research. Since its founding approximately 60 years ago in October 1958, NASA has evolved its business model (Heracleous *et al.*, 2018; forthcoming) and achieved accomplishments such as landing astronauts on the Moon, creating the International Space Station and exploring the solar system using the Hubble Space Telescope and other orbital spacecrafts (Wilson, 2018). However, the golden age of the space race in the 1960s when NASA had access to seemingly unlimited resources ended long ago. Since the Apollo era, funding has decreased from 4.5 percent to less than 0.5 percent of the U.S. federal budget while missions have grown more ambitious (e.g., a manned journey to Mars). Under these competing pressures to become more efficient and more innovative, the organization has moved from a hierarchical closed system to an open network system characterized by international and commercial collaboration, as well as open innovation (Lifshitz-Assaf, 2017). NASA's adaptation over time cannot be attributed to a single organizational leader. Rather, gaining inspiration by what NASA seeks to accomplish (Carton, 2017), several champions and teams have emerged to advance corresponding initiatives and challenged traditional practices over the last 60 years (Heracleous *et al.*, 2018; forthcoming). The Pirate team is one such example of a group of individuals who implemented practices that fostered ambidexterity at the organizational level, thereby creating both direct and residual effects.

Originally part of JSC's Mission Operations Directorate, and later the Engineering Directorate, the Pirate team was established in 1986 and was operational until 2002 when it was disbanded mainly due to resource considerations. During its existence, the team challenged the organizational cultures of the two directorates after the Challenger disaster. The loss of this

shuttle orbiter during mission STS-51-L in January 1986 had profound effects on the U.S. space program and NASA's culture (NASA, 2003). As a direct consequence of the Challenger disaster, NASA was tasked with implementing the recommendations of the Presidential Commission throughout the entire organization. These included additional control mechanisms, such as an "Independent Oversight Group," a "Safety Panel," and a brand new safety organization called the "Safety, Reliability, and Quality Assurance Office"; additional procedural steps; and an increased number of quality reviews, milestones, requirements, and policies (NASA, 1986). In short, NASA introduced more bureaucracy and complexity in an attempt to avoid future accidents (McCurdy, 1993). Meanwhile, the budget- and schedule-related pressures that had led to the Challenger accident continued to persist, and perhaps even strengthened as a result of international collaboration and interdependencies related to the development and assembly of the International Space Station.

It became clear that NASA had to change to master the complex challenges ahead through increased resource efficiency and radical innovations. However, this proved difficult; like most large incumbents, NASA and the JSC were heavily path dependent and were not willing to take any risks in the wake of the Challenger disaster (Bruggeman, 2002). In response, a few young systems engineers and flight controllers circumvented the organization and secured small research grants to develop new technologies (e.g., a real-time telemetry model). The subculture they developed over time and the practices by which they enacted it often sharply contrasted with the organizational culture of their directorate, as evidenced by their motto "build a little, test a little, and fix a little" and their self-given name, "the Pirates" (interview data). Over time, the subculture received top leadership support and was tasked with (a) developing a new control center for the shuttle missions based on distributed computing technology, and (b) building a new spacecraft. The result was ambidexterity and a cultural capability to manage paradoxical tensions.

The cultural change instigated by the Pirates had direct effects that were observable immediately, as well residual effects that unfolded over time and remain observable to this day, over 15 years after the team's dissolution. Our case study therefore constitutes an apt example of the sustainable operationalization of ambidexterity based on cultural capabilities. Our findings provide interesting insights for incumbent organizations in need of organizational change by revealing how they may be able to use existing subcultures or create an environment for new subcultures to emerge that help them pursue organizational ambidexterity via practices that foster cultural oscillation.

4.3.2 Data collection and data analysis

The fieldwork for this project began in August 2016 and ended in April 2019. We performed 70 interviews, which were audio-recorded and transcribed. Additionally, we documented more than 300 pages of observational notes during formal and informal meetings, and collected more than 1500 pages of archival and current documents, such as reports, strategic plans, and presentations. The complete data set offers insights into the contexts in which the Pirates operated before, during, and after the team's existence and provides an opportunity to compare and contrast their subculture with the overall organization culture (see Table 4.1), thus enabling data triangulation. We drew especially from a subset of 20 interviews, which we conducted in two rounds with members of the Pirates and other informants who were closely associated with the subculture at the time. During the first round, we conducted 13 interviews with an average duration of 69 minutes; our aim was to let interesting themes emerge without attempting to lead the interviewees in a particular direction. During the second round, we conducted an additional seven interviews with a subset of the original interviewees, with an average duration of 63 minutes. In this second round, we explored the preliminary categories we had developed based on the first round of data collection and analysis. This enabled us to respect the double hermeneutic of social science, which implies

that researchers' second-order interpretations should be aligned as much as possible with actors' first-order interpretations (Giddens, 1984; Hatch *et al.*, 2008). NASA also provided artifacts, both physical (e.g., pins, badges, flags) and digital (e.g., logos, code of conduct, pictures, articles, project documentation).

Employing Langley's (1999) strategies for analyzing process data, we developed a timeline of key events that shaped the organization's culture and the Pirates' subculture before, during, and after the Pirate team existed (see Appendix C2). We then temporally bracketed the history of the Pirates based on a major shift in work focus, and divided the case study into two narratives aligned with the two projects: the mission control center and the new spacecraft. Employing grounded theory in an inductive manner led to the gradual emergence of themes from our first round of interviews (Strauss, 1987; Strauss *et al.*, 1998). As is typical in qualitative research, some themes such as *organizational culture* emerged early in the data collection process (e.g., in research memos written after conducting the interviews and observing meetings) (Langley, 1999; Lincoln and Guba, 1985). Nevertheless, we engaged in open coding to remain faithful to informants' terms and to ensure that we did not limit our analysis in any way, thus remaining open to any themes (Charmaz, 2006). As we iterated between our preliminary codes and the existing literature (Van Maanen *et al.*, 2007), we found Giorgi *et al.*'s (2015) five faces of culture to be a suitable framework to guide our analysis of the Pirates' subculture and contrast it with the organizational culture before and after the Pirates existed (see Table 4.1).

In a corresponding second round of selective coding (Corbin *et al.*, 1990; 2008) we looked for specific data related to organizational culture that would enable us to identify the practices by which the Pirates enacted their subculture; some practices were problematic, as they directly contrasted with the organizational culture (see Table 4.2). Our axial codes informed the development of two empirical models (see Tables 4.3 and 4.4) during a doubly iterative process by which we moved from our data to emerging themes, and

from the literature to potential concepts (Gioia, Corley, and Hamilton, 2013). We arrived at our two models and their aggregated constructs by grouping and aligning our axial codes informed by relevant literature. During this stage, Helfat *et al.*'s (2003) work on capability lifecycles as well as Hall's (1993) framework for linking intangible resources and capabilities to sustainable competitive advantages proved especially useful. We used their reasoning to underpin our own theorizing, which is summarized in our empirically grounded models on cultural oscillation and subculture lifecycle management (see Figures 4.1 and 4.2). We then conducted the second round of our interviews, coded their transcripts, and continued to analyze archival data (Carton, 2017; Suddaby and Greenwood, 2005) until we reached theoretical saturation (Glaser *et al.*, 2008).

Finally, we re-employed Langley's (1999) strategies for analyzing qualitative data and drew from the quantification strategies she summarized in her 1999 review. Specifically, we found the approach that she pointed out by Van de Ven and Poole (1990) useful. Their methods for analyzing data from the Minnesota Innovation Research Project offered a structured yet nuanced way of coding that helped us tease out the differences between JSC's organizational culture, the Pirate subculture as well as the resulting oscillated culture over time. While we did not simply follow the seven suggested steps of analysis mechanically, we drew from their underlying idea and adjusted them as needed. In this vein, we used Kang and Snell's (2009) original framework and Turner *et al.*'s (2013) more recent extension of it as a structure to operationalize and characterize ambidexterity's opposing demands in terms of human, social and organizational configurations. Following Van de Ven *et al.*'s (1990) basic approach, we then listed and coded our data in relation to the extreme predetermined characteristics of exploration and exploitation in order to produce a quantitative time series. We assigned positive numbers to exploitative characteristics and negative numbers to explorative characteristics. Their sums resulted in the curve portrayed in Figure 4.1. Moreover, this led us to the direct effects of cultural oscillation when the Pirate team was active, and

residual effects after it was disbanded (e.g. during the Mission Control Center upgrade for the 21st century MCC-21 between 2012 and 2014). By iterating between our empirical analyses and prior research, we were able to theorize how organizational subcultures influence organizational ambidexterity across their capability lifecycle (see Figure 4.2).

4.4 Analysis and findings

In this section, we outline the context in which the Pirate subculture emerged in 1986. Then we discuss how five cultural characteristics (values, stories, frames, categories, and toolkits) of the Pirate subculture and of the dominant organizational culture were enacted, as well as what we call the “oscillated” organizational culture after the Pirate team was disbanded in 2002 (Table 4.1). We show how the distance between the organizational culture and the Pirate subculture was reduced over time, as both cultures gradually shifted towards an ambidextrous equilibrium (Figure 4.1). These shifts resulted from the process of cultural oscillation that occurred at the intersections of different sets of practices. We also identify practices of the Pirate subculture (contrasting, amplifying, reframing, labeling, and rewarding conformity) that fostered generative tensions and cultural oscillation with the dominant organizational culture (Table 4.2). We proceed to identify four types of practices at points of intersection between the organizational and Pirate cultures that are implicated in cultural oscillation, and offer illustrations of each (Table 4.3). Finally, we identify a lifecycle of subcultures (Table 4.4) and locate the process of cultural oscillation within it (Figure 4.2).

4.4.1 Context of the emergence of the Pirate subculture

When the agency was established in the 1960s, NASA’s culture was characterized by a “can-do” attitude, nimble processes, and an openness to experimentation and failure (Bruggeman, 2002). At the time, the agency had the freedom to operate outside civil service pay scales and enjoyed less process-

oriented regulatory oversight than in later stages of its existence. Former Space Shuttle Program Manager Wayne Hale (2010) explained:

In the beginning, NASA was full of young, cocky, innovative, hard-charging folks who got us [the United States] to the Moon inside a decade. They were brash, confident, and did not suffer fools gladly. If they were worried, they didn't show it...Their theme—as posted on the factory walls—was “waste anything but time”. Going to the Moon was the cliché for doing the impossible and they [NASA engineers] were going to be the ones to do it.

When it was founded in 1958, NASA was a relatively small organization with 8,000 employees, an annual budget of \$100 million, three research facilities and two smaller test facilities (Garber and Launius, 2005). Things changed dramatically on May 25, 1961, when President Kennedy, at the height of the cold war, announced the goal of landing a man on the Moon before the end of the decade. Shortly after his speech, NASA's budget was increased by 89 percent; the following year, it was increased again by an additional 101 percent (NASA, 2017b). The organization grew larger and more complex, formal procedures were implemented gradually, and centralization in Washington increased (McCurdy, 1993). Despite rapid growth and bureaucratization, the superordinate goal of the Apollo program facilitated cross-functional integration and quick action (NASA, a).

After the first Moon landing in 1969, however, public and political interest in the Apollo program began to wane (NASA, 2017c) and annual budgets were cut steadily. NASA's annual budget, totaling over \$5 billion in the mid-1960s, dropped to \$2 billion by 1969, even though manned flights to the Moon continued until 1972 and new challenging programs such as Skylab and the unmanned Voyager mission to Mars were under way (NASA, b). In the context of shrinking budgets but expanding missions, President Nixon (1972) approved the development of a reusable, low-cost space shuttle system that would “take the astronomical costs out of astronautics”. During their 24 subsequent missions, the space shuttles Columbia, Discovery, Atlantis, and Challenger transported a variety of payloads, served as orbital laboratories and

platforms to erect large structures in space such as the International Space Station and the Hubble telescope, and retrieved orbiting satellites for repair (Presidential Commission, 1986).

Two fatal space shuttle accidents—Challenger in 1986 and Columbia in 2003—had significant impacts on the agency (Garber *et al.*, 2005; O’Connor, 2009). The Presidential Commission’s report on the Challenger accident revealed that safety concerns often were overruled due to budget constraints and schedule pressures; moreover, because NASA routinely engaged in the normalization of deviance (Vaughan, 1996), problems with the shuttle’s O-rings were interpreted as not posing a significant risk (Presidential Commission, 1986). The Challenger accident prompted Congress to implement additional control mechanisms and to establish independent oversight bodies; further analyses, tests, and process steps had to be implemented within 30 days (NASA, 1986). These changes significantly increased bureaucratization and risk aversion at NASA.

Mere months after the Challenger accident in 1986, the founding members of the Pirate team decided that NASA needed a new mission control system based on the emerging distributed computing paradigm rather than the huge mainframe computers in use at the time, which the Pirates saw as unwieldy and unable to handle the real-time data analysis required for missions. Based on, what can be considered, their dynamic managerial cognition, they sensed the technological opportunities and wanted to seize them (Helfat *et al.*, 2015; Teece, 2007). Through their shared values and practices, the Pirates began to challenge NASA’s new culture characterized by higher risk aversion, religious process conformity, and bureaucratic micro-management. From early numbers in the single digits, the Pirate team grew to more than 700 members by 1992. Battling strong political resistance, the Pirates successfully delivered the new mission control center on time, at a lower cost than thought possible, and with significantly enhanced technical capabilities. During an interview, James (pseudonym), the leader of the Pirate team, explained that their way of working yielded results much faster than the established, process-oriented way: “In 24

months, we got everything except the trajectory [calculations] out of the mainframe complex. It took them [after the Pirates had left] another three, four years to only get the trajectory part out.”

The Pirate team was recognized by Vice President Al Gore in 1994 with the Hammer Award for its innovative approach to developing the new mission control center and associated savings of \$74 million in development costs and an additional \$22 million in recurring annual costs (NASA, 1994). After their success with the shuttle mission control project, the Pirates were entrusted with the creation of a new spacecraft after several other teams had been unsuccessful. Even though the spacecraft project was meeting requirements in terms of cost, quality, and time, it was cancelled in 2002 due to budget constraints.

4.4.2 The Pirate subculture and its practices

The Pirate subculture was defined by values (e.g., taking initiative, engaging in rapid experimentation, minimizing documentation, breaking the rules) that explicitly challenged the dominant culture. While the broader organizational culture was focused on safety, standardization, process orientation, and avoiding failure, the Pirate culture was geared toward innovation, exploration, and pushing the limits. The Pirates consciously differentiated themselves:

We made a very conscious effort to communicate what our values were and to talk about it...We used symbology and other things to communicate to people what we were about. We used buttons and pins and we had a lot of all-hands [meetings], and we talked about the culture and what we wanted to achieve in it...We always made sure that our milestones were up (on the walls) and visible (to everyone)...And as we accomplished those milestones, there was a celebration for that. It was very visible what we were expected to achieve and what the goals were, and it was all a team effort like that. (Pirate Change Manager)

In Table 4.1, we employ Giorgi *et al.*'s (2015) five cultural characteristics of values, stories, frames, categories, and toolkits to structure our analysis of the Pirates' practices and juxtapose them against the practices of the

dominant organizational culture. Doing so reveals the oscillation process between the Pirate subculture and the broader organizational culture.

Figure 4.1 illustrates the cultural distance between the Pirate subculture and the wider organizational culture. When the Pirate team was established, the two were almost diametrically opposed (Arrow 1). Over time, as some aspects of the Pirates' approach permeated the wider organizational culture, and as the Pirates amended some of their practices, the distance narrowed (Arrow 2). Arrow 3 depicts the oscillated culture after the Pirate team was disbanded, and subsequent residual effects; for example, the development of the MCC-21 drew from earlier learning produced by the Pirate team.

Table 4.1. Contrasting the organizational culture prior to the Pirates with the Pirate subculture and the oscillated culture post-Pirates

Cultural characteristic	Organizational culture (1986–1992)	Pirate subculture (1986–2002)	Oscillated organizational culture during MCC-21 (2012 and beyond)
Values: what we prefer, hold dear, or desire	<ul style="list-style-type: none"> • Risk-averse culture and linear model of project management: analysis, planning, execution, and control, with sequential steps and a focus on milestones and review points with little to no option to deviate according to the credo “follow the process” • Organizational silos due to task specialization during development cycles between developers and end users • Reliance on proprietary technologies invented “inside the fence”; almost no use of third-party commercially available products 	<p>“Pirate Paradigm” comprised of 13 values including:</p> <ul style="list-style-type: none"> • Do not wait to be told to do something, figure it out for yourself • Challenge everything, and steel yourself for the inevitable cynicism, opposition, rumors, false reporting, innuendos, and slander • Break the rules, not the law. Take risks as a rule not as the exception • Cut out unnecessary timelines, schedules, processes, reviews and bureaucracy • Just get started, fix problems as you go along • Build a product, not an organization. Outsource as much as possible 	<ul style="list-style-type: none"> • Holistic paradigm shift toward being lean, agile, and adaptive to change by responding quickly and effectively while operating more efficiently • “Creating a more customer focused environment” by including the end user early • Partnerships to jointly develop NASA and third-party technologies
Stories: verbal or written narratives with causally linked sequences of events that have a beginning, a middle, and an	<ul style="list-style-type: none"> • Stories about how space pioneers “did the impossible” in the aftermath of Kennedy’s “Moon, man, decade” speech. These showcased NASA’s technology leadership and emphasized national silos due to cold war thinking • Stories about the mission control center during the Apollo days (e.g., the Apollo 	<ul style="list-style-type: none"> • Pirate success stories about particular projects in which Pirate values and practices were seen as superior to dominant organizational values and practices • Stories about the Pirates’ charismatic leader, who former team members often compared to Steve Jobs. He called for 	<ul style="list-style-type: none"> • Story of RISE (Revolutionize ISS for Science and Exploration) as an example of increased speed and agility. Schedule compression was achieved through redesigned procedures, tools and reward systems, and a reorientation toward customers

end	I fire, and the “failure is not an option” creed of the flight operators that permeated all supporting departments)	excellence, empowerment, and proactivity, and rewarded risk taking and innovation, all of which were keys to the emergence and growth of the Pirate subculture	<ul style="list-style-type: none"> • Story of the ISS Class 1E payload development process that streamlined the certification for flight hardware for ISS following an agile and lean development approach
Frames: filters or boundaries that delimit what is paid attention to	<ul style="list-style-type: none"> • NASA’s win of the space race during the Apollo era was still deeply engrained in the agency’s thinking at that time, and led to the preservation of traditional ways of working in terms of processes and technologies so as to minimize risk, even though process and technology innovations were available • The loss of the Challenger spacecraft and its implications for NASA, with a renewed emphasis on safety, process conformity, and micro management 	<ul style="list-style-type: none"> • Frequent and direct leadership communication framing Pirate successes and failures, and communication focused on motivating and moving the team forward • Dividing the project plan into “mini-milestones” to focus the team on the most pressing issues and frequently celebrating milestone achievements to maintain morale 	<ul style="list-style-type: none"> • JSC’s strategic implementation plan and “JSC 2.0” initiative have focused on commercial space partnership support, more partnerships, and third-party collaboration, as well as a balance of innovation and efficiency • Agency-wide technical capability assessments from 2012 onwards have required the JSC to excel in its activities related to human space flight. Cutting-edge upgrades to the mission control center emphasized the need for U.S. global leadership in space exploration
Categories: social constructions or	<ul style="list-style-type: none"> • Strong differentiation between the user community of the mission control room, (i.e., flight controllers), and the developer community. “They [the 	<ul style="list-style-type: none"> • Constructing linguistic barriers by using the pronoun “we” to refer to the Pirates and “they” to refer to outsiders • Creating cross-functional teams (e.g., by 	<ul style="list-style-type: none"> • Reduction of visual cues that differentiated agency employees from external contractors (e.g., on badges) to facilitate collaboration across

classifications that define and structure the conceptual distinctions between objects, people, and practices

developers] were trying to be like a Steve Jobs, thinking: ‘We understand better what they [the users] want,’ and they would go and do it”

- Strong differentiation between agency employees and civil servants through visual cues e.g. on badges, creating an “us vs. them” categorization

bringing the users and the developers together for joint project work)

- Visual differentiation of Pirates through heavy branding of artifacts (e.g., documents, jackets, patches) with bespoke logos and images

organizational borders; “us vs. them” categorization weakened

- Creation of cross-functional teams at the outset of new projects with close collaboration and co-creation (e.g., of new hardware and software), indicating transfer of learning from the Pirate subculture

Toolkits: sets or “grab bags” of stories, frames, categories, rituals, and practices that actors draw upon to make meaning or take action

- Large systems engineering principles imported from the military. Authority and direction flowed from headquarters to program offices to projects across field centers
- Use of the waterfall development model as the primary methodology for project management, including the development of new technology

- Constant adjustment of plans and their execution based on frequent iterations and an adaptive mindset; also referred to as “fast fail approach”
- End users (flight controllers) were brought in early to work side by side with developers to refine their requirements, support developments, and enable the immediate testing of the system
- In addition to agency and center awards, special “Pirate awards” in line with the Pirate paradigm presented during ceremonies
- Functional clusters of the Pirate team, such as “telecommunications systems” or “platforms and systems services” personalized the Pirate logo without deviating much from the original design to ensure consistency

- Guidelines from the JSC Center Director for “adopting commercial best practices such as rapid prototyping, lean development, etc.”
- Facilities for “new ways of working” such as the “sandbox” for rapid prototyping, and specific areas designed to facilitate collaboration within and across internal teams, as well as with external contractors and third-party technology providers
- Use of the “systematic intelligent fast failure” (SIFF) methodology or similar approaches for development and testing

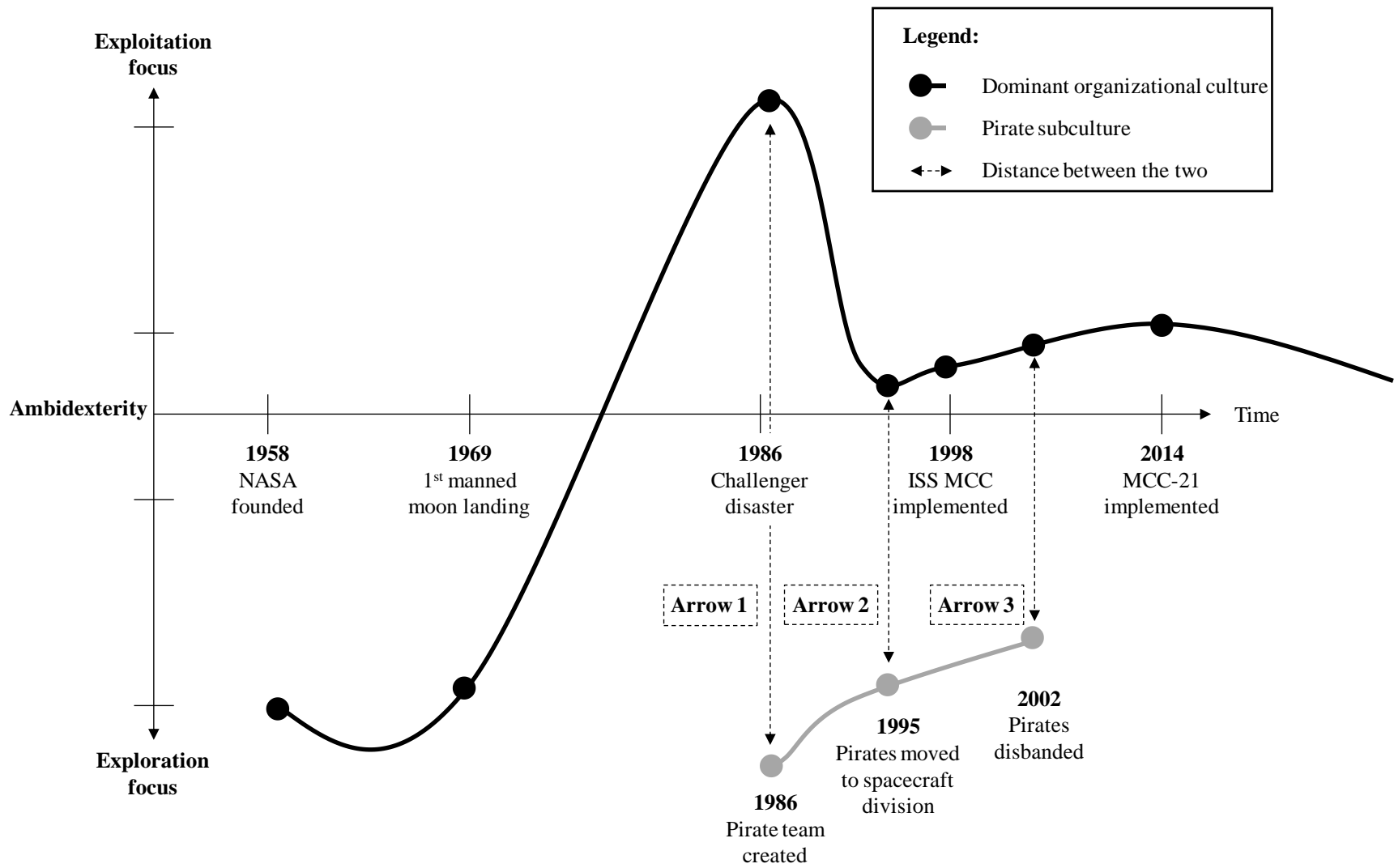


Figure 4.1. Stages of the cultural oscillation process of the Pirate subculture over time

4.4.3 Subculture practices: Enacting culture to develop a cultural capability

Table 4.2 provides an overview of practices that enacted the Pirates’ cultural characteristics. It focuses on the differences, between the Pirate subculture and the organizational culture, that produced generative tensions. These thereby facilitated the emergence of a cultural capability – namely, cultural oscillation.

Table 4.2: Enacting the Pirates’ subculture in practice with strong potential for conflict

Cultural characteristic	Related practices of the Pirates’ subculture
Values: what we prefer, hold dear, or desire	Contrasting: by using linguistic tools, such as juxtapositions, the Pirates differentiated their subculture from the organizational culture and made their own values transparent.
Stories: verbal or written narratives with causally linked sequences of events that have a beginning, a middle, and an end	Amplifying: the success stories were narrated with pride on multiple occasions by the entire Pirate team. This occurred in formal and informal settings to establish the superiority of the Pirates and to clearly differentiate the team from the rest of NASA.
Frames: filters or boundaries that delimit what is paid attention to	Reframing: the Pirates’ leadership team used town hall meetings to provide additional information beyond NASA’s organizational communiqués. They reframed NASA’s narratives to support their objectives. Because leaders shared “insider” information with the entire Pirate organization, members felt more knowledgeable compared to the wider NASA organization.
Categories: social constructions or classifications that define and structure the conceptual distinctions between objects, people, and practices	Branding and labeling: by distributing branded artifacts exclusively to members of the Pirate team, explicitly infusing them with meaning, and prominently showcasing them, leaders were able to establish visible boundaries between the subculture and the wider organization. In addition, the team clearly marked documents with the Pirate logo as a type of quality certification (i.e., “Made by Pirates”). Finally, a clear differentiation in the language of the Pirates enacted the subculture and its perceived superiority further.

Toolkits: sets or “grab bags” of stories, frames, categories, rituals, and practices that actors draw upon to make meaning or take action

Rewarding conformity: specially developed awards were given to Pirates who had exceeded expectations according to the Pirate paradigm (e.g., for the best/fastest failure). These awards were unique within NASA and presented to recipients during memorable ceremonies, which already contrasted, with NASA’s way of doing things; these lavish events opposed NASA’s “matter-of-fact” style.

One illustration of the contrast between the values of the Pirate subculture and those of the organizational culture becomes apparent in the “Pirate Paradigm”, which was explicitly drafted to counter the heightened conservatism and risk avoidance that dominated NASA immediately after the Challenger disaster in January 1986. The focus on internally developed technologies led to long development times, high costs, and an unwillingness to replace incumbent technologies that worked. Although the creed “failure is not an option”, attributed to legendary flight controller Eugene Kranz (1999), was seemingly incompatible with the Pirates’ fast failure and incremental improvement approach, Kranz understood its value and was a key political sponsor of the team.

The Pirate Paradigm was visibly displayed on posters in any rooms where Pirates worked. The 13 values constituting the paradigm were not only inconsistent, but in some cases diametrically opposed to the values of the dominant culture, such as “Cut out unnecessary timelines, schedules, processes, reviews and bureaucracy”, or “Build a product, not an organization. Outsource as much as possible” (internal document). The Pirates’ values advocated the use of third-party products that could help to reduce costs, enhance reliability, and shorten development cycles. The Pirates’ new shuttle mission control system based on distributed computing technologies, commercially available hardware, and their own code was displayed in the mission control room alongside the incumbent system, and its superior functionality slowly won over the operators.

A second illustration of the Pirates’ subculture practices concerns categories. The Pirates designed a variety of physical artifacts (badges, pins, t-shirts, jackets, logos) to symbolize their team’s way of operating and to build

group identity. They wore and displayed these symbols with pride. This resulted in the drawing of boundaries between them and the rest of the organization, creating an “us vs. them” or “insiders vs. outsiders” contrast. Some Pirates felt a sense of superiority and did not readily share information with outsiders. This categorization created tensions between the Pirates and other organizational members who felt “left out” and believed “that they [the Pirates] did not have to play by the same rules as the rest” (outside observer from the Engineering Directorate). Political opposition was inevitable and process constraints were placed on the Pirates.

4.4.4 Cultural oscillation of organizational and subculture practices

Because the Pirates worked on projects that were related to a number of broader stakeholders and users, it was not possible for the Pirate subculture and the broader organizational culture to remain separate; interaction was necessary. Through interaction, and a capability we label *cultural oscillation*, the cultures moved closer to each other and advanced NASA toward an ambidextrous equilibrium. Our data reveal four broad types of practices associated with cultural oscillation. First, subcultures adopt the cornerstone practices of the dominant organizational culture at points of contact—that is, when different groups must work together, such as during final integrated testing for new technologies. Subcultures adopt (and often adapt) these cornerstone practices, moving them closer to the dominant culture. Second, subcultures engage in practices that are not complementary with the dominant culture’s practices (e.g., the Pirates’ engagement in rapid parallel development and testing via modularization). Subcultures can continue to engage in such practices, but they may be constrained and adapted at points of contact with the dominant organizational culture (e.g., the development of the new mission control software). When the incompatible practices meet, the dominant culture, in what can be likened to an immune response, rejects these practices. Subcultures’ practices, however can continue in other contexts, and even be transferred across the organization as members join other groups. Third, subcultures

engage in practices that complement and/or are readily accepted by the dominant culture (e.g., the development and use of shared platforms across work groups). Since these practices do not activate the immune response of the organizational culture, other groups may adopt them, and they may be transferred across the organization as members join other groups. Fourth, practices within a subculture (e.g., the definition and celebration of mini milestones) may be adopted more broadly by other groups in the organization. Table 4.3 outlines these practices.

Table 4.3. Four practices implicated in cultural oscillation

Practices	Cultural oscillation capability via practices	Examples
<p>Cornerstone practices of the dominant culture shape both the dominant culture and subcultures</p>	<p>These practices are employed by subcultures and may be adapted to their requirements, especially if subcultures do not have alternative, complementary practices</p>	<p>Final integration and testing: Final integration tests have been fundamental to the functioning of the agency since its founding. The Pirates had to adhere to the overall schedule of any mission or program they were supporting. They had to deliver their components for the mission or program-wide tests, including the final integrated tests. These tests were conducted by following formal organizational practices and processes of the JSC Engineering Directorate; the Pirates followed similar procedures and fulfilled the same documentation requirements expected of any engineering team within the organization.</p>
<p>Non-complementary practices at the subculture level</p>	<p>Subculture-level practices may need to be adapted to match practices of the dominant organizational culture at the points of contact of different work groups, in the context of joint operations</p>	<p>Rapid parallel development and testing via modularization: The Pirates modularized their projects and granted control to the module teams. Teams could proceed with the development and testing of their modules at their own pace based on needs and resource availability, and not be constrained by the other modules. Synchronization took place at particular points in the process. This process however was seen as introducing too much risk into the overall mission control system that at times was slowed down due to the several applications being worked on, tested, and rolled-out in parallel. In addition, this method did not ensure that everyone in the mission control room could see the same data set at the same time due to ongoing testing and development. Because mission control decisions must be made under time pressure, the consequences were potentially fatal. Therefore, the Pirates had to restrict their rapid and distributed development and prototyping approach and implement a more formal process while maintaining a “Pirate spin” to it.</p>

<p>Subculture-level practices that complement, or are readily accepted by the organizational culture</p>	<p>Subculture-level practices may permeate the dominant organization culture without the need for adaptation</p>	<p>Developing and operating shared platforms across work groups: Prior to the formation of the Pirate team, flight controllers were only able to send their requirements to developers at a few pre-defined points in the process. The developers implemented and tested them, and then provided the final design to the flight controllers. The Pirates created a shared platform where the flight controllers (i.e., the end-users of the new control room), could input requirements, updates, and programs as well as participate in testing. This platform enabled flight controllers outside of the Pirate team to become proactively involved in the development process, leading to a jointly developed mission control system. Shared platforms became more common as Pirates moved to other groups and transferred their learning.</p>
<p>Subcultural practices enacted within and affecting only the subculture</p>	<p>If these practices are seen as desirable, they may be adopted at the broader organizational level</p>	<p>Defining and celebrating mini milestones: The Pirates divided the overall project plan into more detailed subprojects, or “mini milestones” to be accomplished within shorter periods of time. By working in brief sprints, they produced results (and failures) quickly, and celebrated and learned from them to maintain their motivation and momentum. This practice was subsequently adopted by other teams as the Pirate team grew and their practices became more visible.</p>

In our case, cultural oscillation via the first type of practice (i.e., the adoption of cornerstone practices at points of contact) involved documentation, a key cultural practice of the dominant organizational culture. From the outset, the Pirate group eschewed bureaucracy and procedures in favor of experimentation and bricolage. As James, the Pirate leader, put it:

I remember one point at which people brought me a whole bunch of paperwork to sign for the shuttle and I started tearing it up [laughs], and the organization was horrified, and I was like, “This isn’t important. This isn’t about us moving ahead. I’m tearing this up right now”. And the bigger organization pushed back on me for creating chaos.

According to the Pirate responsible for interface management in the mission control center, documentation practices at that time were minimal; he described doing “only what we had to...in order to satisfy all the outside stakeholders”. However, as the Pirate team grew, budgets increased, and work shifted to higher-profile projects (e.g., the design and construction of a new spacecraft), organizational pressure to adopt the dominant documentation requirements increased. The minimal amount of documentation that the Pirates had used to manage the knowledge obtained from their “fast failure” approach was not sufficient for NASA, as it lacked some required data, even though much of it remained similar over time. At that point, the team blended their original approach of incremental experimentation and learning (i.e., “build a little, test a little, and fix a little”) with the process requirements of the larger organization. The Pirates had to adapt their documentation practices by including the required information while avoiding bureaucracy as much as possible. The Pirate responsible for interface management continued:

So, if you go back through these documents, a lot of those things in the diagrams didn’t change, other than maybe a little bit of elements to it. The framework in those pieces was pretty much consistent and we just updated it incrementally...I wasn’t creating a whole new set of documents every time.

The result was a hybrid documentation practice that satisfied the dominant organizational culture's demands, but was optimized by the Pirates' subculture of speed and simplicity.

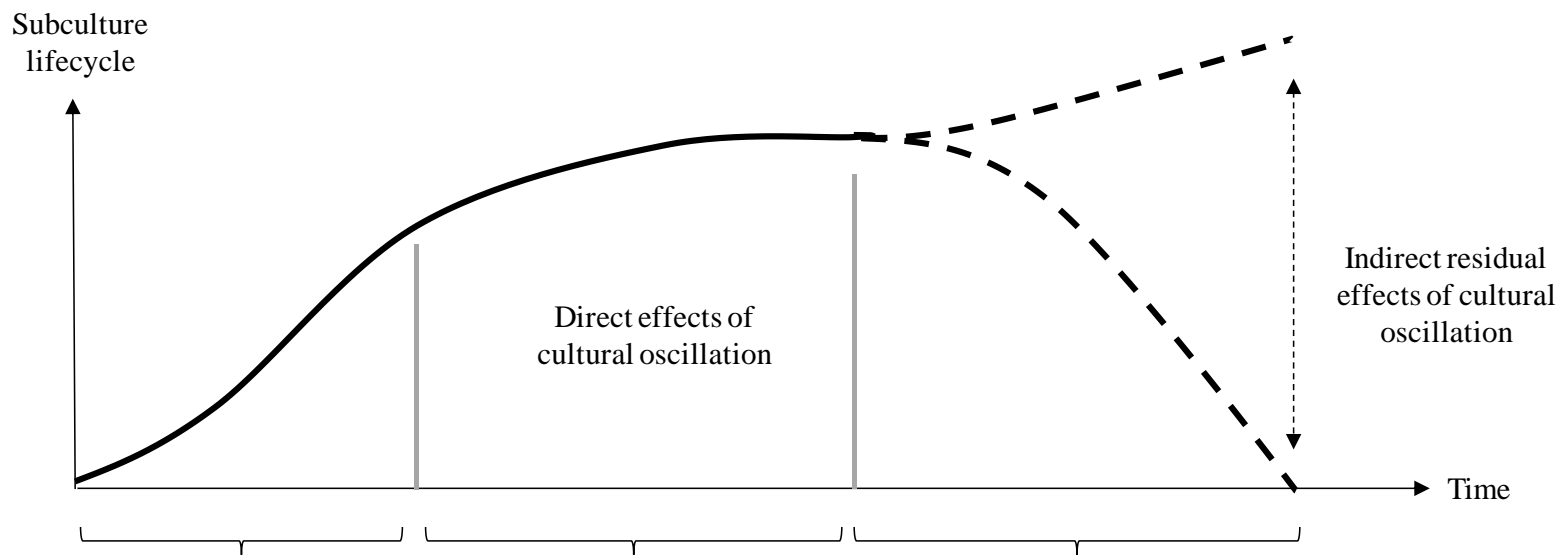
4.4.5 Cultural oscillation in the context of a subculture lifecycle

As we explored the operations of the Pirate subculture, we found that the pattern of a cultural lifecycle provided a useful framework to structure our data. Specifically, our data align with the cultural lifecycle stages of birth and development, growth and maturity, characterized by cultural oscillation with direct effects on the dominant organizational culture; and continuity or decline, characterized by residual effects of cultural oscillation on the dominant organizational culture.

When the Pirates were established, the organization needed an innovative approach, and an opportunity arose in the form of the requirement for a new mission control system. The Pirates were able to garner political support from key individuals and received very modest funding to begin experimentation. During the growth and maturity stages, as points of contact with the dominant culture became more frequent and important, cultural oscillation took place (see Table 4.4). Learning was transferred through imitation and internal job changes. Finally, in the stage of continuity or decline, the Pirates subculture in mission control weakened when their leader moved to the spacecraft project without a clear succession plan. James reflected:

The people who came in were not as gutsy, and as a result, they kept making safe choices with the result that we never were able to get, ever again, the kind of performance that we got during those two, three years.

Nevertheless, the subculture continued in the spacecraft project and beyond as several Pirates obtained influential positions later in their careers, enabling residual effects to occur, for example, in the MCC-21 project, which combined the ambidextrous capability of a traditional waterfall model in some aspects, with an iterative, fast failure approach in other aspects (Smith and Bruins, 2014).



Lifecycle stages	Subculture birth and development	Subculture growth and maturity	Subculture continuity or decline
Conditions	<ul style="list-style-type: none"> • Organizational need and opportunity for new approach • Resources and political support for new approach 	<ul style="list-style-type: none"> • Mediation between subculture and dominant culture • Pursue transfer of learning 	<ul style="list-style-type: none"> • Succession planning • Residual effects of subculture

Figure 4.2. Subculture lifecycle, direct and oscillatory effects, and conditions

Table 4.4. Coding structure for the cultural capability lifecycle

Open codes	Axial codes	Aggregate constructs
<p>“I can still remember the first day that our team got together. We got around in a conference room, there were about 35 federal employees, we threw our badges on the table and we said ‘Well, no pressure, but we have to build a new control center, and if we aren't successful, then the Space Shuttle Program is over. It's done! Because we can't afford to do it the same way [as we did it for the old mission control room] spending \$10 million a year to maintain all those mainframe computers that were at the core of the facility (...) and the 360 technical employees that were maintaining them.” (Pirate Team Member #5).</p>	<p>Organizational need and opportunity for new approach</p>	<p>Subculture birth and development</p>
<p>“We [The Pirates] brought a lot of tools, particularly from the analysis world, like computational fluid dynamics. We brought a bunch of tools doing tests on aircrafts. We brought a bunch of tools with us that then made a big difference. I mean, we'd probably still be on the ground today with the shuttle. We never would have gotten to flying again if we hadn't brought those new tools to bear.” (Pirate Team Member #1)</p>		
<p>“What we did was, we demonstrated enough capability and then the crisis came about, where there wasn't enough time and money to build the new control center, so people were looking for a radical alternative, and then we had the radical alternative.” (Pirate Leader)</p>	<p>Resources and political support for new approach</p>	
<p>“I found some funding and we started doing small, sub-scale experiments. And that team sort of grew to a moderate sized team where we were doing more and more, bigger scale experiments for which we could use modern computer and information infrastructure to improve mission control.” (Pirate Leader)</p>		
<p>“For the spacecraft project, we had cover all the way to the NASA administrator. (...) The fact that the NASA administrator earmarked this and said ‘This is my project. We're going to go do this’ and that he came down three or four times and sat in meetings (...), you can't beat that kind of coverage.” (Deputy Pirate Leader)</p>		

“We had to exist in the existing infrastructure and the existing infrastructure was at times supportive. The flight director gave us a lot of top cover...but in the middle-level management, there was a lot of opposition to the changes we were doing and they felt they were very high-risk.” (Pirate Team Member #2)

“You need a leadership that protects the subculture. If you bring something in new, using the body as an analogy, the rest of the system will attack it with antibodies, because it's sort of something foreign, and that will prevent it from growing. And so James was able to let the Pirate team grow because he protected the Pirates and the team in the midst of everything else that was going on. He even protected them in the midst of all the pressure he was getting from other NASA centers and other programs.” (Pirate Team Member #1)

“Early on when we [the Pirates] would bring new concepts, new ways of doing things. The organization was like: ‘Okay, well, that’s fine if you do that, but you still have to do XYZ’. After we started proving that we could be successful and that these new processes worked, and you’ve got the same results as XYZ, there was more tolerance to not doing XYZ. So, it was really time-phased and success-phased...As we built the credibility, we also built credibility in the processes as well as in our capabilities.” (Deputy Pirate Leader)

“They [The dominant culture] try to run everything the same way...The mistake is translating that discipline into everything you do because there’s a lot of stuff that doesn’t matter...At the spacecraft project we had big parachutes. We had tests with the vehicle during which we had a lot of discipline. We had tests of the parafoil during which we had less discipline. And we had subscale parafoils during which we had no discipline. I mean, we just would send people out in the desert and say go test them until you know what we’re doing. So, the idea is that you don’t have the same discipline, the same process and procedure overhead for everything to the same extent. But as we got to higher levels of integration with other things, we introduced more discipline.” (Pirate Leader)

Mediation
between
subculture and
dominant
culture

Sometimes the Pirates adapted their practices to match those of the organizational culture until an agreement was reached; however, sometimes they simply did things their way and waited for a response. (memo; summary of interview data with Pirate Team Member #3)

“Historically the development of a mission control center was all controlled centrally. So part of what we did is, we got the flight controllers to take ownership of what they wanted it to look like. (...) They were like ‘I

Cultural
oscillation
process

can create it. I can change it. It's mine.' It improved their processes to be able to make changes themselves and that was the switch for them changing and for our collaboration.” (Pirate Team Member #4)

“I worked in the lab with some project managers that were Pirates. So, the Pirates used an agile methodology; agile means you take little short sprints...so the agile method was basically doing things fast. So, I took away from it...you can be agile with one system, I was agile with all the systems. That’s the difference.” (MCC-21 Team Leader)

“The lesson we learned from them [the Pirates] is that, just like in any startup that we see on the outside [of the center], the team that creates a company is usually not the team that keeps it going. And so, the Pirates started the control center transition, but they could not maintain it, someone else had to do that. For the [Johnson Space] Center – if it wants to do something with an agile organization, it needs to know how to move the technologies, or the projects, or the capabilities out from the initial team into the rest of the organization. (...) Because if it stayed just within the Skunk Works [referring to the Pirate approach], within the agile organization, then you create competing cultures and then they won't survive.” (Pirate Team Member #1)

Pursue
transfer of
learning

“You can take a small group and say: ‘Go design the next generation electric car’. And then they can follow their own rules, taking risks. They can maybe do something very innovative and creative, at which point you can then take that idea and introduce it into the larger hierarchy.” (Pirate Leader)

Outsiders from an adjacent organizational unit worked side by side with the Pirates. In addition to witnessing their approach first-hand, they heard about it in management meetings and adopted aspects that worked for their current or future projects. (memo; summary of interview data with the MCC-21 Team Leader)

“James did such a good job with the mission control center. NASA had another problem, and they wanted their best guy on the new problem, so the transition was a lot shorter than what, I think, a normal organization would use. It was sort of like, ‘Hey, James. We want you to work this problem real quick’. And so, James kind of had to pull together the team, and there wasn’t time – a lot of time – for succession planning.” (Pirate Change Manager)

Succession
planning

Subculture
continuity or
decline

“I made a mistake. All of my lieutenants wanted to come with me to the spacecraft project...I should have been grooming someone to stay in charge. I just should have said no to two or three people and said, ‘You’re going to have to bloom where you’re planted or everything we’ve done here is destroyed’. It wasn’t everything destroyed, but there was a lot that fell back.” (Pirate Leader)

“I think if there was an area that we did not do well – and this I think has been pretty much the history in the Johnson Space Center – we did not provide for succession.” (Flight Director)

“I think it was handled a little differently in both cases [control center and spacecraft] where the folks left behind in the control center kind of withered on the vine. They weren’t allowed to continue, they were kind of pushed out of the way for some time...But if you look across the center, there are key managers all over the place that came from the spacecraft project. They still understand the culture and they still have that mindset of challenge...They were strategically put in places throughout.” (Deputy Pirate Leader)

“When we got pulled out of the control center and went over to do the spacecraft project, they approached it differently in that organization. They basically said ‘Okay, that was really cool. Those guys are gone now. We’re gonna lock things back down and go back,’ and they kind of went back to the old way to do business for a while...They are kind of recovered now and are doing great things, but they really slammed the brakes on for a while.” (Pirate Leader)

Residual
effects of
subculture

“They [The Pirates] were able to take away about 20, almost 30 years of history of a separation between development and operations, where the facility was always maintained by a different organization, but when it got merged together, it opened up the opportunity to let the flight controllers in a flight organization take care of the development.” (Pirate Team Member #1)

“I think what you [James, the Pirate leader] did was, you pulled together a team of really strong change makers or change agents, because they’ve continued to do that [their own version of the Pirate paradigm] once they’ve left the original team.” (Pirate Change Manager)

4.5 Discussion

We began this research with the objective of understanding the role and significance of subcultures in shaping strategic outcomes such as organizational ambidexterity via the practices through which they are enacted. The Pirate subculture at NASA provided an apt research setting. Our findings have shown that subcultures can emerge at opportune moments and operate in generative tension with the dominant organizational culture over time. This tension manifests at points of contact between the subculture and dominant culture as *cultural oscillation*, the process of interaction that enables the interpenetration of practices and transfer of learning that gradually shifts both the dominant organizational culture (exploitation) and the subculture involved (exploration) toward an ambidextrous equilibrium (Kassotaki, Paroutis, and Morrell, 2019). Particular subcultural practices (i.e., contrasting, amplifying, reframing, labeling, and rewarding conformity, as outlined in Table 4.2) create tensions with the dominant organizational culture that foster cultural oscillation. Moreover, four types of practices (as outlined in Table 4.3) may be complementary or incompatible across the two cultures, thereby shaping the outcomes of the oscillation process. Direct or residual effects on the dominant culture occur at different stages of a subculture's lifecycle (as shown in Figure 4.2). Based on these findings, we make two main contributions to the literature by (a) identifying a novel mode of ambidexterity that we call cultural oscillation, and by (b) revealing the underlying lifecycle dynamics and practice mechanisms of cultural oscillation.

4.5.1 A novel mode of ambidexterity: Cultural oscillation

Our findings do not fit neatly into the established categories of the ambidexterity literature, as the operations of the Pirate team did not involve pure forms of structural (Tushman *et al.*, 1996), sequential (Gupta *et al.*, 2006), or contextual ambidexterity (Gibson *et al.*, 2004). Rather than operating under structural ambidexterity, as a separate innovation subsidiary shielded from the demands and bureaucratic processes of the parent organization, the Pirates

operated within NASA's structural and cultural confines, at times under a great deal of challenge from the dominant culture. Instead of spatial separation, the Pirates created symbolic separation by defining their group's identity in contrast to the dominant cultural context, and creating tangible artifacts to reflect this identity (e.g., posters, t-shirts, pins etc.). Tushman *et al.* (1996) noted the importance of fostering a shared corporate culture and leadership from the top that takes responsibility to effectively integrate innovations initiated in structurally separate subsidiaries. The Pirates effectively integrated the new mission control system based on the radically different technological paradigm of distributed computing by displaying the new technology alongside the incumbent technology in the control room, thereby demonstrating its superior functionality and reliability. Further, the process of cultural oscillation enabled transfer of learning that encouraged adherents of the dominant culture to gradually accept the new mission control technology.

Furthermore, rather than alternating between exploration and exploitation over time, as in sequential ambidexterity (Gupta *et al.*, 2006; Siggelkow *et al.*, 2003), the Pirates' defining practices such as fast failure, rapid experimentation, continuous learning, and incremental improvement simultaneously encompassed both exploration and exploitation. Exploration was inherent in the practice and intent of the fast failure process, and exploitation was incorporated in how improved versions of technology were built on what had already been learned in prior versions. For example, the Pirates enabled flight controllers to input requirements and their own code into the new mission control system and observe outcomes in real time, thereby enabling simultaneous learning (exploration) and effective performance of mission control tasks based on cumulative technology development (exploitation).

Finally, in their discussion of contextual ambidexterity, Gibson *et al.* (2004) treated culture as an aspect of the organizational context but did not explore its role in detail. Their discussion of stretch, discipline, support, and trust may be seen as relevant to organizational culture, but particular cultural

values may override these elements in particular contexts, and these aspects may be significantly shaped by other organizational factors such as employee learning and development systems, as well as performance evaluation mechanisms. Furthermore, rather than individuals switching between exploration and exploitation in their daily routines, as occurs in cases of contextual ambidexterity, the Pirates' practices, such as rapid parallel development and testing via modularization, did not allow for such a distinction. For the Pirates, the balancing act involved pursuing radical innovation in a conservative, hierarchical organizational context, while trying to fulfill the organization's control-oriented requirements, such as extensive documentation.

Established ambidexterity modes therefore cannot fully account for the process we traced. The Pirates pursued organizational ambidexterity by establishing and developing a subculture that produced generative tensions with the dominant culture, in terms of both values and everyday practices. We label this process cultural oscillation to denote how the two cultural domains interacted at points of contact over time. Cultural oscillation allows for the permeability of practices and learning from one cultural domain to another when different practices meet, as shown in Table 4.3. This enables the two cultural domains to progressively shift closer to each other, as illustrated in Figure 4.1. Cultural oscillation thereby allows tensions to be played out in a way that enables the simultaneous pursuit of exploration (e.g., developing a new mission control system using distributed computing) and exploitation (e.g., effectively carrying out the mission).

4.5.2 Capability dynamics and practice mechanisms of cultural oscillation

Hall (1993) explicitly identified organizational culture and its attributes as a type of intangible resource that is intimately connected with strategic outcomes such as competitive advantages. Chatman *et al.* (2014) showed that a strong culture that encompasses adaptability might lead to enhanced performance. O'Reilly *et al.* (2013) noted that culture might be a key factor for

ambidexterity. Following this line of reasoning, we view cultural oscillation as an important cultural attribute that serves as an intangible resource that can enable strategic outcomes such as organizational ambidexterity. Oscillation has been employed in the literature to refer to a sequential focus between exploration and exploitation (e.g., Thomas, Kaminska-Labbe, and McKelvey, 2005), competing logics (Jay, 2013), or different network foci, such as operating within or across groups (Burt and Merluzzi, 2016). We employ oscillation to refer to interactions between competing practices of cultural domains that are in tension with each other – that is, the back and forth that occurs when different teams negotiate practice modifications in order to achieve common goals.

Our data show that cultural oscillation operates dynamically in the context of subculture lifecycle dynamics (Eisenhardt *et al.*, 2000; Helfat *et al.*, 2003). Via the interpenetration of practices and transfer of learning at the growth and maturity stages of the lifecycle, both cultures gradually move toward an ambidextrous equilibrium (Figure 4.1), where there is balanced focus on both exploration and exploitation. We found residual effects of cultural oscillation after the Pirates were disbanded due to the prior interpenetration of the two cultural domains and the transfer of learning across the organization – what Helfat *et al.* (2003) referred to as a re-deployment of capabilities.

Schein's (1985, 1996) view of culture as being comprised of basic assumptions, values, and observable behaviors enabled us to identify practices that are observable, as well as values that underlie these practices. Our research, informed by the strategy-as-practice approach, where the focus is on what agents do in particular contexts, helped us understand how subcultures may influence broader settings. We suggest that cultural oscillation takes place at points of contact between two cultural domains that heighten and manifest heretofore latent tensions between them. At these points of contact, particular practices intersect that, depending on their degree of compatibility across cultural domains, facilitate a gradual move towards an ambidextrous equilibrium via transfer of learning. By analyzing cultural oscillation at the

level of practices, we extend our understanding of how subcultures can gradually shift organizations toward ambidexterity. Another study on structural ambidexterity by Friesl, Garreau, and Heracleous (2019) similarly observed such a gradual change in their study of Immochan (nowadays called Ceetrus). Their longitudinal analysis of strategic renewal reveals how the parent company gradually and sustainably converged with its subsidiaries in terms of exploration activities, following first their structural separation and then their subsequent reintegration.

4.6 Conclusion

In conclusion, we investigated how teams in incumbent firms employ innovative practices to achieve strategic outcomes such as organizational ambidexterity. We addressed this question by examining how subcultures may emerge, develop, and over time influence a dominant organizational culture and strategic outcomes. Our study of the Pirates and its interactions with the dominant organizational culture at NASA's Johnson Space Center revealed practices that foster organizational ambidexterity. We further uncovered a process of *cultural oscillation* in which these practices operate throughout a capability lifecycle, which leads to direct and residual effects on the organization.

Chapter 5:

Conclusion

5.1 Introduction

My PhD research project was guided by two objectives, as stated in the introduction earlier. These were:

- 1) *Empirically examine the strategizing practices that organizations enact to cope with today's dynamically changing environments, e.g. which are characterized by new societal demands or disruptive technologies.*
- 2) *Develop a theoretical understanding of the development and the consequences of these novel strategizing practices.*

For achieving the above two objectives, I developed a research strategy that rested on my philosophical stance of interpretivism as ontology and social constructivism as epistemology. This worldview is in line with SAP research, whose practice theoretical foundations and focus on the triad of practices, practitioners, and praxis has appealed to me since my master thesis in 2011. Another aspect that I appreciate about SAP is the fact that it introduced qualitative research more widely to the field of strategic management, which had almost exclusively been dominated by quantitative studies as well as objectivism as ontology and positivism as epistemology before (Easterby-Smith *et al.* 2008). In this spirit, I adopted a qualitative approach for my research project and conducted three in-depth case studies in two different organizational settings. The latter were theoretically sampled for the novel phenomena and challenges they exhibited, so that I could investigate the strategizing practices that organizations enacted with the above research objectives in mind. My data collection took place from January 2016 until April 2019 and rested on multiple methods, like interviews and participant observations, to generate primary data and to tap into multiple current and archival secondary sources. The extended period of time that I spent in the field allowed for a longitudinal perspective and an ethnographic immersion in the research settings. Further, I drew on the principle of inductive inquiry, which enabled the gradual emergence of my three specific case studies and their research questions over time. Combined with a grounded theory approach, this led to the fact that I collected and

analyzed the data largely in parallel and only retrospectively identified the common theme that connected the three case studies, namely novel strategizing practices in light of environmental dynamism that lead to the creation of dynamic capabilities. Ex post, I also realized the knowledge gaps in the dynamic capabilities literature to which my research and SAP more widely can contribute as outlined in Table 1.1. Although I discuss my contributions to these knowledge gaps relating to dynamic capabilities below in detail, I want emphasize that my thesis's main focus was on open, temporal, and cultural practices in new ways of strategizing – meaning the three individual papers that make up this thesis with their specific contributions.

5.2 Overview of contributions

As indicated above, my research had set out with two broad research objectives, which encompassed the empirical examination of novel strategizing practices and the corresponding development of theory in this regard. Each of the three case studies adhered and contributed to these objectives while focusing on very different organizational contexts and inductively obtained research questions. In what follows, I summarize the specific contributions from my three papers.

5.2.1 Specific contributions from the three papers

5.2.1.1 Paper 1: The Role of Strategy Tools in Open Strategizing

My first paper (chapter 2) *The Role of Strategy Tools in Open Strategy: A Waltz with Deductive and Inductive Practices* focused on novel strategizing practices that organizations may develop in light of an open strategy process. Opening up the strategy process by being more inclusive and/ or transparent increasingly is a societal demand (Tkacz, 2012). Following early cases like Wikimedia or Creative Commons (Dobusch *et al.*, 2013), firms and governments nowadays are experimenting more and more with openness and try to find effective ways to respond to this contemporary claim. This poses significant and largely unresolved challenges (Dobusch *et al.*, 2019), which was the motivation for me to theoretically sample for a research setting in which I could investigate this

novel phenomenon and help contribute to this specific knowledge gap.

The case study of AutoParts specifically analyzed the emergence and role of multiple strategy tools during its open strategy process, as they were pivotal in facilitating it as technologies of rationality. In this vein, a new typology of tools emerged as a major finding based on the strategizing practices that their affordances favored or restricted, namely either deductive top-down strategizing or inductive bottom-up strategy-making. The four deductive top-down strategizing practices that I identified were 1) educate about strategic management and its process, 2) give direction and guide/ control strategic thinking, 3) integrate discrete parts into the bigger picture, as well as 4) communicate results and facilitate change. Contrasting this, the three inductive bottom-up strategizing practices associated with corresponding strategy tools were 1) generate ideas, 2) detail, specify, and prioritize, as well as 3) implement strategic change and reflect. Further to this, the data showed that a tool-based successive convergence of these deductive and inductive open strategy practices might lead to strategic consensus and thereby produce more actionable strategy outputs.

With this in mind, AutoParts's case study contributed to our knowledge in at least three important ways. Firstly, it showed that traditional strategy tools as technologies of rationality (March, 2006) should remain on the research agenda of scholars as they yield important benefits for strategizing, even in open contexts. Secondly, my co-authors and I suggested a new typology of strategy tools based on their affordances and consequently the type of strategizing practices they favor and constrain. Lastly, I paid close attention to the interplay of inductive and deductive strategizing, which had not yet been investigated before, and proposed that its effective management in an open strategy process likely yields to superior strategic outputs and consensus as well as a corresponding new dynamic capability.

In terms of implications for practice, I suggest that managers should consciously select and adapt strategy tools for their open strategy process. While doing so, they should pay attention to the tools' affordances and

consequently the type of strategizing practices they favor or restrict as to sequence them in a beneficial way. Furthermore, managers should be conscious of the fact that strategy tools with their affordances and strategizing practices may need to change over the course of the open strategy process. This likely requires either the introduction of new tools or the adjustment of existing ones.

5.2.1.2 Paper 2: *Three, Two, One, Liftoff*

My second paper (chapter 3) *Three, Two One, Liftoff: NASA's Practices for Managing Temporal Tensions of Human Space Exploration* produced a close-up longitudinal account of NASA's human space exploration activities and its related management of temporal tensions. This case study was also motivated by environmental dynamism and especially such contexts in which changes are fast paced and uncertainty is high while long-term commitments, e.g. due to extended research and development horizons, exist. NASA's long mission timelines, which heavily depend on funding approval from US administrations at least every four to eight years, were an ideal setting to study temporal tensions.

While I traced NASA and later specifically JSC's Exploration, Science and Integration Directorate deal with temporal tensions over 60 years, I identified two types of temporal strategizing practices that exist in long-term strategic initiatives, namely change-related and vision-related ones. Change-related practices, like developing new roadmaps, allocating budget, planning communications, and building the required skills, directly follow newly introduced strategic change initiatives and explicitly facilitate their implementation. While vision-related temporal practices have the longer temporal context, in which these new strategic change initiatives happen, in mind; dependent on the temporal and strategic fit of the newly introduced strategic change initiatives, they either facilitate or contradict planned outcomes. I found such contradicting practices underneath the surface as potential sources for failure. Examples for vision-related temporal practices that facilitate change initiatives are speeding up processes and focusing attention on

fewer options to be more effective. Inhibiting ones are slow-rolling or working towards alternative outcomes. Such inhibiting vision-related temporal practices are precisely the reason why organizations require the conscious management of temporal tensions. I therefore proposed a process model that may lead to the development of a corresponding dynamic capability, if formalized and routinized, for managing temporal tensions in long-term strategic change initiatives to ensure their success.

My case study on EISD contributed to strategic management scholarship by creating awareness for the active and conscious management of temporal strategizing practices, especially in long-term strategic change initiatives, as otherwise contradictory effects may emerge. I thereby disclosed for the first time that intended consequences might be associated with contradicting practices, which is why a dynamic capability is required by organizations to balance temporal tensions and to ensure that change initiatives yield to success.

In practical terms, this means that managers should be aware of temporal tensions and be capable of identifying them on the surface level and underneath of it. The latter is especially important, if contradictory practices are being enacted that may lead to the failure of strategic change initiatives. It is crucial that organizations actively engage in the management of temporal tensions, e.g. by creating dedicated organizational units with roles and responsibilities for it in addition to establishing corresponding processes.

5.2.1.3 Paper 3: Cultural Oscillation as an Enabler of Ambidexterity

Finally, the third paper (chapter 4) *Cultural Oscillation as an Enabler of Ambidexterity: A Longitudinal Study of a Team Subculture in NASA* focused on incumbents' need to adapt to environmental changes, e.g. by being ambidextrous. This has been a major concern of strategic management scholars for decades, especially since the environment has increasingly been considered as a high-velocity (Bourgeois *et al.*, 1988; Eisenhardt, 1989b) and hypercompetitive one (D'Aveni, 1994), which requires the ability to change fast. NASA's Johnson Space Center depicted a fantastic opportunity to study

this challenge as it can be considered a large bureaucratic incumbent organization while the industry it operates in has been changing dramatically during the last years. The latter requires the agency and especially the JSC to adapt quickly in order to stay a relevant partner in the ongoing commercialization of the space industry by private organizations and for further endeavors into distant dimensions and faraway galaxies of our solar system (Heracleous *et al.*, 2018; forthcoming).

The case study of the Pirates showed that subcultures can develop own practices based on their cultural characteristics (e.g. values, frames, and toolkits), which may bear the potential for conflict with the dominant organizational culture, that has traditionally existed at the incumbent. Examples include contrasting, amplifying, or branding and labeling. However, in the case of the JSC a new dynamic capability was gradually developed, which oscillated the two cultures and thereby moved the space center to an ambidextrous equilibrium. The latter allowed the JSC to balance exploration and exploitation effectively in a cultural way. In total, I observed four types of practices that were implicated in this cultural oscillation. Firstly, cornerstone practices of the dominant culture, which shape both the dominant culture and potential subcultures. Secondly, non-complementary practices at the subculture level, which may need to be adapted to match practices of the dominant organizational culture of the incumbent at points of contact. Thirdly, subculture-level practices that complement, or are, readily accepted by the dominant organizational culture, e.g. because they prove superior. Lastly, I observed subcultural practices within and only affecting the subculture level.

With these findings, I made two contributions to the literature. Firstly, by identifying a novel model of ambidexterity called cultural oscillation, which can also be viewed as a dynamic capability that organizations develop. The latter enables the interpretation of different practices, the transfer of learning, and a shift towards an ambidextrous equilibrium. Secondly, I revealed the underlying lifecycle dynamics and practice mechanisms of cultural oscillation with direct and residual effects being associated with different stages.

The implications for practice are as follows: Managers should recognize the value of organizational culture for becoming innovative and especially for becoming ambidextrous. Further, subcultures that foster innovation and cultural ambidexterity can be actively supported by creating fertile ground for positive deviants to emerge, e.g. by providing seed funding or by granting time for experimentation. At the same time, it is important to realize that emerging positive subcultures require protection in order for them to create change and to overcome inertia at the incumbent. This can be achieved by e.g. sheltering these emerging positive subcultures from organizational bureaucracy and politics and by providing high-level sponsorship and support (Heracleous *et al.*, 2019).

Table 5.1 summarizes the outlined key research findings and contributions to theory and practice in a tabular way for all three papers.

Table 5.1. Summary of research findings and contributions to theory and practice from the three papers

	Paper 1 (Chapter 2) The Role of Strategy Tools in Open Strategy	Paper 2 (Chapter 3) Three, Two, One, Liftoff	Paper 3 (Chapter 4) Cultural Oscillation as an Enabler of Ambidexterity
Overarching research objectives	<ol style="list-style-type: none"> 1. Empirically examine novel strategizing practices that organizations enact to cope with today’s dynamically changing environments 2. Develop a theoretical understanding of the development and the consequences of these novel strategizing practices 		
Research questions	<ol style="list-style-type: none"> 1. What practices are associated with using strategy tools during an open strategy process? 2. What implications does the use of strategy tools have on the outcomes of an open strategy process? 	<ol style="list-style-type: none"> 1. How do actors deal with temporal tensions during long-term strategic change initiatives? 	<ol style="list-style-type: none"> 1. How can subcultures foster organizational ambidexterity via the practices through which they are enacted?
Findings	<ul style="list-style-type: none"> • Affordances of strategy tools either favor deductive or inductive open strategizing practices • Tool-based successive convergence of deductive and inductive practices in open strategizing may lead to strategic consensus and thereby likely produce a more actionable strategy 	<ul style="list-style-type: none"> • Two types of temporal practices may be enacted in contexts of long-term strategic change initiatives • Temporal and strategic fit determine, if temporal strategizing practices facilitate or contradict change • Contradicting strategizing practices may exist underneath the apparent surface, which requires a dynamic capability for their management 	<ul style="list-style-type: none"> • Subcultures can develop practices based on their cultural characteristics that bear the potential for conflict • A new dynamic capability – developed in lifecycle stages – may oscillate two cultures with residual effects • Cultural oscillation enables the organization to move towards an ambidextrous equilibrium

Contributions to knowledge	<ul style="list-style-type: none"> • Extension of the open strategy research agenda by including traditional strategy tools as they remain important for strategizing • Development of a new typology of strategy tools based on their affordances • Management of the interplay between deductive and inductive practices in open strategizing as a novel dynamic capability 	<ul style="list-style-type: none"> • Creation of scholarly awareness for temporal strategizing practices within long-term initiatives and their potential for contradictory effects • Disclosure of the fact that intended consequences may be associated with contradicting practices • Recognition of a need to develop a dynamic capability to balance temporal tensions 	<ul style="list-style-type: none"> • Identification of a novel mode of ambidexterity called cultural oscillation • Disclosure of underlying lifecycle dynamics and practice mechanisms of cultural oscillation • Observation and theorizing of direct and residual effects associated with different capability lifecycle stages
Implications for practice	<ul style="list-style-type: none"> • Managers should create or select multiple adequate traditional strategy tools for their open strategy process • The selection and the sequenced use of these strategy tools should be made with the affordances and the type of practices they favor and restrict in mind • The strategy tools needed during an open strategy process will likely change over time, which requires the selection of new strategy tools or the adjustment of existing ones 	<ul style="list-style-type: none"> • Contradictory strategizing practices may be the source of failing change initiatives, if not managed actively • Managers should be able to identify temporal tensions and resulting practices so that they can adequately manage them, especially contradictory ones underneath the surface • Organizations should actively engage in the management of temporal tensions, e.g. in form of dedicated roles, responsibilities, and processes 	<ul style="list-style-type: none"> • Managers should recognize the value of organizational cultures for innovation and ambidexterity • Organizations can foster renegade subcultures that spur innovation by creating fertile ground for them, e.g. by providing seed funding and granting time for experiments • It is important to protect subcultures that bring about positive change through innovation, e.g. by sheltering them from bureaucracy and providing high-level sponsorship and support

5.2.2 Additional contributions related to the common theme of the thesis

In addition to the contributions that chapters 2 to 4 made to the specific knowledge gaps that they addressed in their individual papers, further contributions can be recognized considering the common theme of the thesis. However, these did not depict the focus of my thesis.

As outlined in the introduction, the notion of dynamic capabilities inductively emerged across all three papers during the data analysis and interpretation phases – even without having conducted a detailed and systematic cross-case comparison. For this reason, I had specified in Table 1.1 ex post some knowledge gaps relating to dynamic capabilities and how SAP in general and my three papers specifically could contribute to closing them. Some of the additional contributions that my papers make in this regard are minor since certain knowledge gaps were not at the heart of my three papers, while others were more in focus. In Table 1.1, those knowledge gaps that my three papers retrospectively targeted are highlighted in bold.

The first category of knowledge gaps from Table 1.1 referred to the *theoretical assumptions* that have mostly implicitly underlain research on dynamic capabilities in the past, such as managers' bounded rationality and their agency. Since these theoretical assumptions have traditionally been taken seriously by SAP research due to its philosophical stance, I also paid special attention to them in my three papers. Even though such theoretical assumptions did not depict a special focus in the research questions of my three papers, I nevertheless contributed empirically and theoretically to understanding bounded rationality and managerial agency for dynamic capabilities further. This is especially true for paper 1 (chapter 2). In this paper, it became evident that (traditional) strategy tools can help to overcome bounded rationality as well as linguistic and conceptual boundaries among the diverse participants of an open strategy process. Their use of AutoParts's multiple strategy tools was essential for the development of a novel dynamic capability that allowed for managing the open strategy process effectively. Similarly, managerial agency played an important role in this regard. Only because the organizational actors

made use of their agency and thereby enacted the strategy tools in intended and unintended ways, the interplay between deductive top-down and inductive bottom-up strategizing practices was able to unfold and eventually and arguably led to the birth of the aforementioned novel dynamic capability. My research thereby advanced a more fine-grained understanding of the role of theoretical assumptions, such as bounded rationality and managerial agency that often explicitly or implicitly underlie strategic management research and its different domains, such as dynamic capabilities. This is especially true in the context of openness.

The second gap category from Table 1.1 related to *research methods* and specifically called for more empirical research across multiple units of analysis and longitudinal research on the temporal aspects of capability development. My PhD research project addressed this gap category across all three case studies by employing a methodology that collected data in a longitudinal way (multi-year data collection, triangulation with archival data) and from all levels of the organization while paying special attention to their interdependencies. Specifically in paper 3 (chapter 4), I provided empirical evidence for cross-level effects from and onto different units of analysis, namely by comparing the Pirate subculture of NASA's JSC to the wider organizational level of the space center. Based on this, I also contributed to this gap category theoretically by subsequently theorizing the underlying cultural oscillation dynamics across the two cultural levels.

The third knowledge gap category related to the *dynamics* of dynamic capabilities in two ways: by focusing on 1) their development over time and 2) on the tensions and resulting contradictions that they generate. Even though the development of dynamic capabilities was not a key concern of mine when I started my exploratory study, Helfat *et al.*'s (2003) capability lifecycle framework became pivotal during the analysis and interpretation phases of all of my three papers. My research project thereby retrospectively contributed empirically and theoretically to this gap category. While in paper 1, the development of a dynamic capability only commenced, paper 2 already traced

its development across several stages. Finally, paper 3 observed an entire capability lifecycle and even identified some residual effects. Especially the last point that relates to feedback loops from dynamic capabilities back onto organizational culture had not yet been investigated and theorized much in strategic management scholarship on dynamic capabilities before.

Tensions and their resulting contradictions also played an important role in the above and were further theorized, especially in paper 2 (chapter 3) concerning temporal tensions and in paper 3 (chapter 4) concerning ambidexterity. By doing so, I responded to a call by Schilke *et al.* (2018) resulting from their recent review of the dynamic capabilities literature. They wrote: “[f]urther research is needed to elaborate on how dynamic capabilities can affect change while at the same time following repetitious behavioral patterns that, despite their continuity, may ultimately also be subject to change” (Schilke *et al.*, 2018:421). Although formulated in a broader way, this call directly applies to research on ambidexterity, since the latter is concerned with balancing often non-routinized exploration activities with the constant exploitation of their current products and services via standardized processes and practices. The empirical and theoretical contribution that paper 3 (chapter 4) hereto made is to suggest a cultural way for oscillating competing demands and to show that organizations might develop a corresponding dynamic capability over time.

Further to the above, the role of time has been highlighted as another way to drive our understanding of dynamic capabilities with their tensions and contradictions. Paper 2 (chapter 3) relates to this gap as it traced how NASA developed a novel dynamic capability to deal with contradicting temporal tensions in the context of long-term strategic change. The latter is necessary as the paper’s empirical findings disclosed that underneath the observable surface, practices might otherwise get enacted that contradict new strategic change initiatives.

Finally, the last category of knowledge gaps that I had outlined in Table 1.1 concerns the *antecedents or mechanisms/ moderators* for dynamic

capabilities. Again, two aspects were highlighted in this regard, namely the effects of dynamic capabilities on organizational culture as well as environmental dynamism as a source and/ or supporting factor of dynamic capabilities. My research contributed firstly by focusing on organizational culture. Paper 3 (chapter 4) specifically investigated the role of organizational culture for ambidexterity and a resulting dynamic capability called cultural oscillation. While several studies had identified organizational culture as an antecedent or mechanism/ moderator for the development of dynamic capabilities before, my research project extended previous knowledge in that it highlighted the residual effects that cultural oscillation may have on the dominant organizational culture as well as the subculture it got oscillated with.

Lastly, all of my theoretically sampled case studies contained environmental dynamism as a source and/ or supporting factor for dynamic capabilities, which is why it can be viewed as the connecting common theme of my thesis. Paper 1 (chapter 2) focused on the novel phenomenon of opening up the strategy process as a response to new societal claims. Paper 2 (chapter 3) investigated the management of temporal tensions that increasingly occur due to augmented levels of uncertainty, high-velocity environments, and hypercompetition. Lastly, paper 3 (chapter 4) focused on incumbents' need to balance exploration and exploitation to succeed in today's fast changing world.

5.3 Limitations and opportunities for future research

Despite the manifold contributions that my PhD research project made to theory and practice, it has also been subject to several limitations, which are outlined next including the mitigation strategies that I employed. The thesis then ends by suggesting multiple opportunities for future research.

5.3.1 Research limitations and mitigation strategies

The purpose of this research project was to highlight novel phenomena, like openness, that organizations might have to increasingly deal with. Naturally, these have received little attention so far. The same is true for research at the

intersection of strategy practices and dynamic capabilities (for an exception see notably Regnér, 2008) due to the divide of strategy process (dynamic capabilities have mostly been investigated in this strategic management scholarship tradition) and practice research in the past (Burgelman *et al.*, 2018). Therefore, my PhD project was of exploratory nature and only able to investigate three novel contexts, namely open strategizing, temporal tensions in the context of long-term strategic initiatives opposing fast-paced environmental changes, and incumbents' need to adapt to a paradigm change in the environment (commercialization of an industry). Further, I was only able to conduct one single case study, albeit in depth and over a multi-year time span, on each of the research contexts without a dedicated cross-case comparison which brings about several limitations.

Firstly, my research could be critiqued of micro-isolationism (Seidl *et al.*, 2014) and of weak external validity. The latter refers to the thread of generalizing findings from single settings with idiosyncratic characteristics (Eisenhardt *et al.*, 2007; Yin, 2009). However, as Eisenhardt (1989a) suggested in her seminal piece on case study research, there are also advantages associated with such methodologies. She argued: "Theories [resulting from case study research and a grounded theory approach] are likely to be testable, novel, and empirically valid (...). They are essentially theories about specific phenomena. To their credit, many of these (...) tie into broader theoretical issues such as adaption (...) and bounded rationality" (1989:547). Following this, there is value in exploratory research, as I have conducted it, in at least three ways. For one, my empirical results and my theorizing modestly advance strategic management knowledge in its own right (see Table 5.1). Secondly, my thesis also directly ties into broader themes, such as dynamic capabilities, and thereby adds to the empirical and theoretical knowledge we have on this important theme of strategic management scholarship (see Table 1.1). Thirdly, my work also provides a starting point for both, theory-building and theory-testing, to eventually and collectively move my initial contributions towards a more extensive theory in the future.

Additionally, I would like to point out that I actively tried to address the limitations mentioned above related to micro-isolationism and the generalizability of my findings by conducting three individual case studies. Albeit I did not attempt a dedicated cross-case analysis, similar patterns emerged across them. Furthermore, I traced open, temporal, and cultural practices in new ways of strategizing and the resulting dynamic capabilities across the whole organization instead of only limiting my research to the source of their emergence, e.g. the subculture of the Pirates. While these steps cannot overcome the aforementioned limitations per se, they at least show that I was aware of them and actively took measures to mitigate them as best as possible within the restrictions of this thesis.

Next, my ethnographic immersion into the two organizations studied can be put forward as a weakness because it bears the risk that my findings were overly sensitive to my personal interpretations (Flyvbjerg, 2006). My results may therefore be criticized regarding their internal validity, meaning the relationship that I tried to establish between the dynamically changing environmental context in the three case studies and the observed practices with their resulting dynamic capabilities. However, the constant exchange and joint collaboration with my doctoral supervisors on the three papers somewhat mitigated this risk. Furthermore, I was conscious of Giddens' (1984) double hermeneutic of social science and therefore started my data analysis by open coding, triangulated my data as much as possible across multiple data sources, and discussed my theoretical leaps with organizational members multiple times throughout all three case studies to ensure coherence with their experiences and depiction (Gioia *et al.*, 2013).

Lastly, the fact that I theoretically sampled my three case studies and allowed their themes to emerge inductively could also be criticized. Connected to this may also be concerns regarding the reliability of my work, which relates to the question of whether the results of the three theoretically sampled case studies are repeatable (Bryman and Bell, 2007). With the novel phenomena that I researched, e.g. openness, becoming more widely spread, theoretical sampling

becomes less admissible; however, in my case it was impossible to avoid. On the positive side, theoretical sampling of unconventional research contexts also has advantages, as they are more likely to lead to novel and frame-breaking findings due to their unique and unusual characteristics (Bamberger *et al.*, 2010). As for the reliability of my results, I want to highlight that I applied the same methodology (as outlined in section 1.4) across all three individual case studies. While the environmental context was different each time, I was able to identify novel strategizing practices and lifecycle stages for the development of new dynamic capabilities across all three case studies. The observed patterns arguably reduce the threat associated with the reliability of my research.

5.3.2 Future research avenues

While I tried to mitigate the limitations of my PhD project as much as possible, future research could further strengthen the empirical and theoretical findings that I produced. My suggestions encompass recommendations regarding the content and the utilized methodologies of future research avenues.

In terms of content, I suggest further studies at the intersection of SAP research and dynamic capabilities that explore the detailed strategizing practices that organizations enact in order to cope with the increasing environmental dynamism and novel phenomena. These could investigate similar contexts as the ones I delved into to increase their initial empirical and theoretical evidence. However, there are also several other novel phenomena that research projects could focus on. One example concerns evolving technologies, such as artificial intelligence, fog and augmented/ virtual reality, as they present many strategic questions for strategy scholars and practitioners (Oviedo *et al.*, 2019). Closely connected with the former but a slightly different example relates to platforms and ecosystems (Gawer and Cusumano, 2002; Jacobides, Cennamo, Gawer, 2018). Unanswered questions in this domain revolve for example around competitive aspects and concerns about their governance. Evolving technologies and the context of platforms and ecosystems depict two out of many novel phenomena that similar research

projects as mine could investigate (Khanagha et al., 2020; Ozalp and Kretschmer, 2019). Future research in this vein should also try to connect the various empirical and theoretical studies on a meso and/ or macro level (Seidl *et al.*, 2014) and should not be limited by any labels or boundaries, e.g. between process and practice traditions (Burgelman *et al.*, 2018).

For the latter, a different methodological approach than I selected could be beneficial. Especially multi-case comparative analyses could clarify whether findings are unique to idiosyncratic settings or whether they depict a broader pattern (Eisenhardt, 1991; Eisenhardt *et al.*, 2007). Additionally, research methodologies that have not yet been widely used in strategic management research could also help to investigate these new phenomena. One example concerns topic modeling, which originated in computer sciences and therefore naturally lends itself to investigate novel contexts related to technological advancements, such as openness, evolving technologies or platforms and ecosystems (Hannigan *et al.*, 2019). Finally, to increase the internal validity of future studies, researchers may want to consider methodologies that have recently been suggested by the SAP community, such as practitioner-led research (Balogun *et al.*, 2003).

In conclusion, research in this vein holds great potential, which is why I encourage future undertakings that have these two research avenues in mind and overcome past boundaries, e.g. between practice and process research.

References

- Ambrosini V, Bowman C. 2009. What are dynamic capabilities and are they a useful construct in strategic management? *International Journal of Management Reviews* **11**(1): 29–49.
- Ancona D, Chong C-L. 1996. Entrainment: pace, cycle, and rhythm in organizational behaviour. *Research in Organizational Behavior* **18**: 251–284.
- Andriopoulos C, Lewis MW. 2009. Exploitation-exploration tensions and organizational ambidexterity: managing paradoxes of innovation. *Organization Science* **20**(4): 696–717.
- Angwin D, Paroutis S, Mitson S. 2009. Connecting up strategy: are senior strategy directors (SSDs) a missing link? *California Management Review* **51**(3): 74–94.
- Ansari SS, Krop P. 2012. Incumbent performance in the face of a radical innovation: towards a framework for incumbent challenger dynamics. *Research Policy* **41**(8): 1357–1374.
- Argote L. 1999. *Organizational Learning: Creating, Retaining, and Transferring Knowledge*. Kluwer Academic: Boston, MA.
- Argote L, Ren Y. 2012. Transactive memory systems: a microfoundation of dynamic capabilities. *Journal of Management Studies* **49**(8): 1375–1382.
- Augier M, Teece DJ. 2009. Dynamic capabilities and the role of managers in business strategy and economic performance. *Organization Science* **20**(2): 410–421.
- Balogun J, Johnson G. 2004. Organizational restructuring and middle manager sensemaking. *Academy of Management Journal* **47**(4): 523–549.
- Balogun J, Johnson G. 2005. From intended strategies to unintended outcomes: the impact of change recipient sensemaking. *Organization Studies* **26**(11): 1573–1601.

- Balogun J, Huff AS, Johnson P. 2003. Three responses to the methodological challenges of studying strategizing. *Journal of Management Studies* **40**(1): 197–224.
- Bamberger PA, Pratt MG. 2010. From the editors – moving forward by looking back: reclaiming unconventional research contexts and samples in organizational scholarship. *Academy of Management* **53**(4): 665–671.
- Bansal P, Reinecke J, Suddaby R, Langley A. 2019. Call for papers: special issue of strategic organization “Temporal work: the strategic organization of time”. *Strategic Organization* **17**(1): 145–149.
- Barley SR. 1983. Semiotics and the study of occupational and organizational cultures. *Administrative Science Quarterly* **28**(3): 393–413.
- Barley SR. 1986. Technology as an occasion for structuring: evidence from observations of CT scanners and the social order of radiology departments. *Administrative Science Quarterly* **31**: 78–108.
- Barlow MA, Verhaal JC, Angus RW. 2019. Optimal distinctiveness, strategic categorization, and product market entry on the Google Play app platform. *Strategic Management Journal* **40**(8): 1219–1242.
- Barney JB. 1986. Organizational culture: can it be a source of sustained competitive advantage? *Academy of Management Review* **11**(3): 656–665.
- Barney JB. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**(1): 99–120.
- Barney JB, Felin T. 2013. What are microfoundations?. *Academy of Management Perspectives* **27**(2): 138–155.
- Baptista J, Wilson AD, Galliers RD, Bynghall S. 2017. Social media and the emergence of reflexiveness as a new capability for open strategy. *Long Range Planning* **50**(3): 322–336.
- Barreto I. 2010. Dynamic capabilities: a review of past research and an agenda for the future. *Journal of Management* **36**(1): 256–280.
- Barry D, Elmes M. 1997. Strategy retold: toward a narrative view of strategic discourse. *Academy of Management Journal* **22**(2): 429–452.

- BCG. 2018. Ambidexterity: combining innovation and efficiency. *BCG Henderson Institute: Ideas & Inspiration*. <https://www.bcg.com/bcg-henderson-institute/ambidexterity.aspx> [1 April 2018].
- Bednarek R, Paroutis S, Sillince J. 2017. Transcendence through rhetorical practices: responding to paradox in the science sector. *Organization Studies* **38**(1): 77–101.
- Benner M. 2010. Securities analysts and incumbent response to radical technological change: evidence from digital photography and internet telephony. *Organization Science* **21**(1): 42–62.
- Bettis RA, Prahalad CK. 1986. The dominant logic: a new linkage between diversity and performance. *Strategic Management Journal* **7**(6): 485–501.
- Birkinshaw J, Gupta K. 2013. Clarifying the distinctive contribution of ambidexterity to the field of organization studies. *Academy of Management Perspectives* **27**(4): 287–298.
- Bock AJ, Opsahl T, George G, Gann DM. 2012. The effects of culture and structure on strategic flexibility during business model innovation. *Journal of Management Studies* **49**(2): 279–305.
- Bourgeois LJ, Eisenhardt KM. 1988. Strategic decision processes in high velocity environments: four cases in the microcomputer industry. *Management Science* **34**(7): 816–835.
- Bradbury H, Lichtenstein BMB. 2000. Relationality in organizational research: exploring the space between. *Organization Science* **11**(5): 551–564.
- Breene R, Nunes P, Shill W. 2007. The chief strategy officer. *Harvard Business Review* **85**(10): 84–93.
- Brewer A. 1993. *Managing for Employee Commitment*. Longman: Sydney.
- Bromiley P. 2005. *The Behavioral Foundation of Strategic Management*. Blackwell: Malden, MA.
- Brown JS, Duguid P. 2001. Knowledge and organization: a social-practice perspective. *Organization Science* **12**(2): 198–213.

- Brown SL, Eisenhardt KM. 1997. The art of continuous change: linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Administrative Science Quarterly* **42**(1): 1–34.
- Bruggeman D. 2002. NASA: a path dependent organization. *Technology in Society* **24**(4): 415–431.
- Bryant A, Charmaz K. 2007. Grounded theory research: methods and practices. In *The SAGE Handbook of Grounded Theory*, Bryant A, Charmaz K (eds.). Sage: London, U.K.: 1–28.
- Bryman A, Bell E. 2007. *Business Research Methods*. (2nd ed.) Oxford University Press: Oxford, U.K.
- Burgelman R, Floyd S, Laamanen T, Mantere S, Vaara E, Whittington R. 2018. Strategy processes and practices: dialogues and intersections. *Strategic Management Journal* **39**(3): 531–558.
- Burke LG, Wolf C. 2017. The affordances of strategy toolmaking in ambiguous strategic environments. In *Academy of Management Proceedings of the 77th Annual Meeting of the Academy of Management*, Atlanta, GA.
- Burrell G, Morgan G. 1979. *Sociological Paradigms and Organizational Analysis*. Ashgate Publishing: Hants, U.K.
- Burt RS, Merluzzi J. 2016. Network oscillation. *Academy of Management Discoveries* **2**: 368–391.
- Cabantous L, Gond JP. 2011. Rational decision making as performative praxis: explaining rationality's Éternel Retour. *Organization Science* **22**(3): 573–586.
- Capgemini Consulting. 2016. Leading in the context of the industrial revolution: the key role of the leader 4.0. *Thought Leadership*. https://www.capgemini.com/consulting-de/wp-content/uploads/sites/32/2017/08/resouces_leader_40_industrial_revolution.pdf [1 April 2018].
- Capron L, Mitchell W. 2009. Selection capability: how capability gaps and internal social frictions affect internal and external strategic renewal. *Organization Science* **20**(2): 294–312.

- Carlile PR, Nicolini D, Langley A, Tsoukas H. 2013. *How Matter Matters: Objects, Artifacts, and Materiality in Organization Studies* (Vol. 3). Oxford University Press: Oxford, U.K.
- Carton AM. 2017. “I’m not mopping the floors, I’m putting a man on the Moon”: how NASA leaders enhanced the meaningfulness of work by changing the meaning of work. *Administrative Science Quarterly* **62**(1): 1–47.
- Chakravarthy BS, Doz Y. 1992. Strategy process research - focusing on corporate self-renewal. *Strategic Management Journal* **13**(S1): 5–14.
- Chandler A. 1977. *The Visible Hand: The Managerial Revolution in American Business*. Belknap Press of Harvard University Press: Cambridge, MA.
- Charmaz K. 2006. *Constructing Grounded Theory: A Practical Guide through Qualitative Analysis*. Sage: London, U.K.
- Chatman JA, Caldwell DF, O’Reilly CA, Doerr B. 2014. Parsing organizational culture: how the norm for adaptability influences the relationship between culture consensus and financial performance in high-technology firms. *Journal of Organizational Behavior* **35**(6): 785–808.
- Chen M-J, Miller D. 1994. Competitive attack, retaliation and performance: an expectancy-valence framework. *Strategic Management Journal* **15**(2): 85–102.
- Chen M-J, Miller D. 2011. The relational perspective as a business mindset: managerial implications for east and west. *Academy of Management Perspectives* **25**(3): 6–18.
- Chesley JA, Wenger MS. 1999. Transforming an organization: using models to foster a strategic conversation. *California Management Review* **41**(3): 54–73.
- Chesbrough HW, Appleyard MM. 2007. Open innovation and strategy. *California Management Review* **50**(1): 57–76.
- Clark P. 1985. A review of the theories of time and structure for organizational sociology. *Research in Sociology of Organizations* **4**: 35–79.

- Collins J, Porras J. 1994. *Built to Last: Successful Habits of Visionary Companies*. HarperCollins Publishers: New York, NY.
- Comi A, Whyte J. 2018. Future making and visual artefacts: an ethnographic study of a design project. *Organization Studies* **39**(8): 1055–1083.
- Clark DN. 1997. Strategic management tool usage: a comparative study. *Strategic Change* **6**(7): 417–427.
- Cloutier C, Langley A. 2020. What makes a process theoretical contribution?. *Organization Theory* **1**(1).
- Cook SD, Brown JS. 1999. Bridging epistemologies: the generative dance between organizational knowledge and organizational knowing. *Organization Science* **10**(4): 381–400.
- Cooren F. 2004. Textual agency: how texts do things in organizational settings. *Organization* **11**(3): 373–393.
- Corbin J, Strauss A. 1990. Grounded theory research: procedures, canons, and evaluative criteria. *Qualitative Sociology* **13**(1): 3–21.
- Corbin J, Strauss A. 2008. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. (3rd ed.) London, U.K.: Sage.
- Crilly D. 2017. Time and space in strategy discourse: implications for intertemporal choice. *Strategic Management Journal* **38**(12): 2370–2389.
- Cummings S, Wilson D. 2003. Images of strategy. In *Images of Strategy*, Cummings S, Wilson D (eds.). Blackwell: Malden, MA: 1-40.
- Cyert R, March J. 1992. *A Behavioral Theory of the Firm* (2nd ed.). Malden, MA: Blackwell.
- Dameron S, Lê JK, LeBaron C. 2015. Materializing strategy and strategizing material: why matter matters. *British Journal of Management* **26**: S1–S12.
- Dameron S, Torset C. 2014. The discursive construction of strategists' subjectivities: Towards a paradox lens on strategy. *Journal of Management Studies* **51**(2): 291–319.

- Danneels E. 2003. Tight–loose coupling with customers: the enactment of customer orientation. *Strategic Management Journal* **24**(6): 559–576.
- Danneels E. 2010. Trying to become a different type of company: dynamic capability at Smith Corona. *Strategic Management Journal* **32**(1): 1–31.
- Darr A, Pinch T. 2013. Performing sales: material scripts and the social organization of obligation. *Organization Studies* **34**(11): 1601–1621.
- D’Aveni RA. 1994. *Hypercompetition: Managing the Dynamics of Strategic Maneuvering*. Free Press: New York, NY.
- Davies A, Brady T. 2016. Explicating the dynamics of project capabilities. *International Journal of Project Management* **34**(2): 314–327.
- Demir R. 2015. Strategic activity as bundled affordances. *British Journal of Management* **26**: S125–S141.
- Devan J, Millan AK, Shirke P. 2005. Balancing short- and long-term performance. *McKinsey Quarterly* **1**: 31–33.
- Di Stefano G, Peteraf M, Verona G. 2014. The organizational drivetrain: a road to integration of dynamic capabilities research. *Academy of Management Perspectives* **28**(4): 307–327.
- Dobusch L, Dobusch L, Müller-Seitz G. 2019. Closing for the benefit of openness? The case of Wikimedia’s open strategy process. *Organization Studies* **40**(3): 343–370.
- Dobusch L, Kapeller J. 2013. Open strategy between crowd and community: lessons from Wikimedia and Creative Commons. In *Academy of Management Proceedings of the 73rd Annual Meeting of the Academy of Management*, Lake Buena Vista, FL.
- Dobusch L, von Krogh G, Splitter V, Walgenbach P, Whittington R. 2018. Special issue call for papers open organizing in an open society? Conditions, consequences and contradictions of openness as an organizing principle. *Organization Studies*: 1–6.
<https://www.newinstitutionalism.org/kos/WNetz?art=File.download&id=5196&name=SI+Call+for+Papers+on+Open+Organizing.pdf> [3 April 2019].

- Dougherty D, Bertels H, Chung K, Dunne DD, Kraemer J. 2013. Whose time is it? Understanding clock-time pacing and event-time pacing in complex innovations. *Management and Organization Review* **9**(2): 233–264.
- Duncan RB. 1976. The ambidextrous organization: designing dual structures for innovation. In *The Management of Organization Design: Strategies and Implementation*, Kilmann RH, Pondy LR, Slevin D (eds). North Holland: New York; 167–188.
- Dyer Jr WG, Wilkins AL. 1991. Better stories, not better constructs, to generate better theory: a rejoinder to Eisenhardt. *Academy of management Review* **16**(3): 613–619.
- Easterby-Smith M, Lowe A, Jackson P, Thorpe R. 2008. *Management Research*. (3rd ed.). Sage: London, U.K.
- Easterby-Smith M, Prieto IM. 2008. Dynamic capabilities and knowledge management: an integrative role for learning? *British Journal of Management* **19**(3): 235–249.
- Egan TM. 2008. The relevance of organizational subculture for motivation to transfer learning. *Human Resource Development Quarterly* **19**(4): 299–322.
- EISD. 2017. *Guiding JSC's Strategic Thinking Process for Human Exploration*.
- Eisenhardt KM. 1989a. Building theories from case study research. *Academy of Management Review* **14**(4): 532–550.
- Eisenhardt KM. 1989b. Making fast strategic decisions in high-velocity environments. *Academy of Management Journal* **32**(3): 543–576.
- Eisenhardt KM. 1991. Better stories and better constructs: the case for rigor and comparative logic. *Academy of Management Review* **16**(3): 620–627.
- Eisenhardt KM, Graebner M. 2007. Theory building from cases: opportunities and challenges. *Academy of Management Journal* **50**(1): 25–32.
- Eisenhardt KM, Martin JA. 2000. Dynamic capabilities: what are they? *Strategic Management Journal* **21**(10–11): 1105–1121.

- Eppler MJ, Platts KW. 2009. Visual strategizing: the systematic use of visualization in the strategic-planning process. *Long Range Planning* **42**(1): 42–74.
- Feldman MS, Orlikowski WJ. 2011. Theorizing practice and practicing theory. *Organization Science* **22**(5): 1240–1253.
- Felin T, Foss NJ. 2005. Strategic organization: a field in search of micro-foundations. *Strategic Organization* **3**(4): 441–455.
- Felin T, Foss NJ, Ployhart RE. 2015. The microfoundations movement in strategy and organization theory. *The Academy of Management Annals* **9**(1): 575-632.
- Flammer C, Bansal P. 2017. Does a long-term orientation create value? Evidence from a regression discontinuity. *Strategic Management Journal* **38**(9): 1827–1847.
- Flyvbjerg G. 2006. Five misunderstandings about case-study research. *Qualitative Inquiry* **12**(2): 219–245.
- Ford CJ, Friesl M. 2019. Abseiling from the Shard: the cognitive foundations of capability development in temporary organizations. *European Management Review* **16**(3): 507–523.
- Foss NJ. 2011. Why micro-foundations for resource-based theory are needed and what they may look like. *Journal of Management* **37**(5): 1413–1428.
- Friesl M, Garreau L, Heracleous L. 2019. When the parent imitates the child: strategic renewal through separation and reintegration of subsidiaries. *Strategic Organization* **17**(1): 62–94.
- Friesl M, Larty J, Jacobs C. 2018. Putting strategy into action – The role of artefacts for business format replication. *European Management Review* **15**(2): 221–235.
- Garber S, Launius R. 2005. *A Brief History of NASA*.
<https://history.nasa.gov/factsheet.htm> [25 April 2018].
- Gavetti G. 2012. Toward a behavioral theory of strategy. *Organization Science* **23**(1): 267–285.

- Gawer A, Cusumano MA. 2002. *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*. Harvard Business School Press: Boston, MA.
- Gegenhuber T, Dobusch L. 2017. Making an impression through openness: how open strategy-making practices change in the evolution of new ventures. *Long Range Planning* **50**(3): 337–354.
- Gersick CJ. 1994. Pacing strategic change: the case of a new venture. *Academy of Management Journal* **37**(1): 9–45.
- Ghemawat P. 2002. Competition and business strategy in historical perspective. *Business History Review* **76**(1): 37–74.
- Ghoshal S, Bartlett CA. 1994. Linking organizational context and managerial action: the dimensions of quality of management. *Strategic Management Journal* **15**(S2): 91–112.
- Gibson CB, Birkinshaw J. 2004. The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal* **47**(2): 209–226.
- Giddens A. 1984. *The Constitution of Society*. Polity Press: Cambridge, MA.
- Gioia DA, Chittipeddi K. 1992. Sensemaking and sensegiving in strategic change initiation. *Strategic Management Journal* **12**(6): 433–448.
- Gioia DA, Corley KG, Hamilton AL, 2013. Seeking qualitative rigor in inductive research: notes on the Gioia methodology. *Organizational Research Methods* **16**(1): 15–31.
- Giorgi S, Lockwood C, Glynn MA. 2015. The many faces of culture: making sense of 30 years of research on culture in organization studies. *Academy of Management Annals* **9**(1): 1–54.
- Glaser BG, Strauss AL. 2008. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Transaction: Piscataway, NJ.
- Grand S, Rüegg-Stürm J, von Arx W. 2015. Constructivist epistemologies in strategy as practice research. In *Cambridge Handbook of Strategy as Practice*, Golsorkhi D, Rouleau L, Seidl D, Vaara E (eds.). Cambridge University Press: Cambridge, U.K.: 63–78.

- Grand S, von Arx, Rüegg-Stürm, 2015. Constructivist paradigms: Implications for strategy-as-practice research. In *Cambridge Handbook of Strategy as Practice*, Golsorkhi D, Rouleau L, Seidl D, Vaara E (eds.). Cambridge University Press: Cambridge, U.K.: 78–94.
- Granqvist N, Gustafsson R. 2016. Temporal institutional work. *Academy of Management Journal* **59**(3): 1009–1035.
- Greiner LE, Bhambri A, Cummings TG. 2003. Searching for a strategy to teach strategy. *Academy of Management Learning & Education* **2**(4): 402–420.
- Gupta AK, Smith KG, Shalley CE. 2006. The interplay between exploration and exploitation. *Academy of Management Journal* **49**(4): 693–706.
- Gylfe P, Franck H, LeBaron C, Mantere S. 2015. Video methods in strategy research: focusing on embodied cognition. *Strategic Management Journal* **37**(1): 133–148.
- Haefliger S, Monteiro E, Foray D, von Krogh G. 2011. Social software and strategy. *Long Range Planning* **44**(5–6): 297–316.
- Hale W. 2010. *Culture Change at NASA* 22 January.
https://blogs.nasa.gov/waynehalesblog/2010/01/22/post_1264172421785/ [22 April 2018].
- Hall R. 1993. A framework linking intangible resources and capabilities to sustainable competitive advantage. *Strategic Management Journal* **14**(8): 607–618.
- Hannan M, Freeman J. 1977. The population ecology of organizations. *The American Journal of Sociology* **82**(5): 929–964.
- Hannigan T, Haans RFJ, Vakili K, Tchaljian H, Glaser V, Wang M, Kaplan S, Jennings PD. 2019. Topic modeling in management research: rendering new theory from textual data. *Academy of Management Annals* **13**(2): 586–632.
- Hatch JM., Yanow D. 2008. Methodology by metaphor: ways of seeing in painting and research. *Organization Studies* **29**(1): 23–44.

- Hardy C, Thomas R. 2014. Strategy, discourse and practice. the intensification of power. *Journal of Management Studies* **51**(2): 320–348.
- Hautz J, Seidl, D, Whittington R. 2017. Open strategy: dimensions, dilemmas, dynamics. *Long Range Planning* **50**: 298–309.
- He Z, Wong P. 2004. Exploration vs. exploitation: an empirical test of the ambidexterity hypothesis. *Organization Science* **15**(4): 481–494.
- Heidegger M. 2008. *Being and Time*. Translated [from the 7th German ed.] by John Macquarrie and Edward Robinson; foreword by Taylor Carmen. Harper Perennial Modern Thought: New York, NY.
- Heimeriks KH, Schijven M, Gates S. 2012. Manifestations of higher-order routines: the underlying mechanisms of deliberate learning in the context of postacquisition integration. *Academy of Management Journal* **55**(3): 703–726.
- Helfat CE, Campo-Rembado M. 2010. Integrative capabilities, vertical integration, and innovation over successive technology lifecycles. *Working paper*: Tuck School of Business at Dartmouth, Hanover, NH.
- Helfat CE, Finkelstein S, Mitchell W, Peteraf MA, Singh H, Teece DJ, Winter SG. 2007. *Dynamic Capabilities: Understanding Strategic Change in Organizations*. Blackwell: Malden, MA.
- Helfat CE, Peteraf MA. 2003. The dynamic resource-based view: capability lifecycles. *Strategic Management Journal* **24**(10): 997–1010.
- Helfat CE, Peteraf MA. 2015. Managerial cognitive capabilities and the microfoundations of dynamic capabilities. *Strategic Management Journal* **36**(6): 831–850.
- Helfat CE, Winter SG. 2011. Untangling dynamic and operational capabilities: strategy for the (n) ever-changing world. *Strategic Management Journal* **32**(11): 1243–1250.
- Hendry J, Seidl D. 2003. The structure and significance of strategic episodes: social systems theory and the routine practices of strategic change. *Journal of Management Studies* **40**(1): 175–196.

- Heracleous L. 2003. *Strategy and Organization: Realizing Strategic Management*. Cambridge University Press: Cambridge, U.K.
- Heracleous L, Gößwein J, Beaudette P. 2018. Open strategy-making at the Wikimedia foundation: a dialogic perspective. *The Journal of Applied Behavioral Science* **54**(1): 5–35.
- Heracleous L, Jacobs CD. 2008. Crafting strategy: the role of embodied metaphors. *Long Range Planning* **41**(3): 309–325.
- Heracleous L, Terrier D, González S. 2018. The reinvention of NASA. *Harvard Business Review*: <https://hbr.org/2018/04/the-reinvention-of-nasa> [8 January 2019].
- Heracleous L, Terrier D, González S. Forthcoming. NASA's capability evolution toward commercial space. *Space Policy*.
- Heracleous L, Wawarta C, González S, Paroutis S. 2019. How a group of NASA renegades transformed mission control. *MIT Sloan Management Review*: <https://sloanreview.mit.edu/article/how-a-group-of-nasa-renegades-transformed-mission-control/amp> [5 May 2019].
- Heracleous L, Yniguez C, González S. 2019. Ambidexterity as historically embedded process: evidence from NASA, 1958 to 2016. *The Journal of Applied Behavioral Science* **55**(2): 161–189.
- Hill CW, Rothaermel FT. 2003. The performance of incumbent firms in the face of radical technological innovation. *Academy of Management Review* **28**(2): 257–274.
- Hodgkinson G, Whittington R., Johnson G, Schwarz M. 2006. The role of strategy workshops in strategy development processes: formality, communication, coordination and inclusion. *Long Range Planning* **39**(5): 479–496.
- Hutter K, Nketia BA, Füller J. 2017. Falling short with participation – different effects of ideation, commenting, and evaluating behavior on open strategizing. *Long Range Planning* **50**(3): 355–370.

- Hutzschenreuter T, Kleindienst I. 2006. Strategy-process research: what have we learned and what is still to be explored. *Journal of Management* **32**(5): 673–720.
- Huy QN. 2001. Time, temporal capability, and planned change. *The Academy of Management Review* **26**(4): 601–623.
- ISS US National Laboratory. 2019. *History and Timeline of the ISS*.
<https://www.issnationallab.org/about/iss-timeline> [23 June 2019].
- Jacobides M, Cennamo C, Gawer A. 2018. Towards a theory of ecosystems. *Strategic Management Journal* **39**(8): 2255–2276.
- Jalonen K, Schildt H, Vaara E. 2018. Strategic concepts as micro-level tools in strategic sensemaking. *Strategic Management Journal* **39**(10): 2794 – 2826.
- Jansen JJ, Simsek Z, Cao Q. 2012. Ambidexterity and performance in multiunit contexts: cross-level moderating effects of structural and resource attributes. *Strategic Management Journal* **33**(11): 1286–1303.
- Jansen JJ, Van Den Bosch FA, Volberda HW. 2009. Structural differentiation and ambidexterity: the mediating role of integration mechanisms. *Organization Science* **20**(4): 797–811.
- Janssen M, Charalabidis Y, Zuiderwijk A. 2012. Benefits, adoption barriers and myths of open data and open government. *Information Systems Management* **29**(4): 258–268.
- Jarratt D, Stiles D. 2010. How are methodologies and tools framing managers' strategizing practice in competitive strategy development? *British Journal of Management* **21**(1): 28–43.
- Jarzabkowski P. 2004. Strategy as practice: Recursiveness, adaptation and practices-in-use. *Organization Studies* **25**(4): 529–560.
- Jarzabkowski P, Balogun J, Seidl D. 2007. Strategizing: The challenges of a practice perspective. *Human Relations* **60**(1): 5–27.
- Jarzabkowski P, Bednarek R, Cabantous L. 2015. Conducting global team-based ethnography: methodological challenges and practical methods. *Human Relations* **68**(1): 3–33.

- Jarzabkowski P, Burke G, Spee P. 2015. Constructing spaces for strategic work: a multimodal perspective. *British Journal of Management* **26**(Special Issue): S26–S47.
- Jarzabkowski P, Giulietti M, Oliveira B, Amoo N. 2013. We don't need no education – or do we? Management education and alumni adoption of strategy tools. *Journal of Management Inquiry* **22**(1): 452–472.
- Jarzabkowski P, Kaplan S. 2015. Strategy tools-in use: a framework for understanding “technologies of rationality” in practice. *Strategic Management Journal* **36**(4): 537–558.
- Jarzabkowski P, Pinch T. 2013. Sociomateriality is ‘the New Black’: accomplishing repurposing, reinscripting and repairing in context. *M@n@gement* **16**(5): 579–592.
- Jarzabkowski P, Seidl D. 2008. The role of meetings in the social practice of strategy. *Organization Studies* **29**(11): 1391–1426.
- Jarzabkowski P, Spee AP, Smets M. 2013. Material artifacts: practices for doing strategy with ‘stuff’. *European Management Journal* **31**(1): 41–54.
- Jarzabkowski P, Wilson DC. 2006. Actionable strategy knowledge: a practice perspective. *European Management Journal* **24**(5): 348–367.
- Jay J. 2013. Navigating paradox as a mechanism of change and innovation in hybrid organizations. *Academy of Management Journal* **56**: 137-159.
- Jermier JM, Slocum Jr JW, Fry LW, Gaines J. 1991. Organizational subcultures in a soft bureaucracy: resistance behind the myth and facade of an organization culture. *Organization Science* **2**(2): 170–194.
- Johnson G, Melin L, Whittington R. 2003. Micro strategy and strategizing: towards and activity-based view. *Journal of Management Studies* **40**(1): 3–22.
- Johnson G, Scholes K, Whittington R. 2008. *Exploring Corporate Strategy* (8th ed.) Pearson Education Limited: Harlow, U.K.

- Kang SC, Snell SA. 2009. Intellectual capital architectures and ambidextrous learning: a framework for human resource management. *Journal of Management Studies* **46**(1): 65–92.
- Kaplan S. 2008. Framing contests: strategy-making under uncertainty. *Organization Science* **19**(5): 729–752.
- Kaplan S. 2011. Strategy and PowerPoint: an inquiry into the epistemic culture and machinery of strategy making. *Organization Science* **22**(2): 320–346.
- Kaplan S, Norton DP. 1992. The balanced scorecard - measures that drive performance. *Harvard Business Review* **January-February**: 71–79.
- Kaplan S, Norton DP. 1996. Using the balanced scorecard as a strategic management system. *Harvard Business Review* **January-February**: 150–161.
- Kaplan S, Orlikowski WJ. 2013 Temporal work in strategy making. *Organization Science* **24**(4): 965–995.
- Kassotaki O, Paroutis S, Morrell K. 2019. Ambidexterity penetration across multiple organizational levels in an aerospace and defense organization. *Long Range Planning* **52**(3): 366–385.
- Kay J, McKiernan P, Faulkner D. 2003. The history of strategy and some thoughts about the future. In *The Oxford Handbook of Strategy. Volume I: A Strategy Overview and Competitive Strategy*, Faulkner D, Campbell A (eds.). Oxford University Press: Oxford, U.K.: 21–46.
- Ketokivi M, Castañer X. 2004. Strategic planning as an integrative device. *Administrative Science Quarterly* **49**(3): 337–365.
- Khanagha S, Ansari S, Paroutis S, Oviedo L. 2020. Mutualism and the dynamics of new platform creation: a study of Cisco and fog computing. *Strategic Management Journal*. Forthcoming.
- Khazanchi S, Lewis MW, Boyer KK. 2007. Innovation-supportive culture: the impact of organizational values on process innovation. *Journal of Operations Management* **25**(4): 871–884.

- Kim A, Bansal P, Haugh H. 2019. No time like the present: how a present time perspective can foster sustainable development. *Academy of Management Journal* **62**(2): 607–634.
- Kipping M. 1999. American management consulting companies in Western Europe, 1920 to 1990: products, reputation, and relationships. *Business History Review* **73**(2): 190–220.
- Knight E, Daymond J, Paroutis S. 2020. Design-led strategy: how to bring design thinking into the art of strategic management. *California Management Review*.
https://warwick.ac.uk/fac/soc/wbs/subjects/sib/people/sotirios_profile/knight_daymond_paroutis_20_cmr.pdf [25 February 2020].
- Knight E, Paroutis S. 2017. Becoming salient: the TMT leader’s role in shaping the interpretive context of paradoxical tensions. *Organization Studies* **38**(3-4): 403-432.
- Knight E, Paroutis S, Heracleous L. 2018. The power of PowerPoint: a visual perspective on meaning making in strategy. *Strategic Management Journal* **39**(3): 894–921.
- Knights D, Morgan G. 1991. Corporate strategy, organizations, and subjectivity: a critique. *Organization Studies* **12**(2): 251–273.
- Kranz E. 1999. Oral history 2 transcript—Eugene F. Kranz. *Johnson Space Center Oral History Project*.
https://www.jsc.nasa.gov/history/oral_histories/KranzEF/EFK_1-8-99.pdf [20 February 2018].
- Krausz M, Koslowsky M, Shalom N, Elyakim N. 1995. Predictors of intentions to leave the ward, the hospital, and the nursing profession: a longitudinal study. *Journal of Organizational Behavior* **16**(3): 277–288.
- Kunisch S, Bartunek JM, Mueller J, Huy QN. 2017. Time in strategic change research. *Academy of Management Annals* **11**(2): 1005–1064.
- Langley A. 1999. Strategies for theorizing from process data. *Academy of Management Review* **24**(4): 691–710.

- Langley A, Smallman C, Tsoukas H, Van de Ven AH. 2013. Process studies of change in organization and management: unveiling temporality, activity, and flow. *Academy of Management Journal* **56**(1): 1–13.
- Lavie D, Stettner U, Tushman ML. 2010. Exploration and exploitation within and across organizations. *Academy of Management Annals*, **4**(1): 109–155.
- Lê J, Bednarek R. 2018. Paradox in everyday practice: applying practice theoretical principles to paradox. In *The Oxford Handbook of Organizational Paradox*, Smith W, Lewis MW, Jarzabkowski P, Langley A (eds.). Oxford University Press, Oxford, U.K.: 490–511.
- Lê JK, Spee A. 2015. The material turn in organization studies and strategy-as-practice. In *Cambridge Handbook of Strategy as Practice*, Golsorkhi D, Rouleau L, Seidl D, Vaara E (eds.). Cambridge University Press: Cambridge, U.K.: 582–597.
- Leonard-Barton D. 1992. Core capabilities and core rigidities: a paradox in managing new product development. *Strategic Management Journal* **13**(Special Issue): 111–126.
- Leonardi PM. 2011. When flexible routines meet flexible technologies: affordance, constraint, and the imbrication of human and material agencies. *MIS Quarterly* **35**(1): 147–167.
- Leonardi PM, Barley SR. 2010. What’s under construction here? Social action, materiality, and power in constructivist studies of technology and organizing. *Academy of Management Annals* **4**(1): 1–51.
- Leonardi P, Nardi B, Kallinikos J. 2012. *Materiality and Organizing: Social Interaction in a Technological World*. Oxford University Press: Oxford, U.K.
- Lifshitz-Assaf H. 2017. Dismantling knowledge boundaries at NASA: the critical role of professional identity in open innovation. *Administrative Science Quarterly* **63**(4): 746–782.
- Lincoln YS, Guba EG. 1985. *Naturalistic Inquiry*. Sage: Beverly Hills, CA.

- Liu F, Maitlis S. 2014. Emotional dynamics and strategizing processes: a study of strategic conversations in top team meetings. *Journal of Management Studies* **51**(2): 202–234.
- Louçã F, Mendonça S. 2002. Steady change: the 200 largest US manufacturing firms throughout the 20th century. *Industrial and Corporate Change* **11**(4), 817–845.
- Lok P, Crawford J. 1999. The relationship between commitment and organizational culture, subculture, leadership style and job satisfaction in organizational change and development. *Leadership & Organization Development Journal* **20**(7): 365–374.
- Luedicke MK, Husemann KC, Furnari S, Ladstaetter F. 2017. Radically open strategizing: how the premium cola collective takes open strategy to the extreme. *Long Range Planning* **50**(3): 371–384.
- MacLean D, MacIntosh R, Seidl D. 2015. Rethinking dynamic capabilities from a creative action perspective. *Strategic Organization* **13**(4): 340–352.
- Maguire S, Hardy C. 2013. Organizing processes and the construction of risk: a discursive approach. *Academy of Management Journal* **56**(1): 231–255.
- Malhotra A, Majchrzak A, Niemiec RM. 2017. Using public crowds for open strategy formulation: mitigating the risks of knowledge gaps. *Long Range Planning* **50**(3): 397–410.
- Mantere S. 2008. Role expectations and middle manager strategic agency. *Journal of Management Studies* **45**(2): 294–316.
- Mantere S, Vaara E. 2008. On the problem of participation in strategy: a critical discursive perspective. *Organization Science* **19**(2): 341–358.
- March JG. 1991. Exploration and exploitation in organizational learning. *Organization Science* **2**(1): 71–87.
- March JG. 2006. Rationality, foolishness, and adaptive intelligence. *Strategic Management Journal* **27**(3): 201–214.
- McCurdy H. 1993. *Inside NASA: High Technology and Organizational Change in the U.S. Space Program*. Johns Hopkins Press: Baltimore, MD.

- McGivern G, Dopson S, Ferlie E, Fischer M, Fitzgerald L, Ledger J, Bennett C. 2018. The silent politics of temporal work: a case study of a management consultancy project to redesign public health care. *Organization Studies* **39**(8): 1007–1030.
- Miles RE, Snow CC. 1994. *Fit, Failure and the Hall of Fame*. Macmillan: New York, NY.
- Mintzberg H. 1987. The strategy concept I: five Ps for strategy. *California Management Review* **30**(1): 11–24.
- Mintzberg H, Ahlstrand B, Lampel J. 2009. *Strategy Safari* (2nd ed.). Harlow, U.K.: Pearson Education Ltd.
- Mintzberg H, McHugh A. 1985. Strategy formation in adhocracy. *Administrative Science Quarterly* **30**: 160–197.
- Mintzberg H, Lampel J. 1999. Reflecting on the strategy process. *Sloan Management Review* **40**: 21–30.
- Mirabeau L, Maguire S. 2014. From autonomous strategic behavior to emergent strategy. *Strategic Management Journal* **35**(8): 1202–1229.
- Moisander J, Stenfors S. 2009. Exploring the edges of theory-practice gap: epistemic cultures in strategy-tool development and use. *Organization* **16**(2): 227–247.
- Mosakowski E, Earley PC. 2000. A selective review of time assumptions in strategy research. *Academy of Management Review* **25**(4): 796–812.
- NASA. 1969. *Report of the Space Task Group, 1969*.
<https://www.hq.nasa.gov/office/pao/History/taskgrp.html> [28 April 2019].
- NASA. 1986. *NASA's Actions to Implement the Recommendations of the Presidential Commission on the Space Shuttle Challenger Accident*. Executive Summary. 14 July.
- NASA. 1994. 'Pirates' reap award, honors. *NASA Johnson Space Center Space News Roundup* **33**(38): 4.
- NASA. 2003. Report of Columbia Accident Investigation Board, Volume I. *Space Shuttle Columbia and her Crew*.

- https://www.nasa.gov/columbia/home/CAIB_Vol1.html [22 April 2018].
- NASA. 2008. *Why we explore: the birth of NASA*.
https://www.nasa.gov/exploration/whyweexplore/Why_We_29.html [28 April, 2019].
- NASA. 2014. *JSC Reorganization*.
- NASA. 2016. Johnson Space Center. *NASA Facts*:
<https://www.nasa.gov/sites/default/files/atoms/files/fs-2016-10-002-jsc.pdf> [08 January 2019].
- NASA. 2017a. About project Mercury.
https://www.nasa.gov/mission_pages/mercury/missions/program-toc.html [28 April, 2019].
- NASA. 2017b. *John F. Kennedy and NASA. NASA History*.
<https://www.nasa.gov/feature/john-f-kennedy-and-nasa> [22 April 2018].
- NASA. 2017c. What was the Apollo program?
<https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-was-apollo-program-58.html> [23 April 2018].
- NASA. 2018a. Our missions and values: <https://www.nasa.gov/careers/our-mission-and-values> [29 May 2019].
- NASA. 2018b. NASA strategic plan 2018.
https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf [3 January 2019].
- NASA. 2018c. Gemini.
https://www.nasa.gov/mission_pages/gemini/index.html [29 April 2019].
- NASA. 2018d. What is NASA's Asteroid Redirect Mission?
<https://www.nasa.gov/content/what-is-nasa-s-asteroid-redirect-mission> [15 March 2019].
- NASA. 2019a. What is Artemis? <https://www.nasa.gov/what-is-artemis> [19 August 2019].

- NASA. 2019b. Johnson Space Center.
<https://www.nasa.gov/centers/johnson/home/index.html> [17 March 2019].
- NASA. 2019c. NASA administrator statement on return to Moon in next five years. <https://www.nasa.gov/press-release/nasa-administrator-statement-on-return-to-moon-in-next-five-years> [01 April 2019].
- NASA. a. Project Apollo: a retrospective analysis.
<https://history.nasa.gov/Apollomon/Apollo.html> [23 April 2018].
- NASA. b. Pruning the Apollo program.
<https://www.hq.nasa.gov/pao/History/SP-4204/ch22-8.html> [28 April 2018].
- Nelson RR, Winter SG. 1982. *An Evolutionary Theory of Economic Change*. Harvard University Press: Cambridge, MA.
- Nixon RM. 1972. President Nixon's 1972 announcement on the space shuttle.
<https://history.nasa.gov/stsnixon.htm> [23 June 2018].
- Nowotny H. 1992. Time and social theory: towards a social theory of time. *Time & Society* **1**(3): 421–454.
- Ocasio W, Joseph J. 2008. Rise and fall – or transformation: the evolution of strategic planning at the General Electric company, 1940–2006. *Long Range Planning* **41**(3): 248–272.
- Ochoa E. 2012. *NASA Johnson Space Center: Leading Human Space Exploration, presentation to the NASA Advisory Council and the Commercial Space Committee*.
- O'Connor GC. 2008. Major innovation as a dynamic capability: a systems approach. *Journal of Product Innovation Management* **25**(4): 313–330.
- O'Connor B. 2009. Organizational and cultural lessons learned from Challenger and Columbia. Paper presented at the APPEL Masters Forum 18, 13 May. https://www.nasa.gov/pdf/396770main_mf18_oconnor.pdf [22 April 2018].

- O'Reilly CA, Tushman ML. 2008. Ambidexterity as a dynamic capability: resolving the innovator's dilemma. *Research in Organizational Behavior* **28**:185–206.
- O'Reilly CA, Tushman ML. 2013. Organizational ambidexterity: past, present, and future. *Academy of Management Perspectives* **27**(4): 324–338.
- Orlikowski WJ, Scott SV. 2008. Sociomateriality: challenging the separation of technology, work and organization. *The Academy of Management Annals* **2**(1): 433–474.
- Orlikowski WJ, Yates J. 2002. It's about time: temporal structuring in organizations. *Organization Science* **13**(6): 684–700.
- Østerlund C, Carlile P. 2005. Relations in practice: sorting through practice theories on knowledge sharing in complex organizations. *The Information Society* **21**(2): 91–107.
- Oviedo LC, Pitsis TS, Beckman SL, Dong A. 2019. *Call for Proposals: Designing the Future: Strategy, Technology, and Society in the 4th Industrial Revolution*.
<https://www.strategicmanagement.net/berkeley/overview/overview> [1 September 2019].
- Ozalp H, Kretschmer T. 2019. Follow the crowd or follow the trailblazer? The differential role of firm experience in product entry decisions in the US video game industry. *Journal of Management Studies* **56**(7): 1452–1481.
- Papachroni A, Heracleous L, Paroutis S. 2015. Organizational ambidexterity through the lens of paradox theory: building a novel research agenda. *Journal of Applied Behavioral Science* **51**(1): 71–93.
- Paroutis S, Franco A, Papadopoulos T. 2015. Visual interactions with strategy tools: producing strategic knowledge in workshops. *British Journal of Management* **26**: S48–S66.
- Paroutis S, Heracleous L. 2013. Discourse revisited: dimensions and employment of first-order strategy discourse during institutional adoption. *Strategic Management Journal* **34**(8): 935–956.

- Paroutis S, Heracleous L, Angwin D. 2016. *Practicing Strategy* (2nd ed.). Sage: London, U.K.
- Payne G, Williams M. 2005. Generalization in qualitative research. *Sociology* **39**(2): 295–314.
- Penrose ET. 1959. *The Theory of the Growth of the Firm*. John Wiley: New York, NY.
- Pettigrew AM. 1979. On studying organizational cultures. *Administrative Science Quarterly* **24**(4): 570–581.
- Pettigrew, AM. 1985. *The Awakening Giant: Continuity and Change in Imperial Chemical Industries*. Blackwell: Oxford, U.K.
- Pettigrew AM. 1992. The character and significance of strategy process research. *Strategic Management Journal* **13**(S2): 5–16.
- Piening EP. 2013. Dynamic capabilities in public organizations: a literature review and research agenda. *Public Management Review* **15**(2): 209–245.
- Pisano GP. 2002. In search of dynamic capabilities. In *The nature and dynamics of organizational capabilities*, Dosi G, Nelson RR, Winter SG (eds). Oxford University Press: New York, NY: 129–154.
- Popper KR. 1959. *The Logic Scientific Discovery*. Hutchinson: London, U.K.
- Porter M. 1980. *Competitive Advantage*. The Free Press: New York, NY.
- Powell TC, Lovallo D, Fox C. 2011. Behavioral strategy. *Strategic Management Journal* **32**(13): 1369–1386.
- Prahalad CV, Hamel G. 1990. The core competence of the corporation. *Harvard Business Review* **68**(3): 79–91.
- Presidential Commission. 1986. *Report to the President on the Space Shuttle Challenger Accident*. Washington, DC.
- Priem RL. 1990. Top management team group factors, consensus, and firm performance. *Strategic Management Journal*, **11**: 469–478.
- Raisch S, Birkinshaw J. 2008. Organizational ambidexterity: antecedents, outcomes and moderators. *Journal of Management* **34**(3): 375–409.

- Raisch S, Birkinshaw J, Probst G, Tushman ML. 2009. Organizational ambidexterity: balancing exploitation and exploration for sustained performance. *Organization Science* **20**(4): 685–695.
- Ravasi D, Rindova V, Stigliani I. 2019. The stuff of legend: history, memory, and the temporality of organizational identity construction. *Academy of Management Journal* **62**(5): 1523–1555.
- Reckwitz A. 2002. Toward a theory of social practices: a development in culturalist theorizing. *European Journal of Social Theory* **5**(2): 243–263.
- Regnér P. 2003. Strategy creation in the periphery: inductive versus deductive strategy making. *Journal of Management Studies* **40**(1): 57–82.
- Regnér P. 2008. Strategy-as-practice and dynamic capabilities: steps towards a dynamic view of strategy. *Human Relations* **61**(4): 565–588.
- Reinecke J, Ansari S. 2015. When times collide: temporal brokerage at the intersection of markets and developments. *Academy of Management Journal* **58**(2): 618–648.
- Rigby R, Bilodeau B. 2015. Management tools & trends 2015. *Bain Briefs*: 1–19.
- Rouleau L. 2005. Micro-practices of strategic sensemaking and sensegiving: how middle managers interpret and sell change every day. *Journal of Management Studies* **42**(7): 1413–1441.
- Rouleau L, Balogun J. 2011. Middle managers, strategic sensemaking, and discursive competence. *Journal of Management Studies* **48**(5): 959–983.
- Roy R, Lampert CM, Stoyneva I. 2018. When dinosaurs fly: The role of firm capabilities in the ‘avianization’ of incumbents during disruptive technological change. *Strategic Entrepreneurship Journal* **12**(2): 261–284.
- Sackmann SA. 1992. Culture and subcultures: an analysis of organizational knowledge. *Administrative Science Quarterly* **37**(1): 140–161.
- Sagan C. 2016. Carl Sagan 1934–96. In *Oxford Essential Quotations*. 4th edition. Oxford University Press: Oxford, U.K.

- Salvato C, Rerup C. 2011. Beyond collective entities: multilevel research on organizational routines and capabilities. *Journal of Management* **37**(2): 468–490.
- Sandberg J, Tsoukas H. 2011. Grasping the logic of practice: theorizing through practical rationality. *Academy of Management Review* **36**(2): 338–360.
- Schatzki T, Knorr Cetina K, Von Savigny E. 2001. *The practice turn in contemporary theory*. Routledge: London, UK.
- Schatzki T. 2002. *The site of the social: a philosophical account of the constitution of social life and change*. Pennsylvania State University Press: University Park, PA.
- Schein EH. 1985. *Organizational Culture and Leadership*. Jossey-Bass: San Francisco, CA.
- Schein EH. 1996. Culture: the missing concept in organization studies. *Administrative Science Quarterly* **41**(2): 229–240.
- Schilke O. 2014. On the contingent value of dynamic capabilities for competitive advantage: the nonlinear moderating effect of environmental dynamism. *Strategic Management Journal* **35**(2): 179–203.
- Schilke O, Hu, S, Helfat CE. 2018. Quo vadis, dynamic capabilities? A content-analytic review of the current state of knowledge and recommendations for future research. *Academy of Management Annals* **12**(1): 390–439.
- Seidl D, Whittington R. 2014. Enlarging the strategy-as-practice research agenda: towards taller and flatter ontologies. *Organization Studies* **35**(10): 1407-1421.
- Shamsie J, Martin X, Miller D. 2009. In with the old, in with the new: capabilities, strategies, and performance among the Hollywood studios. *Strategic Management Journal* **30**(13): 1440–1452.
- Siggelkow N, Levinthal DA. 2003. Temporarily divide to conquer: centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation. *Organization Science* **14**(6): 650–669.

- Simon H. 1978. Rationality as process and product of a thought. *American Economic Review* **68**(2): 1–16.
- Simpson D. 1998. Why most strategic planning is a waste of time and what you can do about it. *Long Range Planning* **31**(3): 476–480.
- Simsek Z. 2009. Organizational ambidexterity: towards a multilevel understanding. *Journal of Management Studies* **46**(4): 597–624.
- Simsek Z, Heavey C, Veiga JF, Souder D. 2009. A typology for aligning organizational ambidexterity's conceptualizations, antecedents, and outcomes. *Journal of Management Studies* **46**(5): 864–894.
- Slawinski N, Bansal P. 2015 Short on time: intertemporal tensions in business sustainability. *Organization Science* **26**(2): 531–549.
- Smets M, Greenwood R, Lounsbury M. 2015. An institutional perspective on strategy as practice. In *Cambridge Handbook of Strategy as Practice*, Golsorkhi D, Rouleau L, Seidl D, Vaara E (eds.). Cambridge University Press: Cambridge, U.K.: 283–300.
- Smets M, Morris TIM, Greenwood R. 2012. From practice to field: a multilevel model of practice-driven institutional change. *Academy of Management Journal* **55**(4): 877–904.
- Smircich L. 1983. Concepts of culture and organizational analysis. *Administrative Science Quarterly* **28**: 339–358.
- Smith B, Bruins AC. 2014. *Breaking Silos with Tight Inter-organizational Collaboration and Intelligent Fail-Pass: A Human Health and Performance and Flight Operations Directorate Success Story*. SD MOD MCC21 Award submission, August.
- Snow DA. 1999. PSA presidential address: the value of sociology. *Sociological Perspectives* **42**(1): 1–22.
- Sorensen J, Stuart T. 2000. Aging, obsolescence, and organizational innovation. *Administrative Science Quarterly* **45**(1): 81–112
- Spee P, Jarzabkowski P. 2009. Strategy tools as boundary objects. *Strategic Organization* **7**(2): 223–232.

- Standifer R, Bluedorn A. 2006. Alliance management teams and entrainment: sharing temporal mental models. *Human Relations* **59**(7): 903–927.
- Statler M., Heracleous L, Jacobs CD. 2011. Serious play as a practice of paradox. *The Journal of Applied Behavioral Science* **47**(2): 236–256.
- Stieger D, Matzler K, Chatterjee S, Ladstaetter-Fussenegger F. 2012. Democratizing strategy: how crowdsourcing can be used for strategy dialogues. *California Management Review* **54**(4): 44–68.
- Strauss AL. 1987. *Qualitative Analysis for Social Scientists*. Cambridge University Press: New York, NY.
- Strauss AL, Corbin J. 1998. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. (2nd ed.). Sage. London, U.K.
- Suddaby R. 2006. From the editors: what grounded theory is not. *Academy of Management Journal* **49**(4): 633–642.
- Suddaby R, Elsbach KD, Greenwood R, Meyer JW, Zilber TB. 2010. Organizations and their institutional environments—bringing meaning, values, and culture back in: introduction to the special research forum. *Academy of Management Journal* **53**(6): 1234–1240.
- Suddaby R, Greenwood R. 2005. Rhetorical strategies of legitimacy. *Administrative Science Quarterly*, **50**(1): 35–67.
- Teece DJ. 2007. Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal* **28**(13): 1319–1350.
- Teece DJ, Pisano G, Shuen A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal* **18**(7): 509–533.
- Thomas C, Kaminska-Labbe R, McKelvey B. 2005. Managing the MNC and exploitation/exploration dilemma: from static balance to dynamic oscillation. *Advances in Strategic Management* **22**: 213–247.
- Thomas H, Pollock T. 1999. From I-O Economics' S-C-P paradigm through strategic groups to competence-based competition: reflections on the puzzle of competitive strategy. *British Journal of Management* **10**(2): 127–140.

- Tkacz N. 2012. From open source to open government: a critique of open politics. *Ephemera: Theory & Politics in Organization* **12**(4): 386–405.
- Tripsas M. 1997. Surviving radical technological change through dynamic capability: evidence from the typesetter industry. *Industrial & Corporate Change* **6**(2): 341–377.
- Tripsas M, Gavetti G. 2000. Capabilities, cognition, and inertia: evidence from digital imaging. *Strategic Management Journal* **21**(Special Issue): 1147–1161.
- Tsoukas H. 2015. Making strategy: Meta-theoretical insights from Heideggerian phenomenology. In *Cambridge Handbook of Strategy as Practice*, Golsorkhi D, Rouleau L, Seidl D, Vaara E (eds.). Cambridge University Press: Cambridge, U.K.: 58–77.
- Turner N, Swart J, Maylor H. 2013. Mechanisms for managing ambidexterity: a review and research agenda. *International Journal of Management Reviews* **15**(3): 317–332.
- Tushman ML, O'Reilly CA. 1996. The ambidextrous organization: managing evolutionary and revolutionary change. *California Management Review* **38**(4): 1–23.
- Tushman ML, Romanelli E. 1985. Organizational evolution: a metamorphosis model of convergence and reorientation. In *Research in Organizational Behavior* 7, Cummings LL, Star BM (eds). JAI Press: Greenwich, CT:171–222.
- Vaara E, Whittington R. 2012. Strategy-as-practice: taking social practices seriously. *The Academy of Management Annals* **6**(1): 285–336.
- Van de Ven AH, Poole MS. 1990. Methods for studying innovation development in the Minnesota Innovation Research Program. *Organization Science* **1**(3): 313–335.
- Van der Heijden K. 2005. *Scenarios, the Art of Strategic Conversation*. (2nd ed.). John Wiley: Chichester, U.K.

- Van Maanen J. 1975. Police socialization: a longitudinal examination of job attitudes in an urban police department. *Administrative Science Quarterly* **20**: 207–228.
- Van Maanen J, Sørensen JB, Terence RM. 2007. The interplay between theory and method. *Academy of Management Review* **32**(4): 1145–1154.
- Vaughan D. 1996. *The Challenger launch decision: risky technology, culture, and deviance at NASA*. University of Chicago Press: Chicago, IL.
- Venkatraman N, Camillus JC. 1984. Exploring the concept of fit in strategic management. *Academy of Management Review* **9**(3): 513–525.
- Volberda HW. 2004. Crisis in strategy: fragmentation, integration or synthesis. *European Management Review* **1**(1): 35–42.
- Volberda HW, Baden-Fuller C, Kanagha S, Mihalache O. 2018. Strategizing in a digital world: implications for strategy process, content and context - special issue call. *Long Range Planning*.
- Vuorinen T, Hakala H, Kohtamäki M, Uusitalo K. 2018. Mapping the landscape of strategy tools: a review on strategy tools published in leading journals within the past 25 years. *Long Range Planning* **51**(4): 586–605.
- Wang CL, Ahmed PK. 2007. Dynamic capabilities: a review and research agenda. *International Journal of Management Reviews* **9**(1): 31–51.
- Wang CL, Rafiq M. 2014. Ambidextrous organizational culture, contextual ambidexterity and new product innovation: a comparative study of UK and Chinese high-tech firms. *British Journal of Management*. **25**(1): 58–76.
- Wassmer U, Li S, Madhok A. 2017. Resource ambidexterity through alliance portfolios and firm performance. *Strategic Management Journal* **38**(2): 384–394.
- Weick K. 1979. *The Social Psychology of Organizing* (2nd ed.). McGraw-Hill: New York, NY.

- Werle F, Seidl D. 2015. The layered materiality of strategizing: epistemic objects and the interplay between material artefacts in the exploration of strategic topics. *British Journal of Management* **26**: S67–S89.
- Wen W, Zhu F. 2019. Threat of platform-owner entry and complementor responses: Evidence from the mobile app market. *Strategic Management Journal* **40**(9): 1336–1367.
- Wernerfelt B. 1984. A resource-based view of the firm. *Strategic Management Journal* **5**(2): 171–180.
- Whittington R. 1996. Strategy as practice. *Long Range Planning* **29**(5): 731–735.
- Whittington R. 2001. *What is Strategy – and Does it Matter?* (2nd ed.). Thomson Learning: London, U.K.
- Whittington R. 2006. Completing the practice turn in strategy research. *Organization Studies* **27**(5): 613–634.
- Whittington R. 2007. Strategy practice and strategy process: family differences and the sociological eye. *Organization Studies* **28**(10): 1575–1586.
- Whittington R. 2015. Giddens, structuration theory and strategy as practice. In *Cambridge Handbook of Strategy as Practice*, Golsorkhi D, Rouleau L, Seidl D, Vaara E (eds.). Cambridge University Press: Cambridge, U.K.: 145–164.
- Whittington R. 2018. Greatness takes practice: on practice theory’s relevance to “Great Strategy”. *Strategy Science* **3**(1): 343–351.
- Whittington R, Cailluet L, Yakis-Douglas B. 2011. Opening strategy: evolution of a precarious profession. *British Journal of Management* **22**(3): 531–544.
- Whittington R, Yakis-Douglas B, Ahn K. 2016. Cheap talk? Strategy presentations as a form of Chief Executive Officer impression management. *Strategic Management Journal* **37**(12): 2413–2424.
- Wilson J. 2018. NASA history overview. 2 April.
<https://www.nasa.gov/content/nasa-history-overview> [25 May 2018].

- Winter SG. 2013. Habit, deliberation, and action: strengthening the microfoundations of routines and capabilities. *Academy of Management Perspectives* **27**(2): 120–137.
- Wright RP, Paroutis S, Blettner DP. 2013 How useful are the strategic tools we teach in business schools? *Journal of Management Studies* **50**(1): 92–152.
- Yakis-Douglas B, Angwin D, Ahn K, Meadows M. 2017. Opening M&A strategy to investors: predictors and outcomes of transparency during organisational transition. *Long Range Planning* **50**(3): 411–422.
- Yanow D, Tsoukas D. 2009. What is reflection-in-action? A phenomenological account. *Journal of Management Studies* **46**(8): 1339–1364.
- Yin R. 2009. *Case Study Research: Design and Methods*. (4th ed.). Sage: Thousand Oaks, CA.
- Zollo M, Winter SG. 2002. Deliberate learning and the evolution of dynamic capabilities. *Organization Science* **13**(3): 339–351.

Appendix A: Research instrument related to chapter 2

A1: Semi-structured interview guide for chapter 2

#	Category/ Question
Background questions	
1	Can you please provide me with a short overview of your person touching on your degree, your previous roles at AutoParts and the current one?
2	Can you please detail your involvement in GML2020?
GML 2020 – Strategy process	
3	Can you please describe in your own words what GML2020 is or tried to achieve? <ul style="list-style-type: none"> – What was the rationale behind it? – What was the key idea? – What objectives were associated with it? – Who was responsible for it/ drove it/ contributed?
4	What was the environmental landscape of AutoParts like before and during GML2020?
5	Can you please describe the strategy process associated with GML2020 and its different elements, like meetings, cockpit updates, communication etc.?
6	What organizational outcomes were associated with GML2020?
GML 2020 – Strategy tools	
7	Have any specific tools been involved in the process? If so which? (Like a framework, objectives, a roadmap, etc.?)
8	How did the following tools support the strategy development process? (E.g. in terms of grasping the business environment better, developing scenarios and discussing them, making decisions, communicating and visualizing the new strategy as well as implementing it.) <ul style="list-style-type: none"> – Vision statement – Strategy presentation

	<ul style="list-style-type: none"> – Target pictures – Objectives (overall and per function) – GML2020 house – GML2020 cockpit – Cross-functional reviews/ meetings
9	Were there any interdependencies among the tools? If so, which ones?
10	By using bespoke tools, was the strategy process different compared to previous years/ times? And if so, how?
	Development of Dynamic Capabilities
11	What benefits yielded the GML2020 process with its iterative steps for strategy development in order to overcome the uncertain environment of AutoParts and its increasingly fast-paced environment?
12	What is your understanding of an “agile” organization?
13	Would you agree with the statement that AutoParts increased its ability to sense environmental changes earlier and therefore was able to react to them quicker and more flexibly due to GML2020? If so, why?
14	Would you consider AutoParts as an agile organization? If so, why or why not?
15	What does AutoParts need to do in order to better cope with its environment/ become more agile?
16	What were the biggest hurdles to overcome in the process?
17	What were the key benefits associated with a) using the tools, b) becoming more agile?
	Closing question
18	Do you have any additional comments?

Appendix B: Research instrument related to chapter 3

B1: Semi-structured interview guide for chapter 3

#	Category/ Question
Background question	
1	Can you please provide me with a short overview of your person touching on your degree, your previous roles at the JSC and the current one?
Temporality at EISD/ JSC/ NASA	
2	How do JSC and more specifically EISD plan, especially since it is responsible for such long timelines as 20-30 years?
3	What tools do you use to facilitate planning? (E.g. scenario planning, gantt charts etc.)
4	What happens when a new US administration comes into the office? (JSC-, EISD- and NASA-level)
5	How do you deal with changes in direction, like recently when President Trump cancelled the Asteroid Redirect Mission and announced that you would go back to the Moon by 2024?
Temporal tensions, practices and capabilities	
6	Do you have the feeling that temporal tensions arise from the mission duration timelines and the frequent changes that NASA/ EISD experiences? If so, can you please describe what specific temporal tensions you have experienced?
7	What have you done to manage these temporal tensions? Do you know of any other instances where colleagues have managed tensions intentionally or unintentionally? If so, which ones?
8	What have the outcomes or the products of these practices been?
9	What challenges in managing temporal tensions have you encountered?
10	Are there any lessons learned that you could share?
11	Following the practices that you engaged in, do you have the feeling that JSC/ EISD/ NASA developed a special capability for managing the temporal tensions over time? If so, can you please describe it further?
Closing question	
12	Do you have any additional comments?

Appendix C: Research instrument and timeline for chapter 4

C1: Semi-structured interview guide for chapter 4

#	Category/ Question
Background questions	
1	Can you please provide me with a short overview of your person touching on your degree, your previous roles at the JSC and the current one?
2	What was your role in the famous Pirate team?
Pirate culture	
3	What were the characteristics of the Pirate culture?
4	How exactly were the team and its specific culture created?
5	What benefits and outcomes were associated with the Pirate team? (E.g. modernize the mission control room)
6	In your opinion, what were the key enablers of creating such a subculture?
7	What were the biggest challenges to create the Pirate culture?
8	What capabilities/ resources were built and associated with the Pirate culture, if any?
9	How did you manage to not turn the outside organization, which was not part of the Pirate team, against you?
10	What happened with the team?
Relevance of Pirate team for JSC today	
11	What legacy and lessons learned did the Pirate team leave behind, if any? (E.g. processes-wise, leadership style, artifacts, etc.)
12	How could the Pirate approach help to overcome JSC's today's challenges of a flat budget, an increased need for commercialization as well as its augmented need to collaborate with the private industry?
Closing question	
13	Do you have any additional comments?

C2: Key events and their implications on NASA's organizational culture and the Pirate subculture

Date	Event	Description of event	Implications for the organizational culture	Implications for the Pirate subculture
01.10.1958	Foundation of NASA	<p>NASA organizationally started its operations and thereby succeeded the National Advisory Committee for Aeronautics (NACA).</p> <p>At the beginning, the agency was a relatively small organization with only 8,000 employees, an annual budget of \$100 million, 3 research and 2 test facilities.</p>	<p>Due to its small size, the organization displayed a “can do”-attitude, nimble processes, and a culture of experimentation and failure.</p>	
25.05.1961	Speech of J.F. Kennedy: “Man, Moon, decade”	<p>President Kennedy significantly increased NASA's budget in 1961 and the following years to win the space race with the Soviet Union.</p> <p>NASA's number of employees and its overall organization grew to match its difficult mission ahead. Additionally, the complexity and time pressure soared for the Apollo program.</p>	<p>Kennedy's speech enflamed NASA by giving a new sense to the organization. The agency worked relentlessly on the goal, accepted risks and had a strong identity.</p> <p>With the agency's increase in size, and first mishaps (e.g. the Apollo launch-pad fire in 1967), new processes and governance structures were introduced, safety measures increased. Consequently NASA's levels of bureaucracy and complexity rose.</p>	

20.07.1969	First manned landing of humans on lunar surface	<p>Apollo 11 successfully landed on the lunar surface and two US Astronauts (Armstrong, Aldrin) became the first humans to set a foot onto the Moon.</p> <p>This achievement also meant that the US won the space race against the Soviet Union.</p> <p>After the Apollo 11 landing, public and political interest in NASA and its missions plummeted. In the aftermath, the annual budget shrank significantly.</p>	<p>With decreasing budgets but an increasing number of programs, pressures grew onto NASA employees and its contractors.</p> <p>Over time, the accepted risk increased by a process called “normalization of deviance”.</p>
05.01.1971	Start of the Space Shuttle program	President Nixon announced the development of a reusable low cost space shuttle system.	The Space Shuttle program provided new enthusiasm to the organization but also emphasized the budget pressures.
12.04.1981	First Shuttle mission (STS-1)	<p>Shuttle’s first mission took place and demarked the beginning of a new era in space flight. In total 135 missions were flown between 1981 and 2011.</p> <p>The Shuttle program served several purposes, most noticeably the launch deployment of the Hubble Space Telescope and the assembly of the ISS.</p>	<p>Even though the status of the space shuttle was moved from “experimental” to “operational” in 1982, it truly remained a developmental vehicle with limited reliability and a high need for resources (time and money) to conduct the required tests. Pressures at the time, however, led to a culture of high-risk acceptance.</p>

28.01.1986

**Loss of Space Shuttle
STS-5-L Challenger**

Seven astronauts were killed due to a leak in the joints of one of two solid rocket boosters, which caused a deadly explosion.

The Space Shuttle Program was grounded for two years after the accident.

A Presidential Commission found several technical, management, and cultural causes that led to the accident.

The recommendations of the commission had to be implemented within 30 days.

The Challenger accident came as a big shock to the agency, which had to acknowledge that the incident was not a tragic anomaly but the result of a pattern. Warning signals and earlier mishaps had been ignored due to the existing pressures.

Consequently, bureaucracy, control mechanisms, and requirements as well as testing and process steps increased significantly. The willingness to accept risk sharply decreased as to avoid another such accident by all costs. This included also the upgrade and experimentation with new technologies, to replace proven ones, and process alterations.

While the recommendations of the Presidential Commission were implemented, the founding members of the Pirate team realized that NASA's organizational culture, with its risk aversion, religious process conformity, and bureaucratic micro-management in the years after the tragedy, had lost its nimbleness and its experimental character. According to their opinion, NASA was not taking advantage of the commercial technological opportunities available and fell further behind schedule. Their proposal for small-scale research funding was accepted and work on a real-time telemetry model began. The initial small team of five Pirates enacted a very different culture, similar as the one during the time of Apollo, for their project.

In April 1988, the Pirates got to test their model and from August on, the old paradigm of the Shuttle mission control room had shifted and the system ran continuously.

01.04.1992	Daniel Goldin becomes NASA's 9th Administrator	<p>President George W.H. Bush appoints Daniel Goldin as new NASA Administrator.</p> <p>In the following Goldin implemented aggressive management reforms, e.g. he reduced the annual budget by \$40 billion.</p>	<p>Goldin's reform directly addressed criticism of NASA being a "bloated bureaucracy". His budget cuts made the acceptance of risk and alternative ways of management ok again. However, changes followed slowly due to the path-dependency of the agency.</p>	<p>The Pirate team with their subculture fit well with the new requirements from headquarters.</p> <p>The Pirate team got tasked with the redesign of the control center for the ISS. Consequently, it grew to a size of 700 contractors and civil servants. The mission control room was delivered on time and operated at lower costs and less staff than planned.</p>
1995 - 2002	Development of a new spacecraft	<p>Goldin tasked the Pirate team with the development of a prototype for an emergency crew return vehicle, also called a "lifeboat", for the ISS.</p>	<p>The new spacecraft project was established within the Engineering Directorate, which still operated largely in a traditional rather bureaucratic, slow and risk-averse fashion.</p>	<p>Although the Pirate team was tasked with the new spacecraft, only the original team members and a couple of Pirates that had joined later were chosen to switch to the new project. The rest remained with the ISS or joint other projects.</p> <p>The "Node-Pirates" purposefully enacted a similar subculture for the spacecraft project again until the project was disbanded mainly due to budget considerations.</p>

2012-2014	Upgrade of the Mission Control Center for the 21st century (MCC-21)	Upgrade of the Shuttle Mission Control Center for future human space explorations, e.g. the Orion spacecraft.	The MCC-21 is an example for the residual effect of the cultural oscillation process beyond the Pirates' existence.	The MCC-21 team consciously leveraged of the oscillated historic Pirate subculture and its approach. For this purpose, the MCC-21 team adapted the above further, so that it fit the current time and its culture as well as the MCC-21 project's objectives.
2012 -2018	New Strategic Implementation Plan for the JSC	In anticipation of becoming the new center director of the JSC, Dr. Ellen Ochoa developed a Strategic Implementation Plan for the JSC and presented it on May 1 st 2012 to the NASA Advisory Council Commercial Space Committee.	<p>The Strategic Implementation Plan encompassed among other things, the JSC's new vision and mission as well as its strategic goals.</p> <p>The plan and the subsequent change initiative "JSC 2.0" emphasized the need for ambidexterity (balance of exploration and exploitation) as well as an agile way of working.</p>	Following the presentation of Dr. Ellen Ochoa's "New Strategic Implementation Plan for the JSC", several leaders and their teams at the center were remembering the Pirates' and looking towards other innovative subcultures' practices in order to implement the "JSC 2.0" initiative. This is comparable to the specific example of the MCC-21 provided above.