The Role of Stakeholder Sentiment in Strategic Decision-Making: a Behavioral Perspective

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The Role of Stakeholder Sentiment in Strategic Decision-Making: A Behavioral Perspective

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La Faculté d'économie et de management, sur préavis du jury, a autorisé l'impression de la présente thèse, sans entendre, par-là, émettre aucune opinion sur les propositions qui s'y trouvent énoncées et qui n'engagent que la responsabilité de leur auteur.

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Dean
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1 Introduction

1.1 The Proliferation of Stakeholder Sentiment

Digitalization has rendered our world increasingly complex. Unprecedented technological progress has connected innumerable individuals, households, machines, and devices to an ever-growing digital landscape—a process that may be accelerating further in the future (George, Haas, & Pentland, 2014). For decision makers in organizations, digitalization increases the amount of information that needs to be acquired, processed, and analyzed. As data and information become ubiquitous in their daily activities, decision makers' attention may become a scarce resource (Hansen & Haas, 2001). Overwhelmed by complexity, decision makers may start to rely more strongly on their intuitions and simple heuristics (Birkinshaw & Ridderstråle, 2017). But there are countervailing forces at play. The proliferation of data has been accompanied by simultaneous advances in digital technologies for analyzing such data (Phan, Wright, & Lee, 2017). Digital technologies have become substantially more effective and efficient in processing data, allowing decision makers to discern and learn from patterns, effectively reducing complexity. This has led scholars to suggest that more data combined with more sophisticated information-processing tools may actually enable senior managers to engage in more deliberate and comprehensive decision making (Brynjolfsson & McAfee, 2014; Raisch & Krakowski, 2020). These competing forces—of increased and reduced complexity—challenge our understanding of how organizations function in the digital age. While scholars acknowledge that digitalization affects strategic decision making in organizations (George et al., 2014), there is less agreement on *how* exactly it influences managers.

With the advent of digitalization, a fundamental shift has occurred in how stakeholders interact with firms (Barnett, Henriques, & Husted, 2018; Wood, Mitchell, Agle, & Bryan, 2018). A firm's various stakeholders—including customers, employees, investors, and suppliers, as well as the government, communities, and the general public—altogether form an intricate web into which the business of the firm is tightly knit (Laplume, Sonpar, & Litz, 2008). The digital *voices* of these groups

have become louder in the recent past: Todays' stakeholders benefit from a much wider range of channels through which they can exchange and proliferate information, which allows them to approach and interact with firms in new ways (Nichols, 2013; Jurgens, Berthon, Edelman, & Pitt, 2016). For firms and researchers alike, digitalization has thus unlocked troves of new data sources that were not previously available.

Textual data holds particular promises because it comprises a wide range of stakeholder views, attitudes, and opinions. In this context, technologies in the field of Natural Language Processing are employed to extract concise but meaningful information from swaths of written or spoken word. These technologies are equally available to firms and organizations as they are to researchers. To firms, innumerable articles, blogs, and microblogs by stakeholders are available at the click of a finger. These can be monitored in real-time, allowing the firms to keep tabs on their stakeholders' satisfaction as well as on their own reputation. One established tool enabling such approaches is sentiment analysis. By assigning a numerical value to the emotional tone of a text, sentiment analysis can provide deep insight into the views, attitudes, and opinions of different stakeholder groups (Cambria, 2016). The *stakeholder sentiment* that emerges in this process captures stakeholders' diverse expectations toward the firm. Even for firms that do not yet employ sentiment-analysis tools, the sentiments of their stakeholders have become accessible through online news databases and other communication channels.

To researchers, these forces change our fundamental assumptions about how decisions are made within organizations, what capabilities firms should develop, and under what conditions firms can interact with their stakeholders. This dissertation aims to fill the gaps that the proliferation of stakeholder sentiment has exposed in the literatures of strategic management and organizational theory.

1.2 Theoretical Motivations

In the field of management, decision making in complex and uncertain environments is commonly studied using behavioral and organizational theories related to the *behavioral theory of the firm* (BTOF). This literature traces its roots to Cyert and March (1963)'s formative and highly influential book of the same name. Over half a century after its initial publication, the BTOF is still

considered one of the most influential and widely used theory lenses for strategic management scholars (Argote & Greve, 2007). Its blend of behavioral and organizational theories with theories from economics, political science, anthropology, sociology, and psychology has proven to be a powerful toolkit for management and organizational scholars (Augier & March, 2008).

At its core, the BTOF aims to explain decision making as it occurs in the real world. Organizations are described as social systems that make decisions based on their internal actors' interactions (Argote & Greve, 2007), most notably those involving managers in charge of making decisions. Managers are assumed to be boundedly-rational actors (Simon, 1958), which implies that they "satisfice" towards reference points rather than maximize with respect to some constraints. The BTOF therefore explicitly incorporates information-processing limitations and cognitive biases into its framework (Payne, Bettman, Coupey, & Johnson, 1992). It has inspired a wide range of behavioral streams in the field of management, including organizational routines (Feldman, 2000; Salvato & Rerup, 2018), performance feedback (Greve, 2003; Gaba & Greve, 2019), and organizational learning (Argote, 2011).

The bulk of prior research in the behavioral theory of the firm tradition focuses on human decision makers' information-processing limitations (Argote & Greve, 2007). Scholars investigate how the information provided to decision makers affects their subsequent decision-making behavior (e.g., Denrell & March, 2001; Rerup, 2009), under which conditions organizations are most conducive to learning and knowledge retention (Argote, 2011), and how decision makers balance multiple goals and aspirations (Joseph & Gaba, 2014; Gaba & Greve, 2019). Overall, prior studies show that, while organizational decision making under uncertainty requires the processing of considerable amounts of information, decision makers tend to use information-processing shortcuts, which often lead to suboptimal decision outcomes (Gavetti, Levinthal, Greve, & Ocasio, 2012). Constructs such as cognitive bias, selective attention, and heuristics describe how organizational decision makers process only a limited amount of information when making strategic decisions (Argote & Greve, 2007; Gavetti et al., 2012; Souder, Reilly, Bromiley, & Mitchell, 2016; Sengul, Almeida Costa, & Gimeno, 2018).

The advent of digitalization challenges our theoretical understanding of how senior managers

process information and make strategic decisions. Digitalization generally refers to three concurrent developments: The massive proliferation of data, advancement in processing power and IT infrastructure, and deep improvements in technologies to analyze data (Raisch & Krakowski, 2020). A growing number of studies suggests that this digitalization process fundamentally alters decision makers' information environment, which they rely on to acquire and process information for the decision-making process (see e.g., Brynjolfsson & McAfee, 2014; Raisch & Krakowski, 2020). There is an ongoing conflict between scholars on whether the advances that digitalization affords will diminish or improve decision quality. Some scholars suggest that more data and more sophisticated information-processing tools should enable senior managers to engage in more deliberate and comprehensive decision making (Brynjolfsson & McAfee, 2014; Raisch & Krakowski, 2020). Others, however, expect the opposite, highlighting that more information tends to overwhelm decision makers, restricting their attention (Hansen & Haas, 2001) and causing them to rely more strongly on their intuition and simple heuristics (Birkinshaw & Ridderstråle, 2017). While scholars acknowledge that digitalization affects strategic decision making in organizations (George et al., 2014), there is less agreement on *how* it influences managers' information processing and judgement. Taken together, it seems likely that digitalization affects the BTOF and its fundamental assumptions, but it is less clear how exactly these assumptions may have to change.

The effects of digitalization on firms—as well as on our theories of them—is closely related to a second gap in the behavioral literature. While many of the main developments associated with digitalization take place in the external environment of the firm, the BTOF tends to pay closer attention to processes *inside* the firm (Argote & Greve, 2007). This is a result of the needs that scholars responded to at the time of the BTOF's conception: In the postwar period, the dominant mainstream economic tradition focused on market-level outcomes of price-quantity equilibria, based on strict assumptions of perfect rationality (Pitelis, 2007). The BTOF was written in deliberate contrast to this approach, which the authors viewed as fundamentally incompatible with organizational decision-making in real life (Posen, Keil, Kim, & Meissner, 2017). The BTOF therefore focuses intensively on firm-internal factors and processes. As Cyert and March note, "*within* the firm, information is generated and processed, decisions are made, results are evaluated, and procedures are changed" (Cyert & March, 1963: 1,

emphasis added). However, in the context of accelerating digitalization, it becomes increasingly important to expand the focus of the BTOF outward, to consider the influence of the firm's external environment more broadly. An integration of external factors with the internal processes of the firm thus appears increasingly pertinent in order to maintain the BTOF's relevance in the 21st century (Argote & Greve, 2007).

Stakeholder theory provides a formidable analytical focus to study the firm's interaction with its increasingly digitalized environment. Like the BTOF, stakeholder theory appreciates organizations as highly complex structures, but it studies them as part of a wider system of stakeholder relationships: "to analyze [organizations] as 'black boxes', […] in the middle of a complex world of external forces and pressures, does not do justice to the subtlety of the flavors of organizational life" (Freeman, 1984: 216). Stakeholder theory conceptualizes the firm's business as "a set of relationships among groups that have a stake in the activities that make up the business" (Parmar, Freeman, Harrison, Wicks, Purnell, 2010: 406). These groups are not limited to primary stakeholders, such as customers, suppliers, employees, and investors, without whom the firm could not survive for long (Clarkson, 1995), or the government, which has direct legal authority over it (Eesley & Lenox, 2006). They also include secondary stakeholders, which comprise the various communities the firm is nested in (Dunham, Freeman, & Liedtka, 2006), activists and advocacy groups concerned with the firm's actions (Eesley & Lenox, 2006), as well as the environment (Phillips & Reichart, 2000). Stakeholder theory posits that value is created (and traded) through the interactions of different stakeholders and the firm, in a multi-party process that evolves continuously over time. In this perspective, it becomes the manager's task to understand, nurture, and *manage* these relationships in order to create the most value for the firm *and* its stakeholders (Freeman, 1984; Laplume et al., 2008; Parmar et al., 2010).

How firms should measure their performance toward stakeholder objectives has been the subject of debate in the stakeholder literature (Laplume et al., 2008). Rather than trying to quantify the objectives themselves, I suggest in this thesis that firms can obtain an idea of their stakeholders' views and opinions by analyzing the stakeholders' sentiment. Today's stakeholders have a wide range of channels and tools at their disposal to exchange and proliferate their views and opinions (Barnett et al., 2018). I suggest that stakeholders' digital communications represent valuable data to firms. Digitally

transmitted views and opinions allow firms to employ data analytics techniques to process and analyze stakeholders' diverse views and opinions in real-time and with relatively little effort (Nichols, 2013). Sentiment analysis tools are highly effective in this regard. By assigning a numerical value to the emotional tone in texts, these tools can substantially reduce complexity for decision makers (Cambria, 2016). Even for firms that do not yet employ such sentiment-analysis tools, the sentiments of their stakeholders have become accessible through online news databases and other communication channels.

Studying publications of various stakeholder groups—such as consumers, competitors, suppliers, and societal actors—allows us to create an index of *stakeholder sentiment*, which offers simple but efficient insights into stakeholders' diverse perceptions of issues pertaining to the focal firm. I define stakeholder sentiments as the collective views, opinions, and expectations of stakeholders toward a particular subject or object. In this regard, the index captures stakeholders' diverse sentiments in a concise and comprehensive construct, which can provide deep insight into their diffuse goal preferences (Li & Hovy, 2017). While this broad definition captures a wide range of applications, such as products and services (Archak, Ghose, and Ipeirotis, 2011; Wiley, Jin, Hristidis, & Esterling, 2014) or events and actions (Bishop, Treviño, Gioia, & Kreiner, 2019), this measure is particularly useful to gauge stakeholders' sentiment toward the firm and its actions as a whole.

The term "stakeholder sentiment" derives from the convention in other fields, which appreciate related concepts including *consumer sentiment* in economics (e.g., Carroll, Fuhrer, Wilcox, 1994; Doms & Morin, 2004), *marketplace sentiment* in marketing (e.g., Gopaldas, 2014), *investor sentiment* in behavioral finance (e.g., Tetlock, Saar-Tsechansky, & Macskassy, 2008), and *political sentiment* in various other social sciences (e.g., Jungherr, Jurgens, & Schoen 2012; Addoum & Kumar, 2016). Despite the common naming convention, prior studies criticize a lack of theorizing regarding sentiment's underlying foundation and meaning (Li & Hovy, 2017). Li and Hovy (2017) suggest that sentiment originates from a psychological state relating to "opinion holder's satisfaction and dissatisfaction with some aspect of the topic in question" (Li & Hovy, 2017: 42). Sentiment is therefore based on either (1) the holder's intrinsic preference or (2) the fulfillment of the holder's goals. There

exist several behavioral accounts explaining the significance of sentiment as a construct. These theories can be roughly categorized into three groups: (1) Sentiment is appreciated for its underlying informational value, particularly as a source of otherwise hard-to-quantify data (Tetlock et al., 2008), making it particularly relevant in situations where other data sources are unavailable (Garz, 2013). (2) The information underlying sentiments is less biased—or differently biased—than other sources of information, for example, when compared to quantitative financial variables (Tetlock et al., 2008: 1451). (3) Sentiment is a source of superior information because it reflects a collective wisdom (Gopaldas, 2014), or a "wisdom of crowds" (Chen, De, Hu, & Hwang, 2014; Surowiecki, 2005), which has superior attributes compared to single opinions.

In the field of Management, sentiment is commonly used to study either the influence of negative events, such as scandals, or as a basis to measure a firm's reputation. Regarding the former, negative news events have been shown to affect strategic change (Bednar, Boivie, & Prince, 2013), board reform (Shipilov, Greve, & Rowley, 2019), and asset divestments (Durand & Vergne, 2015).With regard to the latter, several studies have used sentiment analysis to estimate a measure of firms' reputation (e.g., Deephouse, 2000; Castellucci & Ertug, 2010), although rankings are more commonly used (e.g., Fombrun & Shanley, 1990). Stakeholder sentiment is closely related to the concept of reputation. However, whereas reputation represents an intangible asset of the company (e.g., Zavyalova, Pfarrer, Reger, & Hubbard, 2016), we conceptualize stakeholder sentiment as a stakeholder-based construct. That is, stakeholder sentiment captures the views, attitudes, and opinions of firms' stakeholders toward various subjects and objects. Sentiment can equally pertain to products and services or events and ideas. This definition is broader than that of organizational reputation, which strictly refers to what the firm is known for (Lange, Lee, & Dai, 2010). However, when the object of the stakeholder sentiment is indeed the firm itself, it can be regarded as a measure for the firm's reputation (Deephouse, 2000).

Collectively, the three papers comprised in this dissertation suggest stakeholder sentiment's potentially wider applications beyond Management as a science. Increased computing power, advanced algorithms, and steadily rising amounts of data provide firms with immense opportunities. Sentiment is part of a wider shift from periodic snapshots of quarterly performance and infrequent analyst forecasts

to high-frequency data sources that are updated in real time. Text analytics has unlocked troves of new data sources that are not only broader in their informational value than financial data (Chen et al., 2014). In further contrast to financial data, sentiment enables managers to "dig deeper" into relevant events and scenarios (Atuahene-Gima & Li, 2004). Stakeholder sentiment is a promising avenue in this context. By facilitating a deeper understanding of issues stakeholder care about, it can enable firms to improve their stakeholder relationships in a mutually beneficial way. In practice, decision support systems are waiting to be employed in a diverse range of areas, including strategic planning, product design, and stakeholder engagement. Software solutions can enable decision makers to quickly narrow down lists of thousands of stakeholder publications into a precise set of articles that are relevant to the specific problem at hand[1]. The proliferation of stakeholder sentiment thus holds substantial promises for firms—but only if it is managed well. Like researchers, management practitioners will need to adapt their technological repertoire and expertise in order to reap the benefits of an increasingly connected world. To stay competitive in an increasingly digital world, managers will need to adapt their decision-making processes in order to incorporate these new technical capabilities. This challenges scholars and practitioners alike to develop robust tools that are commensurate with the evolving context of business firms.

The role of complexity in and around organizations has been one of the central columns of research in the tradition of the behavioral theory of the firm and is likely to remain for some time. Many gaps in our understanding of organizational behavior have become more pertinent through the evolving landscape of the sentiment that various stakeholder groups form and disperse. Emanating gaps are only starting to become clear. This dissertation sheds light on some of these emerging issues and aims to contribute to our theoretical understanding of such processes, for a better understanding of organizational behavior in the digital age.

[1] For example, Lausanne-based Finity AI offers such solutions to a wide range of clients, https://finity.ai.

1.3 Dissertation Overview

This dissertation comprises three papers focusing on different roles that stakeholder sentiment plays in the management literature. All three papers combine a strong theoretical foundation with an applied empirical project. The first two papers are coauthored by Sebastian Raisch (University of Geneva) and Johannes Luger (Copenhagen Business School). Both are based in the tradition of the behavioral theory of the firm, scrutinizing how stakeholder sentiment affects decision processes inside firms. The third paper is a single-authored study based in the organizational reputation literature. The following section presents a brief overview of each paper's subject matter.

The first study is rooted in behavioral theory and draws on problemistic search arguments. The study examines how organizations respond to diffuse goals set by their stakeholders. We demonstrate empirically that stakeholder sentiment, which captures stakeholders' collective assessment of an organization against their expectations, systematically affects firms' problemistic search processes. By integrating stakeholder theory arguments with extant behavioral theory on multiple goals, we show how firms balance diffuse stakeholder goals with their explicit profitability goal. Our results suggest that firms engage in higher problemistic search when stakeholder sentiment and profitability jointly fall below aspiration levels. We further find that underperformance toward stakeholder sentiment triggers problemistic search even when profitability goals are met. Our main contribution to the behavioral theory of the firm is a new theoretical perspective highlighting the role of diffuse goals in organizational decisions, and specifically recognizing their importance in enabling firms to attend to multiple goals simultaneously.

In the second study, we examine organizational decision making in the digital age. The proliferation of digital data and technologies challenges behavioral theory's assumptions about decision making in organizations. Prior research suggests that greater information availability forces decision makers to restrict their attention due to their information-processing limitations. Using data on the pharmaceutical industry from 2005 to 2016, we analyze how external experts' collective evaluations affect firms' corporate capital allocation decisions. Our findings show that the higher the expert sentiment regarding a strategic business unit's product-technology domain, the higher the share of

capital allocated to it. We further find that low information determinacy and quantity affect this relationship negatively. Our study contributes to behavioral theory by showing that, in the digital age, corporate managers consider more comprehensive information than traditionally assumed. Furthermore, we clarify the boundary conditions that enable or hinder more comprehensive information processing.

Finally, in the third study, we draw on the organizational reputation literature to study the implications of a stakeholder-centric nexus on the causal relationship between reputation and financial performance. Reputation is an important intangible resource that has been shown to affect firms' financial performance. However, financial performance has been equally proposed as an antecedent to organizational reputation. To shed light on this conflict, we study the causal reputation-performance relationship contingent on the stakeholder group by which the reputation is held. Drawing on stakeholder theory, we provide a detailed theoretical account that distinguishes stakeholder groups based on their relationship with the firm. We derive hypotheses regarding the odds of a causal relationship based on this model and employ a novel approach to study it empirically. Our results, based on a dataset of over 290,000 stakeholder publications and vector auto-regressive models, lend partial support to our main hypotheses, which propose a causal relationship contingent on the depth and locus of the firm-stakeholder relationship.

2 The Pursuit of Diffuse Goals: Stakeholder Sentiment and Firm Search

2.1 Introduction

Problemistic search is a mainstay of organizational theories in the Carnegie tradition (Cyert & March, 1963; Gavetti et al., 2012). It describes firm behavior as the result of performance feedback loops, where underperformance against organizational goals triggers a search for solutions to the underlying problem. While profitability is generally regarded as the primary organizational goal for firms (Shinkle, 2012), more recent studies have shown that organizations also consider additional goals, such as size (Greve, 2008), market share (Baum, Rowley, Shipilov, & Chuang, 2005), and safety (Gaba & Greve, 2019). Multiple goals are translated into reference points against which organizations evaluate their performance either independently (e.g., Gaba & Joseph, 2013) or interdependently (e.g., Gaba & Greve, 2019). This goal-setting process is central in explaining a wide range of organizational behaviors and outcomes (Posen et al., 2017).

A common feature of the goals that the literature has studied is that they are *explicit*. Decision makers are assumed to focus on specific goals that are stable and shared within the organization (Cyert & March, 1963; Greve & Gaba, 2017). There is as-of-yet no theory predicting firms' reactions to more diffuse goals, such as those set by dispersed stakeholders' expectations toward the firm. This is problematic because the digital age has enabled stakeholders to raise and promote new expectations at an increasing pace (Barnett et al., 2018). Coinciding with the proliferation of data, sophisticated data analytics techniques have emerged, enabling firms to monitor their stakeholders' expectations directly and on a real-time basis (Rathore, Kar, & Ilavarasan, 2017). Such technologies support a crucial role of managers in contemporary firms, who must understand and nurture the firm's complex relationships with its stakeholders to maximize value (Freeman, 1984; Parmar et al., 2010). It is therefore crucial to examine whether organizations assign attention to *diffuse* goals, such as expectations that dispersed stakeholders raise, which are non-specific, shifting, and sometimes in conflict with an organization's

explicit goals.

We develop and test theory on how organizations attend to stakeholder sentiment, or their collective assessment of the organization against their expectations, in their problemistic search. Sentiment analysis allows organizations to analyze thousands of assessments and to identify their underlying expectations, root causes, and qualifiers (Cambria, Das, Bandyopadhyay, & Feraco, 2017). Sentiment has been shown to have a high explanatory power over a wide range of organizational decision processes and outcomes, including strategic change (Bednar et al., 2013), board reform (Shipilov et al., 2019), and asset divestment (Durand & Vergne, 2015). Stakeholder sentiment contains valuable information that may help decision makers track and predict emerging problems but could equally be of use for better diagnosing and understanding existing problems (Hogenboom, Van Iterson, Heerschop, Frasincar, & Kaymak, 2011). In this article, we develop hypotheses that consider the role of stakeholder sentiment in the context of goal-setting theory and show that the evidence is consistent with the diffuse goal model.

Our main thesis is that stakeholder sentiment provides valuable information that is pertinent to organizations' problemistic search processes. Stakeholder sentiment is valuable because it is not specific to any explicit firm goal but rather allows for monitoring performance towards multiple conflicting goals. It further enables real-time performance feedback and integrates distributed actors' diverse inputs. Given the increasingly pervasive use of sentiment analysis tools, organizational decision makers can process this rich information at a relatively low cognitive cost. We therefore suggest that organizations evaluate stakeholder sentiment similarly to explicit firm goals, by forming aspiration levels against which they evaluate their firm's performance. Based on the central premise of problemistic search, we expect that decision makers interpret underperformance to stakeholder sentiment aspiration levels as an indication for problems, triggering a search for solutions that continues until performance is restored.

Furthermore, we argue that the rich information that stakeholder sentiment provides should allow organizations to diagnose the performance problems they face more comprehensively. Sentiment analysis relies on machine-learning algorithms to identify complex patterns of diverse expectations and

their interrelations. These inputs may enable firms to attend to multiple goals simultaneously. We therefore expect problemistic search to increase when underperformance towards stakeholder sentiment coincides with profitability shortfalls. Moreover, we expect stakeholder sentiment below aspiration levels to trigger problemistic search even when profitability is above aspiration levels. In these situations, stakeholder sentiment may help organizations predict and attend to problems that do not presently affect profitability but are likely to do so in the future if left unattended by the organization.

We test our propositions in the context of the global automotive industry. This industry is an appropriate context for analyzing the attention to diffuse goals because cars have become a highly contested product in recent times. What was once an industry with stable expectations now faces complex and disruptive demands from a wide range of stakeholders. Responses require unprecedented levels of technological search in areas such as automation, digitalization, and electrification. We therefore predict that automotive firms adjust their research and development (R&D) search intensity based on the collective expectations that their stakeholders' sentiment convey. Our empirical project, based on 277 observations from 38 firms in the global automotive industry, provides supporting evidence for our propositions.

Our paper makes two main contributions. First, by showing that organizations do not just respond to aspirations around explicit firm goals but also consider diffuse goals such as stakeholder sentiment, we provide a more comprehensive conceptualization of goal formation in contemporary organizations. This conceptualization extends the behavioral view of the firm by examining how organizations capture weak signals and highly distributed information in their search decisions. Second, our study shows that multiple goals must not necessarily be in conflict with one another and requiring priority ordering (e.g., Gaba & Greve, 2019; Rowley, Shipilov, & Greve, 2017). In the context of explicit and diffuse goals, multiple goals can provide complimentary signals and insights. This benefits the organizational goal setting process by facilitating the analysis of the latent problems underlying performance shortfalls as well as fostering the search for more synergistic solutions. In consequence, contemporary organizations' problemistic search processes may be more concerned with goal diagnosis to embrace synergistic solutions than goal selection to narrow the organizational attention to parochial solutions.

2.2 Organizational Goals and Problemistic Search

Organizational goals and problemistic search are central concepts in the behavioral theory of the firm (BTOF) (Cyert & March, 1963; Gavetti et al., 2012; Shinkle, 2012), which have influenced a much wider set of organizational theories (Posen et al., 2017). In this Carnegie tradition, organizational goals are seen as a set of constraints that enable managers to develop and implement appropriate courses of action (Simon, 1964). Managers evaluate the organization's performance toward goals in relative terms, by comparing it to aspiration levels. Underperformance against aspiration levels triggers problemistic search; a process with the intention to define the problem, determine an appropriate solution, and ultimately restore performance above the aspiration level (Posen et al., 2017).

An important insight from this research is that organizational goals are contested and political behaviors such as coalition building are essential in selecting and prioritizing goals (Cyert & March, 1963). Organizational goals are formed by considering multiple preferences within the firm. These goals subsequently direct the organization's attention and the allocation of resources towards those preferences. Most of the extant empirical work has focused on profitability goals (Shinkle, 2012). Recent research also highlights the importance of additional goals that go beyond profits. For example, Baum et al. (2005) find that firms form goals for market share and network status as reference points for performance feedback; Greve (2008) find evidence for firms attending to growth goals; Kotlar, Massis, Wright, and Frattini (2018) highlight the importance of ownership control as a goal for problemistic search; and Rowley et al. (2017) show that firms attend to their placement in corporate governance rankings.

Considering the heterogeneity of firm goals, research has also started to explore firm adaptation to multiple goals. Some empirical studies have treated multiple goals as independent determinants of firm activities (Baum et al., 2005; Gaba & Joseph, 2013; Rowley et al., 2017). For example, Gaba and Joseph (2013) analyzed how profitability at both the corporate and the business unit levels affect business unit activities independently. In contrast, another set of studies has considered the interdependencies between multiple goals. The dominant approach is to assume that organizations pursue multiple goals sequentially in a way that less important goals are considered only once the

primary goals are fulfilled. For example, Greve (2008) shows that organizations only attend to organizational size when their profitability is above aspiration levels. Similarly, Stevens, Moray, Bruneel, and Clarysse (2015) find that social enterprises attend to financial performance as their primary goal while their attention to social goals is restrained to situations where their profitability is above aspiration levels. Collectively, these studies suggest that firms attend to other goals only when the primary goal of profitability is met (Shinkle, 2012). While these studies suggest that firms do not consider multiple goals jointly, Gaba and Greve (2019) analyze firms' attention to the conflicting goals of profitability and safety. They argue that airline companies choose between these conflicting goals conditional on the situation. If profitability is below aspirations, survival concerns make decision makers choose the safety goal over the profitability goal since it is more essential for survival. The study shows the importance of considering multiple goals as interdependent and extends prior research by providing evidence that the priority order between multiple goals can vary across situations.

Collectively, this prior work is based on two strong assumptions. First, it assumes that organizations focus on explicit goals (Cyert & March, 1963; Greve & Gaba, 2017). Organizational goals such as profitability, size, network status, or corporate governance rankings are explicit in the sense that they are specific, relatively stable, and widely shared within the organization. Integrating such explicit goals into the organizational goal-setting process focuses decision makers' subsequent attention on specific issues and the associated courses of action while blending out others that go beyond those goals (Simon, 1964). The work on explicit goals is important because it provides insight into how organizations narrow their attention to specific goals and prioritize among these goals. Yet it does not account for more diffuse goals, such as those set by dispersed stakeholders' expectations towards the firm. These expectations may be associated with multiple of the firm's explicit goals, could be contrary to these goals, and sometimes even go beyond the firm's current set of explicit goals (Mitchell, Agle, & Wood, 1997). Not considering the potential role of such diffuse goals means that predictions of organizational search behavior are incomplete.

Second, prior research assumes that multiple goals are contradictory. This trade-off perspective maintains that "the satisfaction of one goal comes at the expense of achieving one or more other goals"

(Gaba & Greve, 2019: 649). Consequently, firms chose between conflicting goals following a stable goal hierarchy (Cyert & March, 1963) or considering situational requirements (Gaba & Greve, 2019). While these arguments are important for highlighting contradictions between goals, they ignore the potential for complementarities between goals. Increasing information availability could help firms diagnose their performance problems more comprehensively, which may allow them to find solutions that attend to multiple goals. For example, companies increasingly use sentiment analysis to gain deep insight into their stakeholder's overlapping and conflicting expectations (Hogenboom et al., 2011). Disregarding the possibility of multiple goals' complementary signals and inputs may result in a partial account of goal formation and problemistic search in contemporary organizations.

2.3 Stakeholder Sentiment and Organizational Goals

Stakeholder theory conceptualizes the firm's business as an intricate web of relationships between different stakeholders, which jointly creates value for the firm as well as for the system itself (Parmar et al., 2010). The term stakeholder refers to "any group or individual who can affect or is affected by the achievement of an organization's objectives" (Freeman, 1984: 46). Value is created and traded through the interactions between the firm and its customers, employees, shareholder, and suppliers, as well as the communities, institutions, and the environment within which it is nested. The firm thus depends on the resources and support of dispersed stakeholder groups for its continued success and survival (Phillips, 2003). Firm managers face the challenge to understand and nurture these relationships, in order to maximize the value for the system. Stakeholder theory specifically suggests that firms should analyze and address their stakeholders' expectations systematically to anticipate unforeseen events, prevent foreseeable problems, and improve access to essential resources (Freeman, 1984).

Dispersed stakeholders have expectations that are sometimes aligned but can also be conflicting both between different stakeholders and between stakeholders and the firm (Barnett et al., 2020; Butterfield, Reed, & Lemak, 2016). These expectations can affect different firm goals. For example, shareholders may have expectations toward profitability goals, societal actors toward social goals, and

suppliers toward network goals. Some stakeholder expectations affect multiple firm goals. For example, stakeholders' demands for a transition from petroleum-based to electric drive vehicles may affect firm profitability, size, and social goals. Stakeholders can also raise entirely new expectations that fall outside the firm's current set of goals, such as emergent demands for social responsibility, gender equality, and sustainability (Berman, Wicks, Kotha, & Jones, 1999). Furthermore, stakeholder expectations can undergo large changes and have little temporal stability (Nason, Bacq, & Gras, 2018).

Stakeholders communicate their expectations across various channels to gain firms' attention. The digital age has enabled dispersed stakeholders to raise and promote new goals and expectations at an increasing pace (Barnett et al., 2018). This development has particularly amplified the voices of secondary stakeholders, which previously tended to go unheard (Jurgens et al., 2016). Stakeholder can provide valuable information that can lead to greater firm efficiency or innovation (Harrison, Bosse, & Phillips, 2010). Scholars have recognized how the influence of stakeholders on a firm's strategies has increased dramatically in recent years (Parmar et al., 2010). However, they have also argued that boundedly-rational firm actors may be overwhelmed by the flow of stakeholder information in the digital age, which could force them to be more selective and less responsive (Barnett et al., 2020).

Stakeholders assess the firm relative to their expectations (Mitchell et al., 1997). Firms falling below shareholders expectations risk losing crucial legitimacy and shareholder support. Nason et al. (2018) have therefore argued that firms are likely to act when they fall below stakeholder expectations. However, not all stakeholders provide feedback to firms and not all feedback is addressed by firms (Waldron, Navis, & Fisher, 2013). It is pragmatically impossible for managers to attend to all claims that stakeholders put forward towards the firm (Mitchell et al., 1997). Moreover, ignoring or taking symbolic actions may be viable responses to negative feedback stemming from activists or less salient stakeholders (McDonnell & King, 2013). However, violating salient stakeholder expectations, those made by powerful stakeholders (Mitchell et al., 1997), can destabilize firm operations (Pajunen, 2006) and even threaten their survival (Suchman, 1995). Firms should therefore continuously monitor their stakeholders' goals and satisfaction regarding the firm's performance towards these goals (Freeman, 1984).

It has been the subject of debate in the stakeholder literature how firms should monitor their performance towards stakeholder objectives (Laplume et al., 2008). In a conceptual paper, Nason et al. (2018) assume that firms cannot capture diffuse stakeholder expectations comprehensively and measure them against a reference point. Firms are therefore expected to formulate explicit goals that capture shareholders' expectations partially. For example, Rowley et al. (2017) show how a consortium of stakeholders' corporate governance ranking provides participating firms with an explicit set of objectives. The ranking's underlying requirements are specific, stable, and universally agreed upon by the consortium members. Such rankings may be important inputs to the organizational decision-making process. However, they fail to recognize stakeholder expectations comprehensively. For example, only select groups of stakeholders are members of the consortium, and even those stakeholders that are part of the consortium may have other expectations than those related to corporate governance. Furthermore, those expectations can change more rapidly than the relatively stable criteria of such rankings permit, and they may not be all as easily acceptable to the focal firm than those they agreed on when joining the consortium.

In recent years, stakeholder sentiment has emerged as an alternative measure of dispersed stakeholders' collective expectations toward the firm (Hogenboom et al., 2011). Sophisticated technologies allow firms to conduct fine-grained analyses of thousands of assessments and their underlying expectations, root causes, and qualifiers (Liu, 2017). Such sentiment is driven by actors' emotions and their rational analysis of how well one or several of their goals are fulfilled (Li & Hovy, 2017). By assigning a numerical value to the opinions expressed, sentiment analysis substantially reduces cognitive complexity for decision makers (Cambria, 2016). Even for firms that do not yet employ such sentiment analysis tools, stakeholder sentiment has become accessible through online news databases and other communication channels. Stakeholder sentiment is a comprehensive construct, which integrates varied expectations held by different actors (Liu, 2017). It can thus provide deep insight into complex patterns of determinants underlying existing or newly emerging problems (Hogenboom et al., 2011; Wang and Zhai, 2017). In this study, we explore the role of stakeholder sentiment as a diffuse goal separately, as well as its interaction with profitability as an explicit goal, for

problemistic search.

2.4 Hypotheses

2.4.1 Pursuing Stakeholder Sentiment

Firms can be expected to monitor and analyze stakeholder expectations for both instrumental and normative motivations (Berman et al., 1999; Freeman, 1984). Attention to stakeholder expectations help firms avoid decisions that might prompt stakeholders to undercut or thwart its objectives by withdrawing their support (Pajunen, 2006) and/or questioning the firm's legitimacy (Suchman, 1995). Firms should therefore be inclined to attend to stakeholder sentiment because of its strategic value to the firm. Furthermore, firms have a moral obligation to stakeholders because their actions can affect them negatively (Parmar et al., 2010). Firms may therefore have an intrinsic motivation to attend to stakeholder expectations in order to avoid harm and/or create value for them (Freeman, 1984).

Given the increasing availability of stakeholder sentiment (Hogenboom et al., 2011), as well as the increasing use of sophisticated tools to analyze sentiment (Cambria et al., 2017), we expect firms to attend to their stakeholders' expectations by monitoring stakeholder sentiment, for two main reasons. First, stakeholder sentiment as a diffuse goal has a high informational value. Contrary to more explicit goals, such as corporate governance rankings (Rowley et al., 2017), stakeholder sentiment provides diffuse information from dispersed stakeholder groups covering their varied expectations towards the firm. Such diffuse information allows firms to track their performance across multiple overlapping or conflicting goals rather than constraining their attention to the limited worldview that explicit goals afford. Such constrained attention implies the risk of missing out on important expectations and/or underestimating the complexity of current performance problems, which leads to the adoption of partial strategies. Furthermore, sentiment provides real-time information and integrates distributed actors' diverse inputs (Liu, 2017), which reduces firms' risk to miss important developments that may cause subsequent problems.

Second, stakeholder sentiment provides such rich information at a relatively low cognitive cost (Hogenboom et al., 2011). Contrary to more traditional forms of monitoring stakeholder expectations,

which have been related to problems of information overload (Barnett et al., 2020), stakeholder sentiment provides decision makers with easily accessible and interpretable metrics that are continuously updated. Sentiment analysis tools rely on natural language processing to convert large quantities of unstructured assessments into numerical values (Cambria, 2016). They further use machine-learning algorithms for finer-grained analyses of the causes and the qualifiers of the assessment (Liu, 2017). Even firms that have not yet adopted such sophisticated tools generally employ more basic news analytic tools, which allow them to track stakeholder sentiment and quantify it in readily available metrics (Rathore et al., 2017).

Consistent with the general argumentation for problemistic search, we suggest that relative changes in stakeholder sentiment – rather than their absolute levels – are associated with risk-taking or search decisions in organizations. According to the behavioral theory of the firm, decision makers simplify the task of interpreting their performance toward goals by evaluating it relative to an aspiration level (Cyert & March, 1963). A central insight from this theory is that performance shortfalls capture decision makers' attention more strongly than performance above aspirations (Gavetti et al., 2012). This logic applies similarly to the context of our study, where external stakeholders' expectations inform the goal-formation process (Locke, Latham, & Erez, 1988; Rowley et al., 2017). Firms can set aspiration levels for stakeholder sentiment in reference to their own past performance (historical aspirations; Greve, 2008), as well as relative to the stakeholder sentiments of their peers (social aspirations; Mishina, Dykes, Block, and Pollock, 2010). As a firm's stakeholder sentiment falls below its aspiration level, it indicates stakeholders' discontent with the focal firm. For managers who are aware of and account for stakeholders' views on their firm, such a shortfall is likely to trigger search behavior with the objective to satisfy the concerns of its stakeholders and avoid the threat of losing crucial stakeholder support (Pajunen, 2006). This logic describes a problem-driven reaction by the firm, aiming to draw attention to potential problems, challenge the status quo, and stimulate search for new practices, strategies, and courses of action. Conversely, we do not expect search if stakeholder sentiment is above expectations given the cost and the uncertain financial benefits of investing into stakeholder initiatives that were not demanded or expected (Nason et al., 2018).

We expect stakeholder sentiment below aspiration levels to result in increased R&D search intensity, which allows firms to solve a wide range of problems through innovation. R&D search intensity is a common decision variable in the performance-feedback theory (Bromiley and Harris, 2014). Behavioral theory scholars regard search through R&D as a primary mechanism through which organizations seek to solve various performance problems, especially those stemming from outdated products, services, and technologies (Greve, 2003; Vissa, Greve, & Chen, 2009). Innovation through more intensive R&D search can subsequently enable firms to renew their product range, charge higher prices, and/or reduce costs in order to close performance shortfalls (O'Brien & David, 2014). As a result, firms can develop new market niches and/or establish market strongholds over competitors (Vissa et al., 2009). This view of problemistic search is closely aligned with our empirical context, the global automotive industry, which has faced continuous stakeholder challenges associated with a need for R&D search in order to replace outdated products, services, and technologies through automation, digitalization, and electrification.

Hypothesis 1: Firms increase their R&D search intensity when their stakeholder sentiment is below its aspiration level

2.4.2 Pursuing Stakeholder Sentiment and Profitability

An important debate in the literature on problemistic search addresses how firms allocate attention between multiple goals (Gaba & Greve, 2019; Shinkle, 2012). Prior studies generally take a trade-off perspective, which assumes that goals are in conflict and firms have to prioritize between them. Empirical research on this trade-off perspective has taken two approaches. The first is based on the original conceptualization of Cyert & March (1963) and thus assumes a fixed goal hierarchy (e.g., Greve, 2008; Rowley et al., 2017; Stevens et al., 2015). Profitability is commonly regarded as the goal of the highest priority because it is consequential for the resources that the firm has at its disposal (Greve, 2008). If profitability falls below aspirations, the focus is thus exclusively on this goal. Other goals are only addressed if profitability is above aspirations. Applied to our study, this logic suggests that firms attend to their stakeholder sentiment goal only when their higher-priority profitability goal is fulfilled.

The second approach has been to assume that decision makers choose between multiple goals dependent on the situation. Gaba and Greve (2019) argue that if profitability is below aspirations, it creates survival concerns that make decision makers choose the goal that is most vital for survival. Conversely, if profitability is above aspirations, there is little need to take risks and, thus, little search. Applied to our study, this rationale suggests that shareholder sentiment is only associated with search if profitability is below aspirations. In that case, survival would be at risk, and stakeholders (and their expectations) would be most essential to ensure survival (Nason et al., 2018).

To conclude, prior research's focus on trade-offs between multiple goals leads to contradictory expectations for our study of shareholder sentiment. Whereas the first approach suggests that firms would only consider a stakeholder sentiment goal when profitability is *above* aspirations, the second approach claims that such search behavior could only be expected when profitability is *below* aspirations.

We argue that these inconsistencies arise from prior theory's tendency to downplay an important part of the search process: the definition of the problem that an organization faces. In their review of the problemistic search literature, Posen et al. (2017) have criticized the extant literature's tendency to link a problem (i.e., performance below aspiration levels) directly to an outcome (i.e., problemistic search). This practice treats the actual search process as a black box, neglecting the fact that organizations that face a performance downfall do not necessarily know what exactly the problem is or how it should be addressed. Firms must engage in problem definition, the process of diagnosing the problem to identify the space of possible solutions (Posen et al., 2017). Since decision makers are limited by their bounded rationality, their representations of the problem are invariably incomplete (Gavetti & Levinthal, 2000), which means they tend to adopt partial solutions, such as choosing to prioritize one goal over another.

We suggest that stakeholder sentiment may allow decision makers to diagnose performance problems more comprehensively, for several reasons. First, stakeholder sentiment extends the breadth of information that is taken into consideration. Whereas explicit goals focus the organizational attention to specific information relevant for these goals (Simon, 1964), diffuse goals such as stakeholder

sentiment broadly capture information associated with dispersed stakeholders' diverse goals and expectations. Sentiment analysis can assign concrete weights indicating different goals' importance (Wang & Zhai, 2017) and their respective degrees of fulfillment (Li & Hovy, 2017). Second, stakeholder sentiment increases the depth of information that is considered. Sentiment analysis allows for capturing insight from huge quantities of unstructured, qualitative data that are otherwise difficult, or even impossible, to grasp (Tetlock et al., 2008). Sentiment analysis provides fine-grained analysis of such data to identify concrete expectations, as well as their underlying causes and qualifiers (Liu, 2017). Third, the combination of greater breadth and depth should allow firms to generate insight with respect to multiple goals. Greater breadth provides a more systemic view of problems and their associations with multiple goals. Greater depth allows for discerning complex patterns that reveal the interrelations across goals (Li & Hovy, 2017). Finally, the use of sentiment and sentiment analysis tools reduce the cognitive load and complexity for decision makers in processing data and diagnosing problems significantly (Cambria, 2016).

More comprehensive problem diagnosis allows for more inclusive problem definition (Posen et al., 2017). Firms monitoring and analyzing diffuse goals such as stakeholder sentiment should thus be more likely to not only perceive the contradictions between multiple goals but also their complementarities. This increases their ability to attend to multiple goals simultaneously rather than sequentially. Stakeholder theory suggests that significant value creation can be achieved through identifying synergies between different stakeholders' expectations (Tantalo & Priem, 2016). Stakeholder sentiment should make it easier for firms to discern such complementarities. We therefore expect that firms attend to stakeholder sentiment and profitability goals simultaneously. Specifically, we predict that problemistic search increases when underperformance towards stakeholder sentiment coincides with profitability shortfalls. The richer information that stakeholder sentiment affords should allow firms to transition from a simple trade-off perspective (considering *either* one *or* another goal) toward a more synergistic perspective (considering *both* one *and* the other goal). For example, R&D search could allow firms to develop new products that increase profits while also fulfilling stakeholders' expectations towards greater environmental sustainability. We therefore expect R&D search intensity

to increase when stakeholder sentiment and profitability are simultaneously below their aspiration levels.

Hypothesis 2: Firms increase their R&D search intensity when stakeholder sentiment below its aspiration level coincides with profitability below its aspiration level

Extending this synergistic goal perspective further, we see two main reasons why stakeholder sentiment below aspiration levels should trigger problemistic search even when profitability aspirations are *above* aspiration levels. First, empirical stakeholder theory studies provide evidence that attending to stakeholder expectations improves firm profitability (e.g., Berman et al., 1999). Similarly, scholars argue that neglecting salient stakeholder expectations hurts firm profitability or even threatens firm survival (Nason et al., 2018). The stakeholder sentiment goal and the profitability goal are therefore not independent but interdependent firm goals. Performance below aspiration levels towards either one of these goals is therefore likely to affect the other goal if unattended. Profit-oriented firms should therefore attend to underperformance with respect to shareholder sentiment even in the absence of profitability problems.

Second, we suggest that stakeholder sentiment works as an early warning system when profitability aspirations are fulfilled. Stakeholder sentiment's high informational value can provide weak signals of possible future profitability issues, thus allowing firms to anticipate adverse events. This proposition is in line with Freeman (1984)'s formative thesis, where he proposes stakeholder analysis tools as a means to prevent unfavorable events (Laplume et al., 2008). Stakeholder sentiment's intrinsic informational value improves organization's predictive ability (Cambria, 2016; Hogenboom et al., 2011). It should help firms to overcome some of their myopia in situations where profitability is above aspirations. Stakeholder sentiment fulfills this role by providing clear signals through the negative feedback it provides. These signals may be associated with the firm's current goals but could also point to salient issues that emerge outside the current set of explicit firm goals. If the negative signals that firms perceive from their stakeholder sentiment risk to threaten their future profitability, those firms should be motivated to engage in problemistic search even if their current profitability does

not yet indicate a performance problem.

Hypothesis 3. Firms increase their R&D search intensity when stakeholder sentiment is below its aspiration level while profitability is above its aspiration level

2.5 Method

2.5.1 The Global Automotive Industry

Our empirical analysis uses firm-level data from the global automotive industry. The automotive industry has seen constant change since Henry Ford built the first assembly line in 1910. Particularly the last two decades have brought about substantial technological advancements, such as drive-by-wire electric systems and driving assistants (Mohr et al., 2013). Environmental scandals, such as Volkswagen's diesel-emissions scandal, have caused increased stakeholder pressures for cleaner technologies (Topham, Clarke, Levett, Scruton, & Fidler, 2015). Innovative new entrants such as Google and Tesla have heightened stakeholders' attention to autonomous driving technology. Stakeholders' changing mobility choices are reshaping the very nature of car ownership and usage, requiring automotive firms to develop innovative solutions to address these shifting demands. What was once an industry with stable expectations now faces complex and disruptive demands and expectations from its stakeholders. Responses require unprecedented levels of technological innovation in multiple areas, including electrification, digitalization, and automation. Taken together, these factors make the automotive industry an excellent context for our study.

Automotive manufacturers and their component suppliers are the subject of a multitude of digital publications, representing the viewpoints of dispersed stakeholders. A wide range of digital publications that we gathered reflect the opinions of customers, particularly private clients (e.g., *AutoWeek*), commercial clients (e.g., *Fleet Owner*), and motorsport enthusiasts (e.g., *Autosport*). Other publications represent the distinctive views and opinions of suppliers (e.g., *Tire Business*), managers (e.g., *Automotive News Europe*), shareholders (e.g., *Financial Times*), and governments or regulators (e.g., *Automotive Plans & Government Policies*). Furthermore, there are publications that cover several of these stakeholder groups at the same time (e.g., *Traffic World*). Finally, we included the automotive

sections of global newspapers, such as the *New York Times* and the *Washington Post*, which often feature the viewpoints of communities, environmentalists, and society at large. While this list is by no means exhaustive of the full spectrum of stakeholders' views and opinions, and only covers a selections of the channels through which these views can be expressed, it nevertheless provides a wide sample of the most often-cited stakeholder groups (Parmar et al., 2010) and a broad array of their expectations and interests. This relatively unique diversity of viewpoints allows us to measure and study the dispersed stakeholders' sentiment.

2.5.2 Sample Construction

Our empirical study is based on two major data sources. Historical firm accounting data is obtained from Standard & Poor's *Compustat* database, which collects financial and operational information for all US-listed companies. The database includes international firms that are cross-listed on US-exchanges, which is the case for most large automotive manufacturers and their component suppliers. Furthermore, we use the *Lexis Nexis* database to obtain news articles from English-speaking trade, industry, and consumer publications covering the global automobile industry between 2005 and 2016. To create the sample, we selected all firms registered under the SIC-code 371 ("Motor Vehicles and Equipment"). Firms in this industry segment include manufacturers of motorized vehicles (cars, trucks, buses, etc.) as well as suppliers auf auto parts, components, and accessories. News articles were subsequently matched for each year using the names, or close equivalents, of the companies in our sample. This process resulted in a longitudinal dataset of 154 automobile firms with 1,262 observations.

2.5.3 Dependent Variable

R&D search intensity: Our dependent variable is measured as total R&D expenditure divided by total sales. This is a common approach to measuring R&D search intensity, on which many prior studies rely (e.g., Chen & Miller, 2007; Gentry & Shen, 2013; Greve, 2003; Lim & McCann, 2014; O'Brien & David, 2014). Dividing R&D expenditure by sales has the advantage that it accounts for the size of firms' production and sales activities. Large R&D to sales ratios indicate that a firm are specialized on R&D, which may require decision processes that are different from those generally described in behavioral theory of the firm studies (Chen & Miller, 2007; Cyert & March, 1963). Further, R&D search

intensity may not account for the full range of innovation-focused search activities firms undertake in response to performance shortfalls (Gentry & Shen, 2013). Greve (2003) argues that because R&D expenditure is a proxy for a wider set of firm activities to solve problems through innovation, its underlying behavioral process is most likely identical to that of related search processes, which suggests that level-changes in R&D search intensity should be more or less proportional to changes in those processes.

2.5.4 Independent Variables

Profitability: We use firms' return on assets (ROA) as a proxy for their profitability, which is calculated as net income divided by total assets. We based this choice on a recent study, which compared various measures of firm financial performance for calculating aspiration levels (Bromiley and Harris, 2014). According to the authors' meta-analysis, ROA has been used most commonly in previous studies and the results of their empirical analysis reported relatively small information loss compared to the best-performing proxy (unscaled net income). We therefore adopted the most common approach from prior studies for our own empirical analysis to ensure comparability and collective knowledge generation.

Stakeholder sentiment: We measure stakeholder sentiment based on stakeholders' assessment of a focal firm as expressed across various publications focused on the automotive industry. Our database primarily contains trade, industry, and consumer publications, but also includes several large newspapers. In total, it comprises 290,047 articles from 41 publications that were published between 2005 and 2016. We computed sentiment using the MPQA Subjectivity Lexicon (Wilson, Wiebe, and Hoffmann, 2005), a lexicon of 7,631 words and their respective sentiment (positive or negative). After counting the unique positive and negative words in each article, we calculated the Janis-Fadner coefficient of imbalance (JFCI) to determine the sentiment of each article (Janis & Fadner, 1965). The coefficient is calculated as

$$JFCI = \begin{cases} \frac{p^2 - pn}{(p+n)^2} & if\ p > n \\ 0 & if\ p = n \\ \frac{pn - n^2}{(p+n)^2} & if\ n > p \end{cases}$$

where p and n refer to positive and negative words, respectively. In the context of dictionary-based methods for sentiment analysis, using the JFCI is a common approach in the literature (e.g., König, Mammen, Fehn, Luger, & Enders, 2015). Having determined the sentiment per article, we matched articles to the firms in our sample using the name of the firm, or a variant of it as keyword. In doing so, the average firm was matched to slightly over 484 articles per year (5807 matches total on average with a standard deviation of 9,837). Finally, we computed the annual stakeholder sentiment of each firm as the median JFCI across all articles published in the 12-months window before the publication date of its annual report.

2.5.5 Control Variables

We follow the prior literature in adding a set of control variables (Bromiley and Harris, 2014). *Firm size* is the most common control variable across performance aspirations studies (Chen, 2008), which we calculated as the log of total assets. Larger firms may be less influenced by performance pressures than smaller firms (Gaba & Greve, 2019), leading to a lower R&D search intensity. Since R&D search intensity is dependent on the amount of financial resources available at any given point in time, we control for firms' slack resources. We include controls for three types of slack: *Available Slack*, *absorbed slack*, and *potential slack.* Each control measures a different dimension of slack resources. Available slack is the firm's current ratio, which is calculated as current assets divided by current liabilities. Absorbed slack is calculated as the sum of selling, administrative, and general expensive divided by total sales. Potential slack is the firm's equity-to-debt ratio. We excluded additional control variables, such as a lagged dependent variable, which some prior studies include to control for routines in R&D expenditures (e.g., Lim & McCann, 2014), based on the Schwartz information criterion (BIC). All our models are estimated with controls for *firm and year fixed effects*. While year dummies control for the firms' macro environment (Chen & Miller, 2007), firm fixed-

effects are added as an additional control for firm-level influences.

2.5.6 Method

Our study uses a weighted-average approach for computing aspiration levels (Bromiley & Harris, 2014; Greve, 2003). That is, we compute aspiration levels as the weighted average of social aspirations, referring to the performance of close peers, and historic or self-referent aspirations. This approach combines the two aspirations into a single measure. In line with prior studies, we calculate social aspirations as the unbiased mean of all the firms in the same industry as the focal firm, defined by the 4-digit SIC code, excluding the focal firm. Self-referent aspirations are calculated as the weighted average of the firm's past performance over the preceding two years. The overall aspiration level (*AL*) then equals the weighted average of the two. That is:

$$AL_{i,t} = a_1 SocialAspiration_{i,t} + (1 - a_1) HistoricAspiration_{i,t}$$

$$= a_1 \left(\frac{\sum_{j \neq i} P_{j,t}}{N - 1} \right)_{i,t} + (1 - a_1)(a_2 P_{i,t-1} + (1 - a_2) P_{i,t-1})$$

In the above equation, $P_{i,t}$ refers to the performance of firm i in year t, either in terms of profitability (ROA) or stakeholder sentiment (median JFCI). The values of the two parameters a_1 and a_2 are inferred endogenously, by running a regression for each parameter value from 0 to 1 in steps of 0.1 and selecting the parameters which maximize the log-likelihood of the model. For profitability, this process selected a value of 0 for a_1 and 1 for a_2. For stakeholder sentiment, the respective parameters are 0 and 0. For both goals, the process thus selected aspiration levels based solely on each firm's historic aspirations, ignoring the performance of their peers. Moreover, the most recent lag was selected for financial performance and vice versa for stakeholder sentiment.

To create the attainment discrepancy between current performance and aspiration level (Bromiley & Harris, 2014), we subtracted each aspiration level from the firm's current performance and took the absolute value, to facilitate the interpretation of the coefficient estimates. In line with our theoretical account and prior empirical studies (e.g., Greve, 2003), we differentiate between attainment discrepancies above and below aspirations by creating a spline variable. That is, we create an indicator

variable that takes the value of 1 for underperforming firms (where current performance falls short of the aspiration level) and 0 otherwise. This allows us to split each attainment discrepancy into two splines, one measuring the discrepancy below the aspiration level and the other above. To test the effect of our hypotheses 2 and 3, we use the profitability variable to split the splines of the stakeholder sentiment attainment discrepancy once more. This process results in four variables of stakeholder sentiment for our final model, which measure its attainment discrepancy, i.e., current stakeholder sentiment above and below aspirations, for cases where profitability is low (below its aspiration level) or high (above its aspiration level). Table 2.1 shows summary statistics and pairwise correlations of all the aforementioned variables in continuous form.

Table 2.1 Descriptive statistics for all variables

Statistic	Mean	St. Dev.	Min	Max	1.	2.	3.	4.	5.	6.	7.
1. Search intensity	0.041	0.03	0.005	0.164	1.00						
2. Firm size	9.57	2.17	1.61	13	0.00	1.00					
3. Available slack	-0.271	0.249	-0.742	0.807	-0.01	-0.49	1.00				
4. Absorbed slack	0.096	0.003	0.085	0.117	0.28	-0.12	0.65	1.00			
5. Potential slack	-0.057	0.063	-0.073	0.977	-0.06	-0.13	0.09	0.02	1.00		
6. Profitability (AL)	0.012	0.135	-1.1	0.769	-0.21	0.33	0.01	-0.07	0.02	1.00	
7. Stakeholder sent. (AL)	0.005	0.06	-0.142	0.28	-0.06	-0.01	-0.02	0.07	-0.07	0.02	1.00

Note: N = 277, AL short for aspiration level

2.6 Results

Table 2.1 provides summary statistics and pairwise correlations for the final dataset. Both aspiration measures are reported as continuous variables, i.e., combining attainment discrepancies above and below aspirations. The final sample was reduced in size due to missing data and the use of lagged variables to compute the aspiration levels. Missing data is a common problem with *Compustat* data, which prior studies also encountered. For example, Chen and Miller (2007) report losing 23.8% of usable observations due to missingness in R&D expenditure and a further reduction by 30% of the data due to incomplete cases.

We conducted t-tests between the full sample and the final sample and found no major difference in terms of sales per assets, meaning that most firms are similar in their operational intensity. However,

the final sample included significantly fewer large firms, meaning that both total assets and total sales differ on average between the two samples. This explains a slight reduction in search intensity from the full sample to the final sample, which prior studies have explained by lower performance pressures for large firms (Gaba & Greve, 2019). However, the variables measuring attainment discrepancies for financial performance and stakeholder sentiment were similar at 5-percent significance. The descriptive statistics and estimation results are shown for the 277 observations from 38 firms with complete data.

Most of the variables display no strong skewness or kurtosis. The only exception is potential slack, which is skewed to the right. Correlations between the variables are low to medium except between absorbed slack and available slack (0.65) as well as between available slack and firm size (-0.49). There are no extreme outliers in our dependent variable or regressors. Consequently, we did not winsorize the data, which allowed us to estimate our models using regular OLS instead of a Tobit model.

Table 2.2 depicts the results of our empirical analysis, regressing controls and aspiration measures on R&D search intensity. The models are estimated using pooled-OLS estimators with robust standard errors in parentheses. All models control for year and firm-fixed effects, whose coefficients are not reported. Column (1) is the baseline model including only control variables and profitability relative to the aspiration level (above and below separately). While the coefficients of all the control variables have the expected sign, only two are significant at the 5-percent level. Column (2) shows the model including stakeholder sentiment, adding the two splines for underperformance and overperformance relative to its aspiration levels to the basic model in column (1). The model in column (3) splits the splines for stakeholder sentiment below and above aspiration levels further, by performing an additional spline over the respective level of profitability. The four resulting coefficients thus show the effect of underperformance and overperformance for cases where the profitability is low or high, i.e., where profitability is below or above its aspiration level. The fit of the model generally increases with the inclusion of additional explanatory variables to the baseline model. The models in column (2) and (3) show the same goodness of fit, since they include the same explanatory variables.

The baseline model in column (1) includes control variables together with the profitability attainment discrepancies. Three effects appear significant at reasonable levels. First, increases in firm

size are associated with a slight reduction in search intensity. As mentioned in the variable description, this is expected since larger firms tend be less pressured to engage in problemistic search (Gaba & Greve, 2019). Second, a higher amount of potential slack leads to a reduction in search intensity. This is also expected, since a higher debt-to-equity ratio implies lower capability for additional R&D spending using debt. Third, the significant coefficient of profitability below aspiration level confirms the basic proposition of problemistic search: An increase of the attainment discrepancy of profitability below its aspiration level leads to an increase in R&D search intensity by the focal firm. In contrast, the coefficient of profitability above aspiration levels is positive but insignificant. Based on profitability alone, our results thus show evidence of problemistic search but not of opportunity driven search (Posen et al., 2017).

The behavioral account underlying our first hypothesis suggests that underperformance toward stakeholder sentiment aspiration levels is associated with an increase in R&D search intensity. The positive coefficient of the respective variable in column (2) of Table 2.2, *Stakeholder Sentiment (below AL),* indicates that an increase in the attainment discrepancy of stakeholder sentiment below aspirations is associated with an increase in R&D search intensity. This effect is significant and thus lends support to our first hypothesis.

The further hypotheses are about the relationship between diffuse goals pertaining to stakeholder sentiments and the explicit profitability goal, i.e., how firms adjust their attention in response to these multiple goals. Hypothesis 2 addresses the effect of underperformance toward stakeholder sentiment aspiration levels when profitability is below its aspiration level. Our behavioral account suggests that firms increase their R&D search intensity in this case. We test this hypothesis by applying a spline to the stakeholder sentiment variable, which splits it based on the value of firms' profitability relative to aspiration levels. The coefficient of the variable *Stakeholder Sentiment (below AL)—Profitability (below AL)* captures the effect of an increase in the attainment discrepancy of stakeholder sentiment below aspirations when profitability is also below its aspiration level. The positive coefficient indicates that it leads to an increase in R&D search intensity. Moreover, comparing the size of the coefficient to the coefficient in column (2) suggests that the effect of underperformance toward stakeholder sentiment

is increased when profitability is below aspiration levels, compared to the general effect of stakeholder sentiment below aspiration levels, not considering the respective performance toward profitability goals. The significance of the effect lends support to our second hypothesis.

Table 2.2 Results of Pooled OLS Regression for R&D Search Intensity

	(1)	(2)	(3)
Constant	0.097	0.093	0.092
	(0.078)	(0.077)	(0.076)
Firm size	-0.005*	-0.006*	-0.006*
	(0.003)	(0.003)	(0.003)
Available slack	0.009	0.009	0.009
	(0.008)	(0.008)	(0.008)
Absorbed slack	-0.437	-0.38	-0.363
	(0.717)	(0.707)	(0.701)
Potential slack	-0.011*	-0.012*	-0.012*
	(0.005)	(0.005)	(0.005)
Profitability (below AL)	0.016*	0.013+	0.013+
	(0.007)	(0.007)	(0.008)
Profitability (above AL)	0.013	0.011	0.009
	(0.011)	(0.009)	(0.007)
Stakeholder Sentiment (below AL)		0.038*	
		(0.017)	
Stakeholder Sentiment (above AL)		0.014	
		(0.015)	
Stakeholder Sentiment (below AL) – Profitability (below AL)			0.065*
			(0.032)
Stakeholder Sentiment (above AL) - Profitability (below AL)			0.001
			(0.011)
Stakeholder Sentiment (below AL) – Profitability (above AL)			0.034*
			(0.017)
Stakeholder Sentiment (above AL) – Profitability (above AL)			0.031
			(0.023)
R2	0.954	0.955	0.955
Adjusted R2	0.943	0.943	0.943

Based on 277 observations and 38 firms. All models include year and firm fixed effects (not reported). Robust standard errors reported in parentheses, significance levels indicated as $^{**}p < 0.01$, $^{*}p < 0.05$ and $^{+}p < 0.1$, AL short for aspiration level.

Hypothesis 3 addresses the case where stakeholder sentiment is below aspiration levels while profitability aspirations are met. In these situations, our behavioral account also suggests that firms increase their R&D search intensity. The significant positive coefficient of the variable *Stakeholder Sentiment (above AL)—Profitability (below AL)* in column (3) indicates that these observations are associated with a significant increase in R&D search, which confirms our third hypothesis. Moreover, we observe that this effect is lower than when profitability falls short of aspirations (H2) as well as when we do not control for the moderation through profitability (H1). These additional findings suggest that firms engage in problemistic search despite of their profitability remaining above expectations, but to a lesser degree compared to situations where their profitability also falls below expectations. This finding makes intuitive sense since the pressure on firms to act may be lower if profitability is not yet affected.

2.7 Discussion

The behavioral theory of the firm has explained how firms attend to explicit goals such as profitability, size, and safety both independently and interdependently (Cyert & March, 1963; Greve & Gaba, 2019; Shinkle, 2012). What that theory did not address is how firms respond to more diffuse goals, such as those set by dispersed stakeholders' collective expectations toward the firm. We approached this question through an integration of the behavioral goal setting theory with stakeholder theory's model of intricate and valuable relationships between firms and their stakeholders (Freeman, 1984). As expected, we found that firms attend to stakeholder sentiment, which serves as an important input to managerial decisions on changes in R&D investment intensity. Moreover, we found strong indications that shareholder sentiment helps firm attend to multiple goals simultaneously. We conclude our study by discussing its main contributions to the behavioral theory of the firm as well as stakeholder theory and identify several avenues for future research on the role of diffuse goals for firm behavior and outcomes.

2.7.1 Explicit and Diffuse Goals

Our primary contribution is the conceptualization and empirical validation of firms' pursuit of

diffuse goals. This theoretical extension challenges the assumptions of goal formation theory regarding the scope, time, and agency of firms' attention to goals in the context of problemistic search. First, prior theory has broadly assumed that firms focus on specific goals (Cyert & March, 1963; Shinkle, 2012). Given their focus on specific goals, they are expected to narrow their attention to signals associated with these goals (Simon, 1964). While there have been calls to develop theory regarding the formation of goals under more ambiguous conditions (Fang, Kim, & Milliken, 2014; Jordan & Audia, 2012), studies addressing these calls have assumed that firms cannot accurately monitor diffuse goals such as dispersed stakeholder expectations (Luo, Wang, Raithel, and Zheng, 2015). Contrary to these assumptions, we show that firms attend to stakeholder sentiment, which quantifies dispersed stakeholders' diverse and varying expectations. The consideration of such diffuse goals expands the scope of firms' attention beyond the limits that the explicit goal theory assumes (Simon, 1964). Stakeholder sentiment provides performance feedback that attends to multiple explicit goals and can even reach beyond the firm's current set of explicit goals. Firms considering such non-specific feedback may be able to capture and respond to a broader scope of signals and problems than widely assumed in the behavioral theory of the firm.

Second, the behavioral theory of the firm generally assumes that goals once set are stable (Cyert and March, 1963). This perspective overlooks how new goals emerge in an organization's environment. Stakeholder expectations may have little temporal stability. Their expectations can change, sometimes even radically, over time. Entirely new expectations can emerge, which change stakeholder sentiment and attract firms' attention long before they get adopted as explicit goals. In turn, firms' responses are likely to become dynamic inputs that update stakeholder sentiment. This dynamism is increased further through stakeholder sentiment's ability to provide real-time feedback (Cambria, 2016). In contrast, the behavioral theory of the firm has traditionally assumed that goals and reference points are fixed and only adapted from year to year as statistical benchmarks become available (Chen, 2008). Furthermore, with few exceptions (e.g., Arrfelt, Wiseman, & Hult, 2013), prior theory has focused on backward-looking performance goals and feedback. Stakeholder sentiment increases firms' predictive abilities (Hogenboom et al., 2011), which may allow those firms to attend to weak signals even before they

manifest themselves in feedback on explicit goals such as profitability. Collectively, these characteristics of diffuse goals contrast with the relatively stable, periodic, and reactive adaptation to explicit goals that prior empirical studies describe (Shinkle, 2012). Diffuse goals may therefore inform more emergent, continuous, and proactive adaptation than generally assumed in the behavioral theory of the firm.

Third, the behavioral theory of the firm has long acknowledged that explicit goals consider multiple preferences in a "quasi-resolution of conflict" between firm-internal actors (Cyert & March, 1963: 117-118). However, this perspective ignores the larger system of stakeholder relations that affect firm behavior and outcome (Parmar et al., 2010). While some scholars have acknowledged that explicit firm goals can be imposed by powerful external actors (Locke et al., 1988), or reference points negotiated between key stakeholders and organizations (Nason et al., 2018), firms may also use stakeholder sentiment as a proxy for the "quasi-resolution of conflict" between dispersed stakeholders. The diffuse goal perspective not only considers a broader set of actors, it also suggests that these actors are more dispersed and diverse than previously assumed. Diffuse goals give these distributed actors a voice and firms the ability to receive and attend to their signals. These insights challenge the traditional concept of a dominant coalition's convergence around explicit firm goals with the vision of a process with distributed actors' convergence and divergence around non-specific, shifting, and distributed goals and expectations.

2.7.2 Contradictory and Complementary Goals

Our study further contributes to the discussion on firms' pursuit of multiple goals (e.g., Greve, 2008; Rowley et al., 2017; Shinkle, 2012). First, prior theory has advanced a trade-off perspective that perceives multiple goals as contradictory. In this perspective, organizations choose between goals and address them sequentially following a priority order (Gaba & Greve, 2019). This research disregards the insight that different goals can also provide complementary signals and inputs. For example, stakeholders' expectations can be an important input for firms to increase their profitability (Teece, 1984). Consequently, multiple goals must not necessarily conflict with one another and requiring priority ordering. Our empirical findings show that firms address stakeholder sentiment and profitability

goals simultaneously. In the case of explicit goals and diffuse goals, the diffuse nature of the latter increases the likelihood of overlaps and complementary insights with the former. Given these complementarities, firms may pursue multiple goals simultaneously rather than sequentially. This point has already been made when arguing that firms calibrate decision making across multiple goals (Cyert & March, 1963), but the key feature overlooked in the current literature is the important role of diffuse goals affecting such goal complementarity.

Second, prior research has strongly focused on performance feedback while largely ignoring the subsequent search process (Posen et al., 2017). This perspective overlooks the challenge for firms to diagnose the problem in order to generate possible solutions. Boundedly-rational organizational decision makers usually form partial and simplified representations of the problem, which constraints their subsequent search for solutions (Gavetti & Levinthal, 2000). This proposition is aligned with goal formation theory's focus on explicit goals, which put constraints on firm's subsequent search (Simon, 1964). In contrast, diffuse goals such as stakeholder sentiment provide more comprehensive information that relates to multiple goals. Such comprehensive information should allow firms to better diagnose problems as well as understanding their association with multiple goals. Our empirical findings provide evidence that firms considering stakeholder sentiment attend to multiple goals simultaneously where prior theory would expect them to attend to them sequentially, and it shows that firms engage in problemistic search in situations where prior theory would not expect them to act. These insights at least indirectly suggest that these firms paid less attention to goal selection (either one or the other goal) compared to goal diagnosis (considering both one and the other goal).

2.7.3 Stakeholder Sentiment

Our study also has broader implications for stakeholder theory (Freeman, 1984). First, Barnett et al. (2020) recently theorized that due to information overload, firms in the digital age may be even less responsive to stakeholder expectations than traditionally assumed. Conversely, our study shows that firms systematically consider dispersed stakeholders' diffuse expectations in their problemistic search activities. These discrepancies may be explained by fact that prior theory did not consider recent advances in data-processing and analysis tools such as sentiment analysis (Cambia, 2016). These tools

allow firms to convert extensive information into aggregate and quantified measures such as stakeholder sentiment, which are relatively easy to monitor. Furthermore, they provide extensive functionality to analyze the underlying data more deeply. Firms may therefore experience less information overload than the cursory observer could expect if solely considering the sheer amount of the available data. We therefore suggest that firms in the digital age may be much more attuned to stakeholder expectations than previously described.

Second, stakeholder theory has discussed extensively whether firms respond to stakeholder demands with substantive or symbolic actions (Bundy, Shropshire, and Buchholtz, 2013; Westphal & Zajac, 1998). Our study provides evidence that firms undertake substantive, large-scale changes in their strategic investments in response to stakeholder sentiment. Prior studies mostly assumed that firms tend to take substantive measures if powerful primary stakeholders raise claims but tend to disregard such claims from secondary stakeholders (McDonnell & King, 2013; Nason et al., 2018). We show that it can also be the collective feedback of dispersed stakeholders that triggers substantive responses. The digital age with its proliferation of data and increasingly sophisticated data analysis tools may both increase the possibility of spillovers between different stakeholders' expectations (Waldron et al., 2013) and firms' ability to perceive the resulting convergence in stakeholders' expectations, which should increase firms' motivation to prioritize substantive actions over symbolic actions.

Third, stakeholder theory has been slow to adopt the concept of stakeholder sentiment. As our study suggests, stakeholder sentiment is more than a novel way of measuring stakeholders' expectations. It accentuates stakeholders' *collective* expectations rather than prioritizing specific stakeholder groups while disregarding others. This broader scope is consistent with Freeman's (1984) original conceptualization of stakeholders and his insistence on the collective importance of diverse groups of stakeholders. Stakeholder sentiment returns to these roots, which have been partially ignored in more recent contributions to stakeholder theory that focus strongly on selected stakeholders (e.g., Zavyalova, et al., 2016). Our study's findings suggest that such a narrow scope may lead to different assumptions and findings than a broader consideration of stakeholders and their collective expectations. Stakeholder sentiment therefore represents a novel mechanism explaining stakeholder influence on firm

behavior. Its consideration allows stakeholder theory to challenge prior assumptions and enable deeper insight.

2.7.4 Boundary Conditions and Future Research

To provide focus and depth to our theoretical development, we have restricted our assumptions and placed boundaries on our propositions. Reconsidering these boundaries leads us beyond the scope of our study but can inform future research. First, we did not explicitly discuss firms' internal use of diffuse goals. We implicitly assumed that firms accurately receive stakeholder sentiment and process it in their problemistic search activities. However, firms may also fail to receive such diffuse information, receive it in a distorted or partial format, and/or misinterpret or disregard it entirely (Fang et al., 2014). We thus suggest that future research opens the black box of firm's internal use of stakeholder sentiment. Firms may vary in their ability to process stakeholder sentiment (Cambria et al., 2017). Future research could explore organizational antecedents explaining such variation. In this research, it may be important to analyze the important role of technology in "augmenting" organizational actors (Raisch & Krakowski, 2020) to process extensive information about diffuse goals more comprehensively and accurately.

Second, we limited our focus on exploring stakeholder sentiment's association with changes in R&D search intensity. Future studies could complement our descriptive study with more normative investigations. An open question is how firms' consideration of diffuse goals such as stakeholder sentiment relates to firm performance and survival. Firms may benefit from the use of sentiment, because of its underlying informational value, particularly as a source of hard-to-quantify (Tetlock et al., 2008) and particularly rich (Surowiecki, 2005) information reflecting the "wisdom of crowds" (Chen et al., 2014). However, even sentiment data may still be biased in some ways (Rosso & Cagnina, 2017) and widespread adoption of sentiment analysis tools could thus lead to herding effects that misdirect firm activities. These contradictory effects motivate future research into diffuse goals' wider implications.

Third, we did not distinguish between different stakeholder groups. Stakeholder research often argues that scholars should differentiate between primary and secondary stakeholders. While

stakeholder sentiment considers expressively stakeholders' collective expectations, it could nevertheless be interesting to explore feedback dynamics among different stakeholder groups and their effects on stakeholder sentiment. Scholars could explore whether more powerful stakeholders play an active role (Waldron et al., 2013) in influencing other stakeholders' sentiments or whether firm prioritize some stakeholders over others (McDonnell & King, 2013) when monitoring stakeholder sentiment. Furthermore, we have considered shareholders' homogenous expectations by measuring aggregate performance levels. It could be worthwhile exploring sources of variance between expectations both across stakeholder groups and over time, as well as firms' response to such variance. Collectively, such work could inform process models of the dynamics between stakeholders' shifting expectations and firms' adaptive responses.

Finally, the nature of our study did not allow us to dig deeper into diffuse goals' larger implications for the problemistic search process. We have provided theoretical reflections regarding diffuse goals' higher informational value and the associated potential to enhance firms' problem definition and solution generation process (Posen et al., 2017). However, these propositions remain speculative and require further theoretical development and empirical validation. Future research could directly investigate whether firms using diffuse goals alongside specific goals are more comprehensive in their problem analysis and solution generation. A related question is whether, and under what conditions, such greater comprehensiveness translates into higher firm performance (Fredrickson & Mitchell, 1984; Forbes, 2007).

In conclusion, while diffuse goals such as those set by stakeholders' collective expectations toward the firm are increasingly important, how firms integrate these goals into their problemistic search is not well understood. We theorize and empirically validate that firms systematically attend to diffuse goals in their problemistic search and reveal the complementarities between such diffuse goals and more explicit firm goals. In doing so, we wish to open new avenues of research that extent beyond the behavioral theory of the firm because diffuse goals are likely to also affect organizational behaviors that have been examined by other organization and management theory perspectives.

3 Strategic Decision Making in the Digital Age: Expert Sentiment and Corporate Capital Allocation in the Pharmaceutical Industry

3.1 Introduction

Management scholars frequently apply behavioral theories to describe strategic decision making under uncertainty in organizations (e.g., Argote & Greve, 2007; Gavetti et al., 2012; Souder et al., 2016). Corporate capital allocation is one of the most important and risky strategic decisions (Busenbark, Wiseman, Arrfelt, & Woo, 2017; Sengul et al., 2018). When allocating scarce financial resources to strategic business units (SBUs), senior managers are required to process substantial amounts of information (Arrfelt, Wiseman, McNamara, & Hult, 2015). However, their cognitive limitations reduce decision makers' ability to process such information comprehensively (Simon, 1958), causing boundedly rational behavior in capital allocation decisions (Arrfelt et al., 2013). Constructs such as cognitive bias, selective attention, and simple heuristics describe how organizational decision makers only process limited information when making strategic decisions (Bardolet, Fox, & Lovallo, 2011).

The recent proliferation of digital data (George et al., 2014), and simultaneous advances in digital technologies for analyzing such data (Phan et al., 2017), challenge our theoretical understanding of how senior managers process information and make strategic decisions. Some scholars suggest that more data, and more sophisticated information-processing tools, should enable senior managers to engage in more deliberate and comprehensive decision making (Brynjolfsson & McAfee, 2014; Raisch & Krakowski, 2020). Others, however, expect the opposite, highlighting that more information tends to overwhelm decision makers, restricting their attention (Hansen & Haas, 2001) and causing them to rely more strongly on their intuition and simple heuristics (Birkinshaw & Ridderstråle, 2017). While scholars acknowledge that digitalization affects strategic decision making in organizations (George et al., 2014), there is less agreement on *how* it influences managers' information gathering and processing.

We investigate the impact of increased information availability on senior managers' decision making by studying the role of expert sentiment (Gopaldas, 2014; Tetlock, 2008), defined as external experts' collective evaluation of a particular subject of interest, such as a product or technology. Before digitalization, organizations had access to selected print journals with expert analyses, which decision makers had to individually process. Today, online databases provide them with thousands of expert analyses and increasingly sophisticated expert systems, news analytics, and sentiment analysis tools with which to analyze this collective information (Cambria et al., 2017). Behavioral finance (Blasco et al., 2012) and behavioral marketing researchers (Hennig-Thurau et al., 2014) have found that these collective expert assessments are critical for investors and consumers' decision making. Our aim is to understand how expert sentiment affects corporate decisions on capital allocation.

We address this research objective by drawing on decision comprehensiveness theory (Atuahene-Gima & Murray, 2004; Fredrickson & Mitchell, 1984; Heavey, Simsek, Roche, & Kelly, 2009), which studies the extent to which corporate managers systematically gather and process information from their external environment when making strategic decisions. This work accentuates the value of comprehensiveness for decision making under uncertainty (Forbes, 2007), where firms face information environments that are high in their determinacy (i.e., how clear the information is) and quantity (i.e., how much information is available). However, this research stream also acknowledges that companies are constrained in their decision comprehensiveness through decision makers' cognitive limitations and the associated costs of information gathering (Fredrickson & Iaquinto, 1989). In this study, we build on these theoretical concepts and insights to describe how expert sentiment affects corporate capital allocation decisions. However, because expert sentiment is publicly available rather than proprietary information, we do not claim that it *per se* provides firms with a competitive advantage.

We study expert sentiment empirically in the pharmaceutical industry, where external experts provide particularly exhaustive and critical information on drugs, treatments, and technologies (Abraham, 2002; Groves, Kayyali, Knott, & Van Kuiken, 2013). Sentiment data were collected from almost 250,000 expert articles published between 2005 and 2016. We used supervised machine-learning classifiers to compute the expert sentiments in each article and employed keyword-matching algorithms to assign articles to each SBU's targeted product-technology domain.

Subsequently, we tested a set of hypotheses regarding expert sentiment's effects on corporate capital allocation decisions, controlling for the SBUs' financial results and prospects. We find that the expert sentiment has a significant effect on capital allocation: A higher expert sentiment of an SBU's product-technology domain is associated with greater capital allocated to that SBU. Furthermore, our findings show that low information determinacy and quantity affect this relationship negatively. Post-hoc analyses enabled us to further qualify our results. We find that senior managers react differently to different expert groups' sentiments. While they tend to disregard sentiments voiced through generic outlets (e.g., *New York Times*), sentiments in business (e.g., *Biotech Business*), regulatory (e.g., *FDA News*), and scientific (e.g., *Clinical Trials Advisor*) outlets have significant effects on their capital allocation decisions.

Our study contributes to the behavioral theory of the firm (Cyert & March, 1963; Gavetti et al., 2012) by providing an updated understanding of organizational decision making in the digital age. Prior studies assume that senior managers rely on narrow financial indicators (Arrfelt et al., 2013; 2015) or simple heuristics (Bardolet et al., 2011) to make corporate capital allocation decisions, but our empirical findings show that they also consider a wide variety of company outsiders' collective wisdom. Furthermore, we shed light on the boundary conditions that enable or hinder more comprehensive information processing. Information determinacy and quantity are critical conditions that allow decision makers to benefit from the greater data availability and processing capacity that digitalization affords. Under these conditions, organizations can use digital data and technologies to *augment* managers for more comprehensive information processing (Raisch & Krakowski, 2020).

3.2 Theory Background

The behavioral theory of the firm concerns "the business firm and the way it makes economic decisions" (Cyert & March, 1963 1). The bulk of prior research focuses on human decision makers' information-processing limitations (Argote & Greve, 2007). Scholars investigate how the information provided to decision makers affects their subsequent decision-making behavior (e.g., Denrell & March, 2001; Rerup, 2009). Overall, prior studies show that while organizational decision making under uncertainty requires the processing of considerable amounts of information, decision makers tend to

use information-processing shortcuts, which can lead to suboptimal organizational decision outcomes (Gavetti et al., 2012).

Corporate capital allocation, the process of allocating scarce resources to a firm's SBUs, is an important application of the behavioral theory of the firm (Sengul et al., 2018). Capital allocation is a crucial decision task for corporate managers (Busenbark et al., 2017), whose competence in allocating resources affects SBU performance, as well as the parent company's overall performance (Arrfelt et al., 2015). Corporate decision makers need to process vast amounts of information during the capital allocation process (Arrfelt et al., 2015). Since internal sources are apt to provide inaccurate information (Rajan, Servaes, & Zingales, 2000), managers should rely strongly on information from outside their organization (Wulf, 2009). However, prior research has also shown that corporate managers have cognitive limitations, which reduce their ability to process such information comprehensively (Bardolet et al., 2011).

Expert sentiment – which refers to external experts' collective opinion of a product or technology – may be an important source of information allowing corporate managers to overcome some of their information-processing limits during the corporate capital allocation process. In the prior management literature, sentiment's empirical properties have been primarily studied (e.g., Das & Chen, 2007; Hribar & McInnis, 2012). However, scholarly research in fields such as behavioral finance (Blasco, Corredor, & Ferreruela, 2012; Tetlock, 2008), behavioral marketing (Gopaldas, 2014), and behavioral economics (Doms & Morin, 2004; Malgarini & Margani, 2009) has explored sentiment's impact on human behavior. In the marketing context, for example, scholars find that sentiment affects decision making by reducing the information asymmetries between consumers, as well as those between consumers and firms (Hennig-Thurau et al., 2014). In finance (e.g., Tetlock et al., 2008) and economics (e.g., Doms & Morin, 2004), sentiment is appreciated as a source of otherwise hard-to-quantify data, making it particularly relevant in situations where other data sources are unavailable (Garz, 2013).

Extant research suggests that sentiment's importance for decision making has increased further with the emergence of big data and advanced digital technologies to analyze it (Dhar & Chang, 2009; Hennig-Thurau et al., 2014). Firms now have access to databases with vast amounts of information on products, technologies, and markets. Sophisticated analysis tools allow these firms to assess sentiments

collectively, in real-time, and at the press of a button (Brown et al., 2011). In banking, for example, natural-language processing is used for sentiment analysis to improve credit-rating models, which were previously only infrequently updated (Kremer, Malzkorn, & Strobel, 2013). In the pharmaceutical industry, which we study in this paper, similar technologies are now widely used (Gurulingappa, Karmalkar, & Megaro, 2019). Leading companies, such as Astra Zeneca, Johnson & Johnson, Pfizer, Roche, and Sanofi, apply such tools to support their information processing in areas such as drug discovery and development, opportunity scouting, competitive intelligence, and social media analysis (Bulgaru, 2019; Fassbender, 2019).

While sentiment data are widely used in practice, predicting sentiment's influence on firms' corporate capital allocation decisions is not a trivial task. Prior work has provided contrasting arguments on how an increase in information availability affects managerial behavior in complex decisions. Traditionally, information-processing research perceives the availability of abundant information as an advantage, because it is expected to enable more informed and accurate decision making (e.g., Zander & Kogut, 1995). This perspective has informed applied research on big data and digitalization, by generally suggesting that advanced digital technology for scanning and analyzing data allows decision-makers to process more information with greater accuracy, which leads to better decision outcomes (e.g., Davenport & Kirby, 2016).

In contrast, others have warned that greater information availability may result in more biased and, therefore, suboptimal organizational decisions. In rich information environments, attention is a scarce resource (Hansen & Haas, 2001), inducing decision makers to rely even more on partial and suboptimal information-selection mechanisms. With 2.5 quintillion bytes of new digital data produced every day (Ahmad, 2018; Jacobson, 2013), organizational decision makers may simply be overwhelmed by information. Prior studies show that decision makers experiencing increasingly complex information contexts use cognitive shortcuts or simplifications to deal with this complexity (Gigerenzer & Brighton, 2009).

Overall, these contradictory perspectives suggest the need for a better understanding of how increased information availability affects corporate decisions in the digital age. In this study, we focus on exploring how expert sentiment affects corporate capital allocation decisions.

3.3 Theory Development

We draw on decision comprehensiveness theory (Atuahene-Gima & Li, 2004; Fredrickson, 1984; Heavey et al., 2009) to develop our theoretical arguments regarding expert sentiment's effects on corporate capital allocation. Forbes (2007: 362) summarizes this theory as follows: "The core variable of this literature is strategic decision comprehensiveness, a concept that captures the extensiveness with which an organization's top executives systematically gather and process information from the external environment in making strategic decisions." Research on decision comprehensiveness includes studies of its antecedents as well as its consequences. For the purpose of this article, we use its insights to describe whether, and under what conditions, firms consider expert sentiment in their strategic decision making rather than exploring the possible implications of considering such expert sentiment on decision or firm performance. We first use this literature to investigate how expert sentiment – comprehensive information that external experts provide – relates to corporate capital allocation decisions. Subsequently, we build on Forbes (2007) to explore the contingent role of the organizational information environment, which the available information's determinacy and quantity characterize.

3.3.1 Expert Sentiment and Corporate Capital Allocation

Corporate capital allocation is characterized by a high degree of uncertainty regarding alternative firm investment opportunities (Busenbark et al., 2017). Decision comprehensiveness theory claims that under such conditions, the more comprehensive the firm's processing of external information, the better the associated decision-making outcomes are (Forbes, 2007; Fredrickson & Mitchell, 1984). However, it also acknowledges that companies are constrained in their ability to gather and process comprehensive information through corporate managers' cognitive limitations and the associated costs of information gathering (Athuahene-Gima & Murray, 2004; Fredrickson & Iaquinto, 1989).

We argue that expert sentiment affects corporate decision making by increasing the benefits that can be attained through comprehensiveness while simultaneously decreasing its costs. First, expert sentiment contains potentially valuable information for senior managers, which could affect their

allocation decisions. For example, expert sentiment may contain valuable information about products and technologies' future viability (Bushee, Core, Guay, & Hamm, 2010; Tetlock et al., 2008), and their associated market or growth expectations (Iselin & Siliverstovs, 2015). Applied to our context, corporate managers in the pharmaceutical industry are often dependent on such unstructured information, because they have to make investment decisions at technological developments' early stages when hard facts and quantitative data are unavailable (Garz, 2013; DiMasi, Grabowski, & Hansen, 2016). Consequently, expert sentiment functions as an information intermediary, providing previously undisclosed or less disseminated information (Bushee et al., 2010). Previous studies have found such information intermediaries highly valuable when senior managers attempt to identify emerging or evolving trends (Napoli, 2016).

Second, expert sentiment provides independent, external information that complements the internal information used for corporate capital allocation decisions (Chen et al., 2014; Tetlock et al., 2008). Prior research shows that division heads tend to provide politically biased information to promote their SBU's interests, which affects the capital-allocation process negatively (Harris & Raviv, 1998). Expert sentiment can provide senior managers with independent, and potentially more reliable, information to challenge the SBU leaders' internal accounts. Senior managers can contrast and compare internal and external data sources, which could help them identify and prevent biases, while simultaneously increasing their understanding of the relevant domain.

Third, expert sentiment provides a wide range of external experts' collective wisdom (Gopaldas, 2014). Rather than processing many experts' individual views and opinions, which would require extensive cognitive resources, senior managers can access these experts' collective opinion directly. Digital technologies, such as sentiment analysis, provide senior managers with such a collective expert opinion, with little need for further human information processing (Cambria et al., 2017). Since the sentiment reflects multiple experts' opinions, this is likely to give corporate managers greater confidence in the face of uncertainty (Smith & DeCoster, 2000). They do not have to trust an expert's individual opinion, but can benefit from many experts' collective wisdom, which reduces the bias frequently present in single opinions (Chen et al., 2014; Surowiecki, 2005). Furthermore, the thought of aligning themselves with respected industry experts' majority view may afford senior

managers more comfort.

To conclude, expert sentiment provides corporate managers with unique information and allows them to debias internal information. Furthermore, it affords these benefits at relatively low information-processing costs. We therefore expect corporate decision makers to consider external experts' collective assessment of a specific product-technology domain, which can subsequently influence their decision on how much capital to allocate to an SBU focused on this domain.

Sentiment conveys the experts' collective assessment of a specific product-technology domain. A high average sentiment reflects the experts' positive assessment of a product-technology domain, which should on average increase corporate managers' allocation of corporate capital to an SBU focused on this domain. In contrast, a low average sentiment indicates the experts' negative assessment of a given product-technology domain, which should decrease corporate managers' capital allocation to an SBU targeting this domain.

In keeping with the tradition of the decision comprehensiveness literature, we describe corporate managers' decision comprehensiveness regarding their *systematic* gathering and processing of information (Forbes, 2007; Heavey et al., 2009). In specific decisions, these corporate actors may still disregard expert sentiment due to their bounded rationality, which prevents them from processing available information accurately and consistently (Cyert & March, 1963). Or, they may be privy to deeper insight that external experts fail to provide, which suggests alternative courses of action. However, we argue that across decisions and over time, corporate managers consider expert sentiment in their capital allocation decisions by making higher investments into SBUs focused on product-technology domains with higher expert sentiments compared to SBUs with lower expert sentiments. This leads to our first hypothesis:

Hypothesis 1: A higher expert sentiment regarding an SBU's product-technology domain leads to a higher corporate capital allocation to this SBU.

3.3.2 The Organizational Information Environment's Contingent Role

Prior studies further suggest that the value of decision comprehensiveness is constrained to environments characterized by conditions of uncertainty (Fredrickson & Mitchell, 1984), which are

high in their information determinacy and quantity (Forbes, 2007). Further dynamism would create an information environment that is low in determinacy and quantity, causing ambiguity for decision making. Under such conditions, the value of insights that can be reached through comprehensiveness may be as low as to render comprehensiveness futile, while simultaneously increasing the cost of such comprehensiveness extensively (Heavey et al., 2009).

We build on these ideas to explore the boundary conditions of expert sentiment's use in corporate capital allocation decisions. Specifically, we argue that corporate managers' consideration of expert sentiment in their capital allocation decisions is moderated through the determinacy and the quantity of information underlying the expert sentiment.

Determinacy describes how clear decision makers find the available information (Huber & Daft, 1987). Determinacy is important, because even if corporate managers have access to external information, they may not always be able to use this information to "distinguish effective strategies from ineffective ones" (Forbes, 2007: 372). Insight is limited when there are multiple possible interpretations of the same information. Conflicting views and opinions, or mixed evidence, leading to alternative conclusions, are a sign of the organizational information environment's low determinacy. Contrary to alternative arguments, such as those related to the wisdom of crowds, decision comprehensiveness theory suggests that as far as large-scale external information is concerned, conflicting views and opinions are not a source of better understanding, but of confusion and poorer understanding (Forbes, 2007).

Expert sentiment's determinacy regarding a given product-technology domain, functions as an indicator of experts' level of agreement on this domain's viability and development prospects. In contrast, a low determinacy indicates the expert community's disagreement regarding the domain's prospects, which makes it more difficult for decision makers to draw insights and conclusions from expert sentiment. According to behavioral theory, the resulting ambiguity regarding the firm's investment opportunities should affect decision makers' willingness to take investment decisions based on that information, since they usually prefer "easily verified data in lieu of uncertain estimates and […] easily checked information instead of more remote anticipation" (Cyert & March, 1963: 82). When the expert sentiment's determinacy is low (i.e., the experts disagree strongly), there is room for multiple

alternative interpretations, which signals ambiguity and should thus motivate risk-averse corporate decision makers to pay less attention to the respective expert sentiment when taking their capital allocation decisions.

Hypothesis 2: Expert sentiment's low determinacy affects the relationship between expert sentiment and corporate capital allocation negatively.

In addition to determinacy, the *quantity* of external information may also affect the relationship between expert sentiment and corporate capital allocation. Forbes (2007) suggests that information is heterogeneously distributed across different organizational environments and that, *ceteris paribus*, the more information available to a corporate manager, the better this manager's understanding of the environment in that context. In contrast, a low quantity of information can seriously constrain the corporate manager's ability to draw actionable insights from that information. The quantity of information can thus be used as a proxy for the richness of the external information environment to which a given corporate manager is exposed.

The pharmaceutical industry context illustrates this argument well. New product development initiatives in this industry generally take years, if not decades (Nerkar & Roberts, 2004). The amount of information available throughout the product development process changes significantly. In the early development stages, information is particularly scarce. Moreover, product development relies on information from a wide range of experts, who disseminate their results to varying degrees. Whereas public institutions engaged in fundamental research publish their results in scientific journals, private institutions focused on applied research tend to publish their results less, thus remaining more opaque (Stevens et al., 2011). Finally, some trends may be highly publicized and draw massive expert attention, whereas others fly under the radar for a long time (Harrysson, Metayer, & Sarrazin, 2014). Consequently, the quantity of information underlying an expert sentiment can vary significantly across product-technology domains.

A low quantity of information underlying an expert sentiment for a given product-technology domain can complicate the use of the expert sentiment in corporate decisions for several reasons. First, a low quantity of information about a given domain should decrease managerial attention to the

respective expert sentiment. While the expert sentiment provides a general assessment, the quantity of information underlying this sentiment makes this assessment more discernable. For example, Dhar and Chang (2009) find that the *volume* of online chatter predicts the music industry's new product sales. Garz (2013) explains that the "availability heuristic" induces people to rely more strongly on the most accessible information, which they can recall more easily owing to repeated activation. Repeated news coverage is likely to have long-term effects, which are simply "due to the accumulation of effects" (Garz, 2013: 157), making the respective information more salient. It is therefore likely that the quantity of the information available also affects corporate managers' tendency to consider (or not) expert sentiment on a specific product-technology domain in their capital allocation decisions.

Second, a key benefit of more information is that it gives corporate managers a richer understanding of the product-technology domain (Tetlock et al., 2008). Corporate capital allocation decisions require managers to navigate vast amounts of complex information (Bolton & Scharfstein, 1998; Busenbark et al., 2017) and, although corporate managers are known to possess certain information advantages (Gertner, Scharfstein, & Stein, 1994), much of the information needed for capital allocation decisions is domain-specific (Miller, 1993). Having a greater quantity of information available in the firm's environment may therefore reduce the gaps in corporate managers' knowledge and their (perceived) risk of making investments (Tetlock et al., 2008). In contrast, low information quantity makes it more difficult for corporate managers to analyze and assess the expert sentiment, which should decrease the likelihood that they rely on it in their strategic decisions (Chen et al., 2014).

In sum, we argue that a low quantity of information decreases both the salience and the consideration of expert sentiment through corporate managers in their capital allocation decisions. This informs our third hypothesis:

Hypothesis 3: A low quantity of information underlying an expert sentiment affects the relationship between expert sentiment and corporate capital allocation negatively.

Table 3.1 provides an overview of the three constructs, as well as their definitions, measurements, and expected relationships.

Table 3.1. Overview of Empirical Constructs

Construct	*Definition*	*Measurement*	*Expected outcome*
Expert sentiment	Experts' collective assessment of a product-technology domain	(Arithmetic) mean of expert sentiments regarding an SBU's product-technology domain	Positive (*Hypothesis 1*)
Determinacy	Clarity of an expert sentiment	Inverted standard error of the mean sentiment	Moderation (*Hypothesis 2*)
Quantity	Quantity of information underlying an expert sentiment	Number of articles mentioning an SBU's targeted product-technology domain	Moderation (*Hypothesis 3*)

3.4 Methods

3.4.1 Empirical Context

Our empirical project uses data from the global pharmaceutical industry. Pharmaceutical companies' unique features are beneficial for our analysis. One such feature is a high level of uncertainty about its firms' alternative investment opportunities. This industry has often been described as a high-stakes, high-reward one, with substantial upfront investments in product and market development (Darby, Liu, & Zucker, 2004). Recent estimates put the average pre-approval cost at a staggering USD 2.6 billion per approved drug (DiMasi et al., 2016). In part, this is due to new drug ventures' low success rate, which is currently estimated at less than 25 percent (DiMasi et al., 2016). These conditions make capital allocation decisions particularly important for multidivisional pharmaceutical companies.

Moreover, the pharmaceutical industry benefits from the presence of many experts specialized in analyzing industry developments. A wide range of professional magazines and trade press publications, such as *Medical Device Daily* and *Fierce Pharma,* provides detailed insights into technological developments and market prospects. Pharmaceutical companies have invested strongly in digital databases, which provide them with comprehensive access to professional publications (Groves et al., 2013). Further, they were early adopters of digital information-processing technologies,

such as expert systems, news analytics, and sentiment analyses (Fassbender, 2019; Yi & Kim, 2016).

Finally, pharmaceutical companies report specific data on each SBU's product-technology domain by identifying the SBU's targeted therapeutic areas (e.g., "oncology") and/or chemicals types (e.g., "antimicrobials"). This classification allows us to map SBUs to a set of product-technology domains by following a consistent process, which provides greater accuracy than more coarse-grained standard industry-classification systems such as SIC or NAICS (McGahan & Porter, 1997). All of the above reasons make the pharmaceutical industry a particularly promising context for our empirical study.

3.4.2 Sample Construction

Our sample of pharmaceuticals companies was constructed from the global *Compustat* database. We initially selected all the firms with the primary SIC code 283, which comprises firms engaged in the development and manufacturing of pharmaceutical drugs. We then used *Compustat*'s Historical Segments function to identify each firm's SBUs. Since we were interested in SBUs engaged in operational activities, such as the development and manufacturing of drugs, we screened the entire list of SBUs manually for names suggesting non-operational activities. We excluded all SBUs engaged in "corporate," "holding," "eliminations," "investments," or similar non-operational activities. If the SBU name gave no clear indication of its product-technology domain, we consulted the company's annual reports. SBUs whose activity could still not be identified clearly, were subsequently removed from the sample.

Following McGahan and Porter (1997), we also removed SBUs with only one observation. Such single-year appearances tend to be "anomalous because they are created for the disposition of assets prior to exit" (McGahan and Porter, 1997: 21). However, and unlike McGahan and Porter (1997), we refrained from systematically removing small SBUs with assets less than USD 10 million. In our final sample, the average small SBU had more than six years of observations, compared to the larger ones' five years. This difference is not statistically different from zero, which suggests that McGahan and Porter's (1997) specific concern regarding small firms' limited data availability does not apply to our sample of pharmaceutical firms.

Subsequently, we removed all the firms with a single SBU, as the internal capital allocation process in such firms is likely to be "drastically simplified" and therefore indistinguishable from the external mechanism (Arrfelt et al., 2015: 1023). We ended our observation period in 2016, the latest year for which data were available at the time of our empirical analysis. These cleaning steps resulted in a full sample of 161 firms with 536 SBUs and 2,893 observations (or an average of 3.3 SBUs and close to 18 observations per firm). The final sample was reduced in size due to missing data and the use of lagged variables. Missing data is a common problem with *Compustat*, which prior corporate capital allocation studies also encountered. For example, Arrfelt et al. (2013) report losing 85% of usable observations due to missing data. T-tests indicate that our full sample and the final sample are similar in terms of sales per assets and net income per assets. However, the final sample has fewer small firms, resulting in larger total sales and assets. The reason may be that larger firms generally receive higher scrutiny from financial markets in terms of reporting complete data, and have greater resources to comply with these demands, and therefore have fewer missing values if compared to small firms. The descriptive statistics and estimation results are shown for the 669 observations with complete data. The final sample consists of 85 firms with 2 SBUs on average. Given that our previous screening ensured that all firms in our sample have at least two SBUs with operations activities, we retained firms in our final sample for whom data was only available for one of their SBUs, since this still provides as with a partial view of their capital allocation decision.

We complemented the *Compustat* dataset with a separate expert sentiment dataset. The expert sentiments were computed from a database of 249,287 expert articles from 2005 to 2016. The articles were retrieved from *LexisNexis*, an online archive comprising a total of 69 journals covering the pharmaceutical industry. These journals are all professional magazines and trade press, which we identified using the industry tag that *LexisNexis* assigns to each publication. To supplement these data with expert analyses accessible to a wider public, we screened three large, internationally distributed newspapers: the *Financial Times*, the *New York Times*, and the *Washington Post*. We limited our search of these newspapers to articles containing variants of the word "pharma" in their full text. Overall, this dataset constitutes a partial representation of the respective firms' information environment. It does not include firm-internal information, such as employee correspondence, nor does it include other sources

of external information such as blogs, forums, and microblogging services.

We used a supervised machine-learning (SML) approach to determine each article's sentiment (Sebastiani, 2002). SML provides a range of different algorithms (or classifiers), which are "supervised" in the sense that they are trained and evaluated based on a subsample of data that human coders have pre-classified. An advantage of using pre-classified data for training is that the machine learns to identify the textual characteristics or features most likely to be associated with a given sentiment. This method allows the classifiers to glean the characteristics that a new, previously unseen document should have in order to be classified as positive or negative (Sebastiani, 2002).

Earlier studies have often employed lexicon-based approaches to determine a given text's sentiment. However, SML has persistently outperformed such lexicon-based approaches in terms of reliability (Piryani, Madhavi, & Singh, 2017). In our dataset, SML outperformed a lexicon-based approach by almost 30% (see Table 3.2). SML's key advantage is that it adapts to the specific content and nuances of the documents for which it is trained, rather than simply counting the occurrences of positive and negative words. This is particularly useful in expert publications, since experts' language tends to be rather factual and less marked by emotive patterns of speech. For these reasons, other organizational scientists have also chosen SML approaches over lexicon-based approaches (e.g., Kabanoff & Brown, 2008).

To train the SML classifier, we randomly selected a subset of 0.1 percent of the full dataset for manual annotation, which corresponded to 314 articles. Three human coders with different backgrounds classified the data. Two coders were native English speakers, of whom one held an academic degree in medicine. The third coder was a graduate student in management. The coders received individual sets of articles, which they classified on a paragraph level as either positive or negative. All three coders annotated about 30% of the articles after we convened several meetings to ensure that they used a consistent process to determine the sentiment. We measured inter-coder reliability, using case-wise agreement, as well as Krippendorff's alpha. Overall, our coders agreed in 83.2% of the cases, which corresponds to an alpha of 0.745.

The resulting dataset was split into training data and testing data on the basis of an 80:20 ratio. As there are several SML classifiers that could be used on our type of data, we followed Sebastiani's

(2002) approach to infer the best classifier directly from the data. We trained six different classifiers on the pre-coded data, varying the size of the feature sets, as well as comparing stemmed and un-stemmed words. We tried set sizes ranging from 250 to 15,000 features. We recorded each trained classifier's precision, recall, F-score, and accuracy.

We then used macro-averaging to aggregate the results (Sebastiani, 2002) by selecting the classifier maximizing the precision. Of the classifiers we tested, the Multinomial Naïve Bayes classifier performed best, with a set holding 8,000 features based on the use of stemmed words. This classifier has been found to be particularly well-suited to binary classification problems, such as document classification (McCallum & Nigam, 1998). The classifier's accuracy of 78.9% is reasonably close to the human coders' inter-reliability and comparable to the scores that prior studies report (Sebastiani, 2002). In addition, this classifier significantly outperforms a dictionary-based classifier whose accuracy scores together with the SML results we report in Table 3.2. This performance difference is most likely attributable to the specific language used in expert publications, which tends to be less emotional or affectionate, and to the SML approach's greater ability to systematically determine sentiment in these contexts (Cambria, 2016).

We finally aggregated the expert sentiments from the paragraph level to the article level by taking the mean paragraphs. The sentiment of each paragraph thus reflects the average sentiment of its paragraphs. Combining the sentiment dataset with the Compustat data allowed us to match the articles to SBUs by using their domain classifications. Each SBU was matched to articles mentioning its targeted product-technology domain in respect of each year. We retained all matched articles for each SBU, irrespective of whether they matched several SBUs of the same firm, since a single article may contain information for several business of the firm. Thereafter, we computed that SBU's relevant statistics from each year's matched articles.

Table 3.2. Comparison of Classification Accuracy

Method	Precision	Recall	F-Measure	Accuracy
Machine Learning	0.770	0.766	0.768	0.789
Lexicon-based	0.628	0.639	0.613	0.619

Comparison of accuracy scores (Sebastiani, 2002) of the employed machine-learning classifier with an alternative lexicon/dictionary-based approach. The former refers to a multinomial naïve-Bayesian classifier trained on stemmed word features. The latter is based on the MPQA dictionary (Deng & Wiebe, 2015), which contains 7,630 common words and their polarity scores. Word counts were aggregated using the Janis-Fadner coefficient of imbalances (Janis & Fadner, 1965) and the general tendency (positive or negative) compared to the score assigned by human coders.

3.4.3 Variable Description and Measurement

3.4.3.1 Dependent variable

Our dependent variable is the corporate parent's capital expenditure on each of the firm's SBUs. We normalized capital expenditure across SBUs and firms by dividing it by the total assets of the respective SBU in each year. This approach follows prior studies investigating capital allocation decisions (e.g., Bardolet et al., 2011).

3.4.3.2 Independent variables

We computed three distinctive variables from the sentiment dataset. Our main variable is the *expert sentiment*, which we computed as the arithmetic mean of the sentiment across all the matched articles, for a given SBU and year. The variable is continuous and bound between -1 and 1, which the method employed to determine each article's sentiment explains. Computing the mean across articles yields an indicator of the experts' collective sentiment. The underlying assumption is that the average sentiment captures the expert publications' overall assessment of a given product-technology domain, i.e., whether their collective evaluation is positive (above 0) or negative (below 0). Hribar and McInnis (2012) have shown that such expert sentiment can influence financial investment decisions.

Determinacy is the second variable derived from the sentiment dataset, which is operationalized by calculating the inverted standard error of the mean expert sentiment. This measure captures how

well the average expert sentiment approximates the true population mean, or, in other words, how much experts agree. Determinacy is therefore a measure of the average expert sentiment's clarity. In contrast, low determinacy indicates experts' disagreement and ambiguity. For example, Diether, Malloy, & Scherbina (2002) propose that the dispersion of analysts' forecasts can be used as a measure of their disagreement about the prospects of hard-to-value stocks, i.e., stocks with high uncertainty about their future performance. In line with our theoretical account, we differentiate between conditions of high and low determinacy by creating an indicator variable that takes the value of 1 for low determinacy and 0 otherwise. We define the threshold for low determinacy as the average determinacy overall. The resulting variable allows us to interact the expert sentiment for an SBU's specific product-technology domain with a conditional variable indicating low determinacy.

Q*uantity* is the third variable calculated on the basis of the sentiment dataset. As a proxy for general information availability, this measure reflects the total number of articles published on a product-technology domain in a given year, which is transformed by using natural logarithms to curb the skewness. The resulting variable measures the overall amount of information available at that point in time, which is a proxy for the external information environment's accessibility to managers (Forbes, 2007). Analogously to determinacy, we transform the variable for quantity into an indicator variable, taking on the value of 1 for low quantity and 0 otherwise, using average quantity as the threshold between high and low. The resulting variable thus captures conditions where the quantity underlying the expert sentiment is low, which we can interact with our main expert sentiment variable in our analysis.

Although our independent variables are lagged, some concerns may remain about reverse causality. To alleviate these concerns, we removed the variation part in our independent variables that capital expenditure explains, which we did by regressing our dependent variable on the sentiment variable and only retaining the residuals of that regression. These residuals of that regression are the component of expert sentiment that is not explained by (prior) capital expenditure (Yu, 2008).

3.4.3.3 Control variables

We added six control variables that we chose after the prior literature review. *Tobin's Q* is the

ratio of the market value to the book value of a firm's assets. We followed Bardolet et al. (2011) by defining this as the median Q for all stand-alone firms with the same four-digit SIC code as the focal SBU. This measure is a proxy for the SBU's median investment opportunities in its targeted product-technology domain, which reflects the investors' expectations about this domain's prospects (Arrfelt et al., 2013). *Industry investment* is the average level of investment that the SBU's industry peers make each year. It is measured as the average capital expenditure over assets by stand-alone firms with the same four-digit SIC code (Bardolet et al., 2011). Three additional control variables are drawn from Bardolet et al. (2011): *Firm cashflow* is measured as the firm-level operational cashflow over sales, *SBU growth* as the SBU's year-on-year sales growth, and *SBU profitability* as its operating profits relative to its sales. Finally, our control variable for *firm diversification* is based on Arrfelt et al. (2013). We calculated an inverse Herfindahl index using the focal SBU's share of its parent company's sales (i.e., $\sum_{j=1}^{J} s_j * \ln(1 - s_j)$, where s_j is the SBU's sales share). All the control variables were lagged by one period and standardized by subtracting the mean and dividing by the standard deviation. This procedure facilitates the regression coefficients' interpretation, especially regarding the sentiment variables. Table 3.3 presents the descriptive statistics and correlation matrix.

Table 3.3 Descriptive Statistics

	Mean	Std. dev	Min	Max	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Capex	0.04	0.06	0.00	0.83	1								
2. Tobin's Q	-0.16	1.03	-3.29	1.83	0.00	1							
3. Cash flow	0.02	0.37	-9.27	0.06	0.03	-0.06	1						
4. Growth	-0.05	0.11	-0.11	1.97	-0.03	0.01	-0.01	1					
5. Profit.	0.00	1.26	-31.80	0.17	0.04	-0.02	0.00	0.01	1				
6. Divers.	0.06	1.07	-2.34	1.20	-0.25	0.01	-0.06	0.06	-0.05	1			
7. Industry inv.	0.08	1.03	-0.57	8.31	0.03	-0.45	0.03	-0.01	0.02	-0.02	1		
8. Tendency	-0.06	0.94	-5.29	2.59	0.05	-0.04	-0.03	0.03	0.01	0.10	0.05	1	
9. Determinacy	-0.03	0.99	-0.63	8.07	0.04	-0.09	0.02	-0.02	0.02	-0.13	0.08	0.23	1
10. Quantity	0.18	0.88	-1.96	1.35	0.02	0.12	-0.03	0.01	-0.03	0.12	-0.12	0.07	0.665

669 observations

3.5 Results

Table 3.4 shows the results of our empirical analysis. Model (1) represents the results of our baseline model, which tests the control variables' effects on the dependent variable (i.e., capital

expenditure). Models (2) through (4) sequentially add the respective independent variables of our three hypotheses. Model (5) shows the complete model, including all the empirical constructs and control variables in the same regression.

In the baseline model, the SBU profitability and firm diversification explain changes in the capital expenditure. This SBU profitability result is comparable to that of Bardolet et al. (2011), who additionally found that industry investment, firm cashflow, and SBU growth are significant. Industry investment's insignificance in our sample is most likely due to our single-industry study, which should generate less variance in this variable than Bardolet et al.'s (2011) cross-industry study observes. Similarly, firm cashflow and SBU growth may be less relevant predictors for the pharmaceutical industry than in the cross-industry context. Contrary to prior results by Bardolet et al. (2011), as well as Arrfelt et al. (2013), we find that firm diversification is significant. The SBUs of more uniform firms tend to receive more capital than those in more diverse firms. An explanation for this finding could be that having more SBUs with decreasing relatedness makes "the allocation decision less clear" (Arrfelt et al., 2013: 1091), which may explain senior managers' prudence when allocating capital to these SBUs (Bardolet et al., 2011). We tried modelling diversification according to the behavioral account and method used by Bardolet et al. (2011), i.e., by controlling for the number of SBUs and a measure of diversification that does not rely on this number. However, the respective coefficients were insignificant and model selection criteria (AIC and BIC; Enders, 2010) strongly suggested using the more common Herfindahl index to measure diversification. Therefore, we chose to follow the majority of prior studies in using this measure of diversification.

In order to simplify the model interpretation, all the explanatory variables are standardized. Changes in an independent variable by one standard deviation translate into a change in the respective coefficient multiplied with one standard deviation in the dependent variable. For example, an increase in a given SBU's profitability of one standard deviation is associated with an increase in the capital allocated to that business unit by 0.001 standard deviations. We found effect sizes in a meaningful range in respect of all the significant coefficients.

Hypothesis 1 explores the relationship between the expert sentiment and corporate capital allocation. The positive coefficient of the tendency variable in models (2) and (5) indicates that a higher

average expert sentiment regarding an SBU's specific product-technology domain is associated with a higher capital allocation to this SBU. In both models, an increase in the expert sentiment by one standard deviation is associated with an increase in the capital expenditure by 0.04 standard deviations, holding the SBU's financial characteristics constant. These effects are significant, thus supporting our hypothesis.

Hypothesis 2 addresses the relationship between the expert sentiment's *determinacy* and corporate capital allocation. Using behavioral arguments from information comprehensiveness theory, we argue that the positive effect of expert sentiment on corporate capital allocation should be reduced if the determinacy underlying the expert sentiment is low. Our results in models (3) test this hypothesis by interacting expert sentiment with an indicator variable reflecting such conditions of low determinacy. The negative coefficient indicates that under conditions of low determinacy, the effect of a expert sentiment on capital allocation is reduced by 0.017. These effects are significant, thus supporting to hypothesis.

Hypothesis 3 assesses the relationship between the *quantity* of information underlying the expert sentiment and corporate capital allocation. Our results in models (3) support this hypothesis. The negative coefficient indicates that in conditions of low quantity, the effect of expert sentiment on capital allocation is reduced by 0.011, This effect is significant at reasonable levels, lending support to our hypothesis.

Endogeneity concerns due to variable omissions are a potential threat to our results' interpretation. Our results could be due to an unobservable variable describing a product-technology domain's "true economic prospects," which could affect the expert sentiment and the corporate capital investment. However, we have reason to believe that this alternative explanation is not a major threat. According to the efficient market hypothesis, market prices (as captured by our control variable Tobin's Q) include all certain information about a product-technology domain's economic prospects as soon as this becomes available (Tetlock et al., 2008). Our expert sentiment variable should cover the remaining, less certain information. Prior work has provided a similar argumentation regarding sentiments and investment decisions' relationship (Tetlock et al., 2008). Moreover, this logic is consistent with our prior argumentation that expert sentiment affects senior managers' capital allocation decisions under

conditions of uncertainty regarding the firm's alternative investment opportunities.

Table 3.4 Estimation Results: Main Model

	(1)		(2)		(3)	
	Coef.	**P-value**	**Coef.**	**P-value**	**Coef.**	**P-value**
Constant	0.052	0.001	0.052	0.001	0.052	0.001
	(0.015)		(0.016)		(0.016)	
Tobin's Q	0.001	0.454	0.002	0.418	0.001	0.420
	(0.002)		(0.002)		(0.002)	
Firm cashflow	0.003	0.172	0.003	0.130	0.003	0.139
	(0.002)		(0.002)		(0.002)	
SBU growth	-0.010	0.175	-0.011	0.139	-0.009	0.236
	(0.007)		(0.007)		(0.007)	
SBU profitability	0.001	0.013	0.001	0.015	0.001	0.013
	(0.000)		(0.000)		(0.000)	
Firm diversification	-0.013	0.000	-0.013	0.000	-0.014	0.000
	(0.002)		(0.002)		(0.003)	
Industry investment	0.002	0.271	0.002	0.295	0.002	0.305
	(0.002)		(0.002)		(0.002)	
Expert sentiment			0.004	0.017	0.018	0.002
			(0.002)		(0.006)	
Expert sent. (low quantity)					-0.011	0.009
					(0.004)	
Expert sent. (low determinacy)					-0.017	0.002
					(0.005)	
Observations	669		669		669	
R_2	0.075		0.079		0.083	
Adjusted R_2	0.052		0.055		0.058	

All the models are estimated using pooled-OLS estimators, controlling for year fixed effects (coefficients not reported); robust standard errors reported in parentheses below coefficients; robust p-values reported to the right of each coefficient. The variables have been standardized for easier interpretation of the coefficients. *Expert sent. (low quantity)* and *Expert sent. (low determinacy)* are interactions of the expert sentiment variable with dummy variables indicating low quantity and low determinacy, respectively.

3.5.1 Post-hoc test

The richness of the data used for our sentiment variables provided a valuable opportunity for investigating the mechanisms underlying our suggested relationships in greater detail. Specifically, we re-evaluated our Hypotheses 1 to 3 by taking the type of journal through which the relevant expert sentiments were conveyed into account. We gained some indication of the different groups of experts that influence capital allocation decisions by classifying the journals into five categories (business,

general, practitioner, regulatory, and scientific). We calculated our independent variables for each category and used these more fine-grained variables to recompute the models in Table 3.4. This post-hoc analysis led to the following additional insights:

First, the overall post-hoc analysis indicates that generic outlets' (such as the *New York Times* or the *Washington Post*) expert sentiment does not affect the pharmaceutical industry's corporate capital allocation decisions. This finding applies to all the three hypotheses. In contrast, the collective expert opinions taken from the business, regulatory, and scientific outlets have the strongest and most significant effects on the different models shown in Table 3.4. The practitioner outlets' findings are more partial and less significant.

Second, expert opinions from the business and regulatory categories have the strongest impact on the relationship between the expert sentiment and corporate capital allocation (Hypothesis 1). The specific coefficient of these categories increased significantly when compared to the general coefficients presented in Table 3.4 ($\beta = 0.005$; $p = 0.003$ and $\beta = 0.006$; $p = 0.005$, respectively, compared to 0.004 in main model). Given the importance of the regulatory drug approval process in the pharmaceutical industry as well as the pressure to be profitable following the highly expensive drug development process, this finding seems natural, especially when comparing it to other categories, such as those targeting practitioners or the general public. However, the scientific category's collective opinions also have an impact on how the expert sentiment relates to capital allocation, albeit weaker and less significant ($\beta = 0.005$; $p = 0.096$).

Finally, only the expert sentiment from the practitioner category showed signs of moderation through conditions of low quantity and low determinacy (hypotheses 2 and 3). Both indicator values suggested a reduction in the effect of expert sentiment on corporate capital allocation ($\beta = -0.007$; $p = 0.091$ and $\beta = -0.005$; $p = 0.073$). This result suggest that corporate managers are more sensitive to the quality of the information environment when evaluating practitioner publications than regarding other sources. This may reflect the influence of practitioner's assessment of products and technologies on the future viability and marketability of these products and technologies.

3.6 Discussion

Our study provides theoretical arguments for and empirical evidence of the way experts' sentiment influences firms' capital allocation decisions. The results indicate that a higher expert sentiment regarding an SBU's product-technology domain leads to an increase in the corporate capital allocated to that SBU. This result is moderated based on the two dimensions of the external information environment that we tested. The positive effect of a higher expert sentiment on corporate capital allocation was reduced if either the quantity or the determinacy underlying this information was low. In both cases, we found significant evidence of a moderation of the influence that expert sentiment had on the corporate capital allocation decision. Drawing on these findings, we contribute to the behavioral theory of the firm (Cyert & March, 1963; Gavetti et al., 2012) by developing an updated understanding of organizational decision making in the digital age.

3.6.1 Theoretical Contributions

One of behavioral theory's most fundamental assumptions is that information availability affects organizational decision makers' information processing and judgment (Cyert & March, 1963; Rerup, 2009). Prior theory describes a "paradox of information" (Hansen & Haas, 2001), namely that given greater information availability, organizational decision makers tend to restrict their attention due to their information-processing limitations. Our findings provide evidence challenging this proposition. In the digital age, with senior managers having access to unprecedented amounts of data and advanced analytical tools to process these data, the increased information availability becomes an important driver of these managers' decision making. We show that decision makers consider a wide variety of external experts' collective wisdom in their organizational decisions. They respond to complex information, such as the insights that the level of disagreement between experts conveys, or the different assessments that specific expert groups provide. While such expert sentiment is just one expression of the digitalization phenomenon and corporate capital allocation is only one type of strategic firm decision, our study provides theoretical arguments for and initial evidence of organizations' more comprehensive information processing in the digital age than previous behavioral theory studies have generally suggested.

We also clarify the boundary conditions that enable or constrain more comprehensive information processing. Most fundamentally, this study focuses on decisions under uncertainty, which are the shared focus of investigation in the corporate capital allocation literature (Busenbark et al., 2017), the decision comprehensiveness theory (Forbes, 2007), and the overarching behavioral theory of the firm (Cyert & March, 1963). However, our findings also confirm that more comprehensive information processing requires a certain level of determinacy in the available information (Forbes, 2007). Moreover, the sentiments in our study emerged from large volumes of available information. While we did not find clear evidence that relative differences matter regarding the quantity of information, scarcity of information would seriously constrain senior managers' ability to process comprehensive information (Forbes, 2007). Further, our post-hoc analysis indicates that the available information's quality may set further boundaries to more comprehensive information processing. Building on these findings, we suggest a contingency view of decision making in the digital age. The use of digital data and technologies may enable more comprehensive information-processing than the behavioral theory of the firm traditionally assumes, but these changes are limited to contexts in which senior managers have access to information of sufficient determinacy, quantity, and quality. Outside these contexts, decision making remains constrained by humans' cognitive limitations.

In the specific context of the corporate capital allocation literature (Busenbark et al., 2017; Sengul et al., 2018), our findings show that senior managers do not only rely on their limited internal information to make complex capital allocation decisions, but also consider rich, qualitative data from their external environment. Prior research has generally assumed that, due to senior managers' cognitive limitations (Argote & Greve, 2007; Simon, 1958), they limit their attention to financial performance indicators (Arrfelt et al., 2013), or even revert to simple heuristics such as allocating capital equally across SBUs (Bardolet et al., 2011). In contrast, our findings suggest that senior managers consider much richer expert sentiments, assessments, and expectations than their financial indicators could convey. Sentiment may partially act as a general proxy for financial expectations, but it also provides more specific information on concrete developments and opportunities, as well as insight into whether and how a specific organization could realize them. If expert sentiment informs corporate capital decisions, firms may no longer be constrained to crude financial targets, but could instead pursue

"multiple intermediate objectives across different time horizons" (Sengul et al., 2018: 65).

We also contribute to decision comprehensiveness theory (Atuahene-Gima & Li, 2004; Fredrickson, 1984) by integrating its thus far disparate normative and descriptive sub-streams. The normative sub-stream (e.g., Fredrickson & Mitchell, 1984; Forbes, 2007) explores the comprehensiveness-performance relationship with a focus on uncertainty as a contingency factor, but largely ignores the question whether companies that *should* be comprehensive also have the ability to *be* comprehensive in their decision making. In contrast, the descriptive sub-stream (e.g., Simons, Pelled, & Smith, 1999; Souitaris & Maestro, 2010) explores how top management team demographics and processes enable or constrain companies in their decision comprehensiveness, but disregards external predictors of firms' decision comprehensiveness. Our study shows that the normative sub-stream's contingency conditions regarding the nature of the information environment that firms face (i.e., high determinacy and quality) also function as predictors of their actual use of greater comprehensiveness in their decision making. Furthermore, we expand the descriptive sub-stream's scope from firm-internal processes to firm-external expert sentiment as a predictor of decision comprehensiveness in the digital age.

Furthermore, our study has implications for the literature on sentiments, sentiment analysis, and opinion mining (Piryani et al., 2017; Rathore et al., 2017). Prior studies primarily used sentiment to analyze individual consumers or investors' decision behaviors (e.g., Blasco et al., 2012; Hennig-Thurau et al., 2014). We extend this literature by showing that sentiments also affect organizational decision-making processes. Our key conceptual contribution is connecting the sentiment literature with behavioral theory arguments regarding decision-making in organizations. This theoretical integration allows for mutual enrichment. For instance, whereas prior studies on sentiment were mostly limited to the expert sentiment's general tendency (Tetlock et al., 2008), we show that additional dimensions, such as the sentiment's determinacy and quality, may also inform decisions (see also Hribar & McInnis, 2012).

Finally, digital transformation has also informed our methodological approach. Management scholars have started acknowledging digitalization's potential to revolutionize the methods we apply in scholarly research (George et al., 2016). In this study, we have used large-scale digital data, as well as

sophisticated machine-learning algorithms, to analyze the data. These and other new digital methodologies allow researchers to identify and study previously unattainable mechanisms. Our study suggests that capturing these previously unattainable mechanisms can lead to new insights that make us challenge and rethink our previously held theoretical assumptions and conclusions. We therefore encourage the further use of unstructured digital data and advanced digital technologies to explore the digitalization phenomenon and to derive or test theoretical propositions on its effects on organizational decision making.

3.6.2 Limitations and Future Research

Our work has some limitations that could be fruitful avenues for future research. First, we suggest that future research should open the internal decision-making process's "black box." Our finding that senior managers broaden their perspective to consider various experts' collective wisdom suggests that this rich information may help them overcome some of their cognitive limitations. Expert sentiment not only provides external (and therefore more independent) information, it is also collective information (and therefore less prone to individual biases). While behavioral theory assumes that humans are mostly incapable of debiasing their judgments (Kahneman, 2003), prior studies also show that rich and collective external information – such as expert sentiment – can motivate them to complement their intuitive thinking with more deliberate analysis (Heath et al., 1998; Larrick, 2004). Access to digital data and information-processing technologies could therefore enable senior managers to challenge and debias their corporate decisions. However, our large-scale research approach did not allow us to investigate this internal decision-making process. Future research should use laboratory studies and field experiments to explore digitalization's impact on humans' cognitive decision processes in organizations.

Second, management and organization theory scholars have recently started exploring the *augmentation* concept (Raisch & Krakowski, 2020), which refers to the complementary interaction between humans and machines to address managerial tasks. Driven by progress in digital technology, organizations increasingly use intelligent machines to augment their managers' abilities (Brynjolfsson & McAfee, 2014; Daugherty & Wilson, 2018). While we do not report on the actual interaction between

corporate managers and sentiment-analysis technologies in our study, we provide theoretical arguments on and first evidence of digital content and tools enabling more comprehensive information processing, which, in turn, informs organizational decisions. We therefore provide an empirical context for exploring the theoretical augmentation concept. Our findings provide first insights into the potential and the limitations of such augmentation, which could inform future research on digital technologies and their use for managerial tasks in organizations.

Third, digital data and technologies may alter organizational decision outcomes. Taking a normative perspective, behavioral theory scholars assume that more comprehensive information processing and judgment lead to more accurate decision outcomes in complex settings (Calabretta, Gemser, &Wijnberg, 2016; Elbanna & Child, 2007). However, scholars have also described the trade-off between accuracy and effort in decision making (Johnson & Payne, 1985; Kuo, Chu, Hsu, & Hsieh, 2004): Although decision makers prefer outcomes with greater accuracy, realizing this accuracy requires greater effort. We surmise that digital data and technologies will increasingly help organizations solve the accuracy-effort trade-off. For example, the use of sentiment analysis greatly reduces the effort required to process expert information. Furthermore, access to diverse experts' collective wisdom should increase the accuracy of decisions made in complex contexts. However, this may also lead to herding effects, with all the firms in a given product-technology domain pursuing similar opportunities, which could reduce their potential return. While we did not test such performance affects in our descriptive study, future normative research should explore these non-trivial performance relationships more formally.

3.7 Conclusion

Drawing on our theoretical arguments and empirical findings, we suggest that the digital transformation has altered organizational decision making's nature, drivers, and outcomes. Given the growing interest in digitalization's effects on organizations, and the emerging attention devoted to "augmented" decision making (e.g., von Krogh, 2018; Raisch & Krakowski, 2020), it seems that strategy and organization theory as research fields are ready for studies on the role of digital data and technology in complex firm decisions. This paper is an early step in that direction by substantiating the

claim that digital data and technology can enable more comprehensive decision making in organizations. Further research will be needed to illuminate the various ways in which digitalization affects organizational behavior and outcomes.

4 The Chicken or the Egg? A Causal Analysis of Organizational Reputation and Firm Performance

4.1 Introduction

Organizational reputation is an important intangible resource that has received considerable attention from organizational theory scholars (Rindova, Williamson, Petkova, & Sever, 2005; Pfarrer, Pollock, & Rindova, 2017). It is conceptualized as the recognition and approval an organization receives from its stakeholders (Lange et al., 2010, Zavyalova et al., 2016). Prior studies have found that organizational reputation influences important organizational outcomes, including earnings surprises and investors' reactions (Pfarrer et al., 2017), exchange partner selection (Castellucci & Ertug, 2010), and firm financial performance (Rindova, 2005; Boyd, Bergh, & Ketchen, 2010).

The link between firms' financial performance and organizational reputation is an old insight from reputation studies (Money, Saraeva, Garnelo-Gomez, Pain, & Hillenbrand, 2017). However, despite its success in explaining multiple causes of performance and reputation, the organizational reputation literature suffers from a fundamental limitation. Prior studies have taken little account of the dynamic relationship between reputation and performance (Bergh, Ketchen, Boyd, & Bergh, 2010). On the one hand, a higher reputation may enhance performance since it improves a firm's access to financial capital (Beatty & Ritter, 1986), signals better future performance to stakeholders (Shamsie, 2003), and increases its access to job applicants (Fombrun & Shanley, 1990). On the other hand, studies show that reporting good financial results improves a firm's reputation directly (McGuire, Schneeweis, & Branch, 1990) as well as indirectly (Hammond & Slocum, 1996). Despite the emerging consensus that the direction of causality runs both ways, prior studies tend to resort to statistical remedies to control for the resulting endogeneity (e.g., Roberts & Dowling, 2002), rather than modelling the bidirectionality of the causal relationship endogenously. Hence, no prior study has empirically determined in which direction causality between performance and reputation actually runs.

Stakeholder theory suggests that the causal relationship between firms' reputation and

performance may be more complex than it seems. Firms interact with a broad range of stakeholder groups, such as customers, suppliers, investors, competitors, governments, and social activists (Freeman, 1984; Laplume et al., 2008). Stakeholder groups differ along many dimensions, such as their respective degrees of power, legitimacy, and urgency (Mitchell et al., 1997; Eesley & Lenox, 2006). It should thus be expected that each holds its own reputation of the firm, which interacts with the performance of the firm in different ways (Mishina, Block, & Mannor, 2012). For example, investors tend to weigh firms' financial performance more heavily in their assessment of the firm than social activist groups. In contrast, social activist groups can be deliberately outspoken about their discontent with a firm in order to affect its performance (Nasi et al., 1994), whereas investors are typically more reserved in this regard. This heterogeneity in stakeholder interests and salience suggests that the causal direction between reputation and performance may be contingent on the type of stakeholder group and its respective relationship with the firm.

We address the causal relationship between organizational reputation and firm performance by modelling their interdependencies endogenously. Vector-autoregressive (VAR) models allow us to study the interdependent relationship between the two variables using simultaneously estimated equations. Using VAR models, we can estimate the two effects – of reputation on performance and vice versa – at the same time. To study the causal direction, we use the Toda-Yamamoto procedure (Toda & Yamamoto, 1995), which provides an established standardized process for using Granger causality tests on panel data (Granger, 1969). A unique dataset of over 290,000 articles covering the automobile industry from a diverse set of stakeholders' perspectives allows us to calculate the firm's reputation by different stakeholder groups. We combine the resulting reputation measures with quarterly accounting data retrieved from Compustat, using Return on Assets (ROA) as a measure of performance.

Our results suggest that heterogeneity among stakeholder groups leads to strong variation in the way they perceive firms' performance as well as in how their reputation affects performance. This result is contingent on the respective stakeholder group the reputation is referent to. We test hypotheses regarding the depth and locus of the firm-stakeholder relationship on the odds of finding a significant causal effect from reputation on performance and vice versa. Specifically, we hypothesize that a closer

proximity of stakeholders to the firm increases the odds of an effect from reputation to performance, while a deeper relationship should increase the odds of an effect from performance to reputation. Our results provide support for the first hypothesis but reject the second, suggesting that the depth-locus of the relationship is relevant for explaining the effect from reputation on performance but not the other way around.

We contribute to the literature on organizational reputation by providing a detailed account of the complex causal relationship between a firm's reputation and its performance. This responds to numerous calls for research to disentangle this relationship (Rindova & Martins, 2012; Money et al., 2017; Lange et al., 2010; Bergh et al., 2010). Prior studies tended to take a narrow stakeholder perspective on the concept of reputation, focusing on the views and opinions of either customers (Deephouse, 2000) or managers (Roberts & Dowling, 2002). In considering a broader set of stakeholder groups in our analysis and providing a theoretical account that is commensurate to each group's relationship with the firm, we also respond to calls for research into a more stakeholder-centric view of organizational reputation (Lange et al., 2010). Finally, our large dataset with a wide range of stakeholders is more representative of the reputational challenges faced by firms in the digital age. Media has become substantially more fast-paced and firms' reputation, thus, more delicate (Etter, Ravasi, & Colleoni, 2019). Today's firms manage their reputation permanently, by interacting with their stakeholders on a real-time basis (Brown, Chui, & Manyika, 2011). Studying higher frequency data from broader data sources is thus a step towards taking the organizational reputation literature into the digital age.

4.2 Theory Background

Reputation research has had considerable influence over a wide range of organizational theories (Money et al., 2017). It is commonly defined as the recognition and approval a firm receives from its stakeholders (Zavyalova et al., 2016). Reputation allows stakeholders to infer certain attributes about organizations when better information is either "unavailable or too costly to obtain" (Mishina et al., 2012: 460). Multiple theoretical perspectives have been applied to the study of organizational reputation

(Bergh et al., 2010; Rindova & Martins, 2012). Prior studies have studied its influence over organizational outcomes (e.g., Boyd et al., 2010; Castellucci & Ertug, 2010; Pfarrer et al. 2017) as well as its antecedents (e.g., den Hond, Rehbein, de Bakker, & van Lankveld, 2014; Staw & Epstein 2016; Zavyalova et al., 2016). Reputation is viewed as deriving from combinations of firm internal actions, such as investments into CSR or marketing (Highhouse, Brooks, & Gregarus, 2009; den Hond et al., 2014), and external appraisals by its stakeholders (Roberts & Dowling, 2002; Shamsie, 2003; Boyd et al., 2010). Most studies view reputation as a general yet multidimensional organizational attribute (Lange et al., 2010). Some studies suggest that reputation is among the most relevant strategic resources firms develop (Carmeli & Tishler, 2004).

Despite a rich literature on the relationship between organizational reputation and firm performance, a central issue has remained unresolved: The direction of causality between the two constructs. Detailed theoretical accounts have been proposed and tested for a causation from reputation to performance (e.g., Roberts & Dowling, 2002; Boyd et al., 2010) as well as the other way around (e.g., Fombrun & Shanley, 1990; Hammond & Slocum, 1996). While most studies to date have studied unidirectional causal relationships (Lange et al., 2010), there is a growing consensus that the true causal relationship is much more complex (Walsh, Mitchell, Jackson, & Beatty, 2009; Lange et al., 2010). Several scholars have pointed out this gap as an important opportunity for future research (Rindova & Martins, 2012; Money et al., 2017; Lange et al., 2010; Bergh et al., 2010). However, few studies with a bidirectional account exist (e.g., Roberts & Dowling, 2002; McGuire et al., 1990), and none has modelled the causal relationship endogenously.

Early reputation research has been described as primarily concerned with the benefits of successful reputation management for firm performance (Balmer, 2010). Subsequent studies attribute the positive effect of reputation on performance to a signaling effect or a form of information exchange, which helps reduce information asymmetries (Rindova et al., 2005). Prior studies have also identified several channels through which a good organizational reputation may improve financial performance. Reputation has been linked to market dominance, in that a strong reputation enables firms to differentiate their products and thus outperform lesser known rivals (Shamsie, 2003). To customers,

organizational reputation can function as a signal for perceived product quality (Lin, Yang, & Arya, 2009), which may allow the firm to charge price premiums as a result (Rindova et al., 2005). A good reputation can improve firms' access to higher quality job applicants (Turban & Cable, 2003) as well as signal lower financial risk to investors, thus facilitating access to financial capital (Hammond & Slocum, 1996).

On the other hand, multiple theories suggest that performance serves as an antecedent to organizational reputation (Bergh et al., 2010). Financial performance is a fundamental factor in how individual stakeholders determine a firm's perception (Highhouse et al., 2009). Fombrun and Shanley (1990) argue that a firm's accounting profitability and financial risk serve as informational signals, on which stakeholders base the firm's reputation. Such predictions have been confirmed by a multitude of studies, which report significant empirical findings supporting financial performance's effect on organizational reputation (e.g., Sobol & Farrelly, 1988; Fombrun & Shanley, 1990; Hammond & Slocum, 1996; Cable & Graham, 2000; Deephouse, 2000; Brammer & Pavelin, 2006; Staw & Epstein 2016).

The fact that performance has been proposed to be both a consequence and an antecedent of organizational reputation suggests "that the relationship between firm performance and firm reputation is not simple and unidirectional" (Lange et al., 2010: 177). This indicates a strong need to better understand how the two variables interact (Bergh et al., 2010).

4.3 Theory Development

We draw on stakeholder theory to develop our hypotheses for this study. Stakeholder theory suggests that firms interact with a broad set of stakeholders, whose relationships form an intricate web into which the business of the firm is tightly knit (Parmar et al., 2010). From this perspective, it becomes the role of the manager to nurture the firm's relationships with its stakeholders. This is as much a moral endeavor, since stakeholders are often affected by firms' actions, as it is a financial one (Freeman, 1984). A number of studies have found a positive relationship between stakeholder management and firm financial performance (Laplume et al., 2008; Berman, Wicks, Kotha, & Jones, 2017).

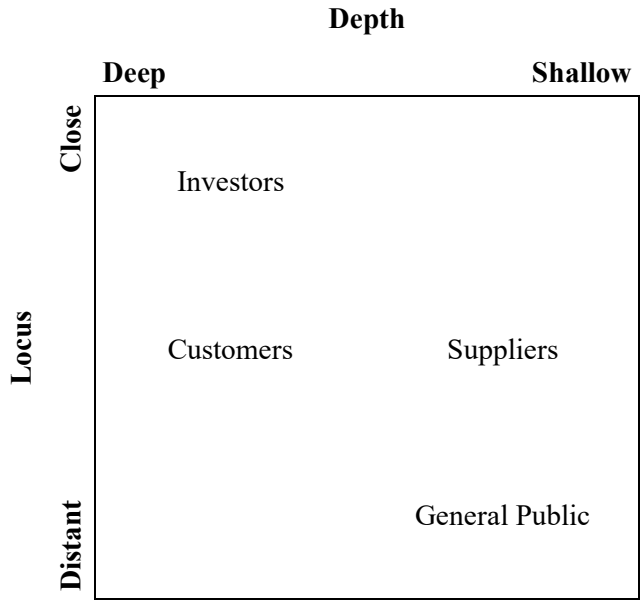
A core stipulation of stakeholder theory is that distinct stakeholder groups – such as customers, suppliers, investors, and the general public – differ across many different dimensions, such as their power, legitimacy, and urgency (Mitchell et al., 1997; Eesley & Lenox, 2006). Distinct stakeholder groups may thus have different degrees of influence over firm performance and they may also perceive firm actions in different ways. This broader interpretation of stakeholders is shared by the reputation literature, which recognizes that distinct stakeholder groups may have "different perceptions of corporate reputations" (Walker, 2010: 357) and "attend to different features of firms' performance" (Fombrun & Shanley, 1990: 235). It is thus likely that stakeholders respond to companies in a diverse manner (Money et al., 2017). Similarly, this interpretation suggests that firms have a different reputation with distinct stakeholder groups and that these groups perceive the firm's actions in different ways (Mishina et al., 2012). For example, layoffs will likely be perceived more negatively by employees than by investors, while investors may similarly value sustainable practices differently than the general public. Viewing reputation as a "stakeholder-group specific [collective] assessment" (Mishina et al., 2012: 460), and differentiating the analysis among stakeholder groups, is thus consistent with stakeholder theory and the reputation literature.

We propose that the causal relationship between a firms' reputation and financial performance is contingent on the respective stakeholder group that holds the reputation. Prior studies have identified multiple dimensions along which various stakeholder groups can be differentiated (e.g., Mitchell et al., 1997; Eesley & Lenox, 2006). In this study, we adopt the depth-locus framework of stakeholder-relationships (Pirson & Malhotra, 2010). This framework is rooted in network analysis theory, which distinguishes stakeholder groups based on their relative position in a social network (Rowley, 1997). Pirson and Malhotra (2010) suggest studying two dimensions; (1) the intensity of the relationship between stakeholders and organizations and (2) the stakeholders' proximity to the organization, which they refer to as *depth* and *locus*, respectively. The level of depth measures the strength or intensity of the relationship, reflecting its importance as well as the frequency of contact (Rousseau, Sitkin, Burt, & Camerer, 1998; Sheppard & Sherman 1998). Shallow relationships pertain several risks, such as unreliability, indiscretion, and coordination problems (Sheppard & Sherman, 1998). These risks are

mitigated in deep relationships. Moreover, risks pertaining to deep relationships, such as the increased propensity to cheat, are often mitigated by proximity, i.e., by the *locus* of the relationship (Sheppard & Sherman, 1998, Levin, Whitener, & Cross, 2006, Schoorman, Mayer, & Davis, 2007). The relevance of proximity in relationships has been extensively studied by extant stakeholder research, which distinguishes, for example, between internal and external stakeholders (Freeman, 1984) or between primary and secondary stakeholders (Clarkson, 1995).

Both dimensions, *depth* and *locus,* are positively related to the level trust in the stakeholder-relationship (Pirson & Malhotra, 2010). As trust is highly consequential for the value and utility that can be derived from relationships (Schoorman et al., 2007, Sheppard & Sherman, 1998), it has important consequences for the value of organizational reputation in the firm-stakeholder relationship. Reputation is commonly conceptualized as a signal for quality as well as a basis for information exchange, both of which are relevant because of the inherent information asymmetries in the firm-stakeholder relationship (Rindova et al., 2005). Trust thus plays an important role, because it facilitates information exchange while increasing the value of reputation as a signal (Macy & Skvoretz, 1998; Benjamin & Podolny, 1999; Mazzola, Ravasi, & Gabbioneta, 2006).

Figure 4.1 Depth-Locus Framework of Stakeholder Relationships



Our study focuses on a diverse set of stakeholder groups with different types of relationships

with the firm: Customers, suppliers, investors, and the general public. The remainder of this section, we derive our hypotheses based on each group's firm-stakeholder relationship, given its depth and locus. Figure 4.1 depicts the relative position of each stakeholder group in terms of the depth-locus framework graphically.

In terms of the depth-locus framework, investors and customers typically have a relatively deep relationship with firms. Firms' regularly inform their own investors as well as the wider investor community. For example, Chen (2008) notes that there is extensive communication between investment analysts and executives through interviews and routine disclosure of updated information. Similarly, firms invest into relationship-building activities and direct communication with customers, such as through corporate social responsibility (Scherer & Palazzo, 2011) and active customer relationship management (Bhattacharya & Sen, 2003). Although similar activities may be beneficial for the relationship with suppliers or the general public as well, few firms currently appear to actively invest in their relationship with these groups (Bhattacharya, Korschun, & Sen, 2009). We therefore assume that these stakeholder groups have a shallower relationship with the firm, at least when compared to customers and investors.

Prior studies suggest that such communication channels are positively related to organizational reputation (Brammer & Pavelin, 2006; den Hond et al., 2014). We therefore expect that stakeholder groups that have a deeper relationship with the firm are more likely to adjust their reputation of the firm in response to changes in the firm's financial performance. This leads to our first hypothesis:

Hypothesis 1: Stakeholder groups with a deeper relationship are more likely to adjust their reputation of firms in response to changes in their financial performance

Regarding locus, we can distinguish our stakeholders as internal or external, or as primary or secondary. Each classification system has its merits (Laplume et al., 2008). The distinction between internal and external stakeholders is the original conceptualization of Freeman (1984), which places investors inside the firm because they represent it as owners (Goodpaster, 2015). In contrast, customers, suppliers, and the general public are external stakeholders, because they do not own or work for the

organization and are thus not typically seen as representing it (Pirson & Malhotra, 2010). We can further distinguish between these groups by using the additional lens of primary and secondary stakeholders (Clarkson, 1995). Primary stakeholders are defined as those without whose continuing support the firm cannot survive. This applies to customers and suppliers, because if either group were to withdraw [its] support, it would leave the firm unable to continue operating. Secondary stakeholders, in contrast, are groups that fulfill the basic definition of a stakeholder (to affect or be affected by the firm), but who are not essential to its survival. This includes the *general public,* which we define as those stakeholders that may form a reputation of the firm, but that do not necessarily hold a formal claim over it (Eesley & Lenox, 2006). This definition may include the various communities the firm is nested in (Dunham et al., 2006), activists and advocacy groups that are concerned with the firm's actions (Eesley & Lenox, 2006) as well as the environment (Phillips & Reichart, 2000). While it is possible that these groups mobilize customers against the focal firm (Lange et al., 2010), they have no formal claim or influence on its activities on their own (Clarkson, 1995; Eesley & Lenox, 2006).

Stakeholders proximity to the firm reflects their potential to affect its activities and fortunes. We therefore expect the financial performance of firms is more likely to be affected by the reputation held by stakeholder groups that are closer to the firm rather than distant. This leads to our second hypothesis:

Hypothesis 2: The reputation held by stakeholder groups is more likely to affect the financial performance of the firm if their locus is closer to the firm

4.4 Method

4.4.1 The Automobile Industry

Our empirical analysis uses firm-level data from the global automobile industry. Automobile companies possess some unique features that are beneficial to our analysis. Notably, automobile manufacturers and their component suppliers are the primary subject of a multitude of publications, representing the viewpoints of many different stakeholder groups. A wide range of publications that we gathered reflect the opinions of customers, particularly private clients and car enthusiasts (e.g.,

periodicals such as AutoCar and AutoWeek), commercial clients (e.g., American Trucker, Fleet Owner, or Refrigerated Transporter), and motorsport fans (e.g., Autosport). Suppliers equally have a unique outlet of their own, in publications such as Tire Business, Trailer/Body Builders or Inside Fuels & Vehicles. There are publications that tend to represent the views and opinions of investors and the investment community at large (e.g., Automotive News Europe or Just-Auto Global News, and auto news published in The Financial Times London, particularly those in the section "Merger and Acquisition Stories"). Finally, we included the automobile sections of large English-speaking newspapers, such as the New York Times and the Washington Post, which we use to represent the viewpoints of the general public at large. While this list is by no means exhaustive of the full spectrum of stakeholders' views and opinions, it provides a sample of some of the most often-cited stakeholder groups (e.g., Parmar et al., 2010). This relatively unique diversity of viewpoints thus allows us to measure and study the reputation of a relatively wide range of stakeholders.

Adding to that, the automobile industry has seen constant change since Henry Ford built its first assembly line in 1910. Particularly the last two decades have brought about substantial technological advancements, such as drive-by-wire electric systems and driving assistants (Mohr et al., 2013). Environmental scandals, such as Volkswagen's diesel-emissions scandal, have caused increased stakeholder pressures for cleaner technologies. Innovative new entrants such as electronic car manufacturer Tesla or Google's Waymo have garnered stakeholders' attention to automation technologies, such as autonomous driving. Rising incomes have opened new markets across the globe, shifting demand and growth potential away from increasingly saturated Western markets, while also attracting new competitors, such as China's BYD. At the same time, there have been numerous scandals, particularly surrounding manufacturers of internal combustion vehicles. In a well-known example, Volkswagen, the world's second largest car producer, was caught using fraudulent technology in order to insinuate compliance with environmental standards. The company had built software into more than eleven million diesel-engine vehicles, which significantly reduced carbon emissions during laboratory testing to insinuate regulatory compliance (Topham et al., 2015). Taken together, these factors make the automobile industry a good fit for our empirical study to understand the nuanced

relationship between reputation and financial performance.

4.4.2 Data sources and sample construction

Our empirical study is based on two major data sources. Historical firm accounting data is obtained from Standard & Poor's Compustat database, which collects quarterly financial information for all US-listed companies. The database includes international firms that are cross-listed on US-exchanges, which is the case for most large automobile manufacturers as well as numerous large component suppliers. Finally, we used Lexis Nexis to obtain news articles from English-speaking trade, industry, and customer publications covering the global automobile industry between 2000 and 2016. To create the sample, we selected all firms registered under the SIC-code 371 ("Motor Vehicles and Equipment"). Firms in this industry segment include manufacturers of motorized vehicles (cars, trucks, buses, etc.) as well as suppliers of auto parts, components, and accessories. News articles were subsequently matched for each quarter using the names, or close equivalents, of the companies in our sample. We applied two major cleaning steps. First, we removed firms that had more than 50 percent missingness in either of our dependent variables. Second, we removed firms with less than three years (12 quarters) of complete data. This process resulted in an unbalanced panel dataset of 31 automobile firms with 1,880 observations from 2000 to 2016. The shortest panel has 28 observations (7 years of data) and the longest 69 observations (17.25 years), with the average firm having 60 observations (15.25 years).

4.4.3 Estimation procedure

Our estimation procedure is designed to study the direction of causation between corporate performance and firm performance endogenously, contingent on the type of stakeholder group that holds the respective reputation. To ensure robust and comparable results across firms, we employ a standardized procedure to test for Granger causality (Granger, 1969) in vector autoregressive (VAR) models called the Toda-Yamamoto procedure (Toda & Yamamoto, 1995). This procedure provides a standardized approach to estimating VAR models consistent with asymptotic theory, even when the underlying time series data may be integrated or cointegrated. It thus allows us to estimate VAR models for each where the usual asymptotically distributed test statistics can be used for inference, i.e., to test

for Granger causality between organizational reputation and firm performance.

In a nutshell, Toda & Yamamoto (1995) show that when additional lags equal to the maximum order of integration of the included time series are added to an optimally specified VAR model, then the estimated coefficients up to the last optimal lag are unbiased[2]. In practice, we start by determining the maximum order of integration of the two data series, using Augmented Dickey-Fuller tests (Hansen, 1995). Differencing the data and re-testing until stationarity is achieved reveals the level of integration of each data series. The maximum order of integration, in turn, is equal to the highest order of integration of the series included in the model (e.g., if the first series is integrated of order 1 and the second of order 3, the maximum order of integration is 3). Next, we determine the optimal lag-length by estimating VAR-models with various lag-orders, selecting the optimal lag-length using the AIC-criterion (Enders, 2010). Toda & Yamamoto (1995) show that a stationary VAR-model can be estimated with both variables in levels, i.e., without differencing, by adding additional lags equal to the maximum order of integration to the optimal model. Stationarity can thus be achieved without the need to adjust the included variables, which may remove relevant variation from the data. Following this procedure, we estimate the following simplified VAR-model for each firm and respective stakeholder-specific reputation measure in our sample:

$$Rep_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i}\, Rep_{t-i} + \sum_{j=k+1}^{dmax} \alpha_{2j}\, Rep_{t-j} + \sum_{i=1}^{k} \delta_{1i}\, Perf_{t-i} + \sum_{j=k+1}^{dmax} \delta_{2j}\, Perf_{t-j} + \epsilon_{1t}$$

$$Perf_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i}\, Perf_{t-i} + \sum_{j=k+1}^{dmax} \beta_{2j}\, Perf_{t-j} + \sum_{i=1}^{k} \phi_{1i}\, Rep_{t-i} + \sum_{j=k+1}^{dmax} \phi_{2j}\, Rep_{t-j} + \epsilon_{2t}$$

In this equation, Rep and $Perf$ refer to organizational reputation and firm performance, respectively, k is the number of lags in the optimal model, and $dmax$ the maximum order of integration

[2] We do not test for cointegration between reputation and performance. Toda & Yamamoto (1995) note that common tests for cointegration "are very sensitive to the values of the nuisance parameters in finite samples and hence not very reliable for sample sizes that are typical for economic time series" (Toda & Yamamoto: 226).

between performance and reputation. As Toda & Yamamoto (1995) suggest, we test for Granger causality by calculating a Wald test on the coefficients up to the optimal lag k, i.e., excluding the additional lags from $k + 1$ to $dmax$, which we include only to control for the potentially asymptotic nature of the data. In doing so, we determine whether each firm in our sample falls into one of four categories for each of its respective stakeholder groups: A firm's performance may Granger cause its reputation, its reputation may Granger cause its performance, its reputation and performance may Granger cause each other, or there may be no causal relationship at all.

4.4.4 Variable selection

Following the organizational reputation literature, we employ the Toda-Yamamoto procedure to determine Granger Causality on the following two data series.

4.4.4.1 Firm performance

We use firm-level return on assets (ROA) as a proxy for financial performance. ROA is a common performance proxy in reputation studies (e.g., McGuire et al., 1990; Roberts & Dowling, 2002). It captures how well a firm utilizes its assets while also controlling for differences in size (Deephouse, 2000). As such, it presents an appropriate as well as relatively unbiased measure of financial performance.

4.4.4.2 Organizational reputation

We approximate organizational reputation based on the stakeholder sentiment towards the firm in various publications focused on the automobile industry. Our database comprises 290,047 articles from 41 publications that were published over the seventeen-year period from 2000 to 2016. The database covers publications reflecting the viewpoints of a wide range of stakeholder groups, with titles such as *AutoCar*, *Ward's Dealer Business,* and *Fleet Owner* for customers; *Inside Fuels & Vehicles* and *Tire Business* for suppliers; and *Automotive News* and *The Financial Times London* for investors. *The New York Times* and *The Washington Post* are included to reflect the views of the general public. We compute sentiments using the MPQA Subjectivity Lexicon (Wilson et al., 2005), a lexicon of 7,631 words and their respective sentiment (positive or negative). After counting the unique positive and

negative words in each article, we calculate the Janis-Fadner coefficient of imbalance (JFCI) to determine the sentiment of each article (Janis & Fadner, 1965). The coefficient is calculated as:

$$JFCI = \begin{cases} \frac{p^2 - pn}{(p+n)^2} & if\ p > n \\ 0 & if\ p = n \\ \frac{pn - n^2}{(p+n)^2} & if\ n > p \end{cases}$$

where p refers to positive words and n to negative words. In the context of dictionary-based approaches, using the JFCI is a common method in the literature for aggregating positive and negative words (e.g., Deephouse, 2000; König et al., 2015). After determining the sentiment per article, we match articles to the firms in our sample using the name of the firm, or a variant of it as keyword. In doing so, the average firm got matched to slightly over 710 articles per year. We then calculate our final measure of organizational reputation by aggregating the individual sentiments of each stakeholder group in each fiscal year using the arithmetic mean.

Table 4.1 presents summary statistics and correlations for financial performance and the reputation measures for each stakeholder group.

Table 4.1 Descriptive Statistics

	N	Mean	St. Dev	Min	Max	1.	2.	3.	4.	5.
1. ROA	1,763	0.000	0.065	-1.600	0.881	1				
2. Rep. Overall	1,640	-0.023	0.075	-0.691	0.216	0.019	1			
3. Rep. Customer	1,337	-0.010	0.072	-0.628	0.211	-0.005	0.693	1		
4. Rep. Investor	1,121	-0.006	0.079	-0.691	0.319	0.025	0.704	0.380	1	
5. Rep. Supplier	951	-0.015	0.099	-0.612	0.375	0.014	0.553	0.433	0.325	1
6. Rep. General Public	825	-0.084	0.069	-0.405	0.096	-0.021	0.099	-0.130	0.110	-0.008

4.5 Results

Tables 4.2 depicts the results of our empirical analysis. The table shows the four cases for causal relationships between firm performance and organization reputation in rows. The cases are no causal relationship (*None*), performance Granger causes reputation (*Perf.* → *Rep.)*, reputation Granger causes

performance (*Rep. → Perf.)*, and dual Granger causality (*Dual*). The categories are not mutually exclusive. That is, the two unidirectional cases count the bidirectional case as well, since the unidirectional cases are true for the bidirectional case as well. Each column of the table represents a single stakeholder group, for which the value indicates the number of firms that fell under a given case. In the final column, we show results representing the firm's reputation overall, i.e., using the reputation across all stakeholder groups in our sample. The leading row indicates the number of firms for which we were able to estimate results using the Toda-Yamamoto procedure.

Table 4.2 Overview of Toda-Yamamoto Procedure by Stakeholder Group

Results of granger-causality tests, following Toda-Yamamoto procedure. The values indicate the number of cases where evidence for a causal relationship between performance and reputation was found for the respective stakeholder group and causal direction.

	Investor	**Customer**	**Supplier**	**Public**	**Overall**
None	14	19	18	9	16
Perf. → Rep.	5	5	2	4	8
Rep. → Perf.	9	6	4	2	9
Dual	2	3	0	1	3

A visual inspection of the results shows that there is substantial variation in the causal reputation-performance relationship between different stakeholder groups. The groups are ordered by their hypothesized depth-locus. Visually, the number of cases appears to be increasing with the relative depth-locus of the stakeholder group. However, this relationship seems clearer for the case of reputation to performance than the other way around. For the case performance → reputation, the number of cases is increasing from suppliers in both directions. In addition, there is also a substantial number of firms for which we did not detect any causal relationship at all. For investors, this was the case in half the cases, for customers in 63%, for suppliers in 75%, for the general public in 60%. For reputation overall, across stakeholder groups, we found evidence of causation in 52% of the cases.

To evaluate our results with respect to our hypotheses, we ran a logistic regression for the two pertinent cases ($Rep. \rightarrow Perf.$ and $Perf. \rightarrow Rep.$), using the outcome variable of the Toda-Yamamoto procedure (i.e., if the Wald-test in either direction was significant or not) as the dependent variable and

the Locus and Depth of each stakeholder group as the independent variable. We interpreted the absence of results for a given stakeholder group as the absence of a causal effect, as these were unanimously caused by a lack of data in the reputation variable. Results for this analysis are reported in Table 4.3. The coefficients in the table indicate the change in the log-odds ratio of the dependent variable, given an increase in the independent variable by one level, where the level of *Depth* is modeled as 1 for shallow and 2 for deep, and the level of *Locus,* as 1 for distant, 2 for middling, and 3 for high. Exponentiating the coefficients yields the odds-ratio, i.e., the change in the odds of finding a significant causal relationship for the given case.

Table 4.3 Results Probabilistic regression

Results of probabilistic regression of Depth and Locus on result of Granger causality test in Toda-Yamamoto procedure. Dependent variable is Granger causality test outcome (0 or 1). Standard errors reported in parentheses, significance levels indicated as $^{**}p < 0.01$, $^{*}p < 0.05$ and $^{+}p < 0.1$.

	$\boldsymbol{Perf.} \rightarrow \boldsymbol{Rep.}$		$\textbf{Rep.} \rightarrow \textbf{Perf.}$	
	(1)	**(2)**	**(3)**	**(4)**
Constant	-2.130*	-2.750**	-3.350**	-3.270**
	(0.83)	(0.93)	(0.88)	(0.91)
Locus	0.145		0.862*	
	(0.38)		(0.37)	
Depth		0.591		1.110*
		(0.55)		(0.53)
Observations	116	116	116	116
Log Likelihood	-46.5	-46	-51.9	-52.4
Akaike Inf. Crit.	96.9	95.9	108	109

Our behavioral account for depth conceptualizes the dimension as an important factor for stakeholders' evaluation of firm performance. We hypothesized that a deeper relationship would increase the odds of finding a significant effect from financial performance to reputation. Our results reject this hypothesis. Although the coefficient in column (2) indicates that the odds of finding a causal effect from performance on reputation increase by a factor of 1.8 ($\approx e^{0.591}$) if the depth of the stakeholder-firm relationship increases from shallow to deep, this effect is not statistically significant at any reasonable confidence level. We therefore reject our first hypothesis.

With regard to the locus of the stakeholder relationship, our behavioral account suggested that

this dimension should be particularly meaningful in the direction from stakeholders to firm, since a closer proximity between stakeholders and the firm would suggest that stakeholders have greater power over the firm's performance. We therefore hypothesized that a relationship with a closer locus would increase the odds of finding a significant causal effect from reputation to financial performance. Our results provide significant support for this hypothesis. The significant coefficient of *Locus* in column (3) indicates that the odds of finding a causal effect from reputation on performance increases by a factor of 2.4 ($\approx e^{0.862}$) if the locus of the stakeholder-firm relationship increases by one level from distant to close.

Taken together, our results suggest that the two dimensions of the stakeholder-firm relationship stipulated by the depth-locus framework increase the odds of a causal effect from reputation to performance. However, in the opposite direction, from performance to reputation, we did not find a similar effect. In our sample of automobile firms, both the proximity of stakeholders to the firm and the depth of their relationship increased the odds of a causal effect from their reputation to firms' financial performance, while there was no evidence for this relationship from financial performance to reputation. Looking at the results in Table 4.2, these results seem to be driven by multiple cases identified in the General Public stakeholder group, which renders the depth-locus effect less clear. A potential explanation for this could be the existence of spillover effects from customers to the general public, which has previously hypothesized in the organizational reputation literature (Lange et al., 2010). That is, the number of cases where the reputation held by the general public increased as a result of changes in firms' financial performance may be driven by spillovers from one of the other stakeholder groups, notably investors and customers.

4.6 Discussion

Our study provides a detailed theoretical account of the causal relationship between organizational reputation and firm performance, which we test empirically using data from the automobile industry. The results indicate that causality in the reputation-performance relationship is contingent on the stakeholder group to which the reputation refers in one direction, but not in the other.

Our findings show that both the depth and locus of the relationship between firms and stakeholders increases the odds of a causal effect from reputation to firms' financial performance. However, the other way around, we found no evidence for this effect. These results suggest that the strength of the relationship between firms and stakeholders is an important factor when studying the causal relationship from reputation to financial performance, but not necessarily the other way around.

In more general terms, our results show that the reputation held by investors appears to be the most pertinent with regard to a causal relationship from reputation to financial performance, while it is on par with that of customers for the other causal direction. Investors thus appear to be the most pertinent stakeholder group, in terms of the effect of their reputation of the firm on the firm's financial performance. In terms of the causal effect from firms' financial performance to reputation, investors and customers appear to be of equal pertinence in our sample of automobile firms. However, both are only marginally more relevant than the general public—a finding which we attribute to spillover effects from the former two on the latter group (see e.g., Lange et al., 2010). The effect of reputation overall shows a relatively even split between both casual directions, suggesting that the reputation across stakeholder groups is as likely to cause performance as it is caused by performance. However, for all groups we found a significant number of cases for which there was no causal relationship at all.

4.6.1 Theoretical Contributions

The organizational reputation literature studies have received considerable attention from a wide range of organizational theories (Rindova et al., 2005; Pfarrer et al., 2017). A longtime conundrum in this literature has been the direction of causality between organizational reputation and firm financial performance (Rindova & Martins, 2012; Money et al., 2017; Lange et al., 2010; Bergh et al., 2010). Detailed theoretical accounts have been proposed and tested for a causation from reputation to performance (e.g., Roberts & Dowling, 2002; Boyd et al., 2010) as well as the other way around (e.g., Fombrun & Shanley, 1990; Hammond & Slocum, 1996). While most studies to date have studied unidirectional causal relationships (Lange et al., 2010), there is a growing consensus that the true causal relationship is much more complex (Walsh et al., 2009; Lange et al., 2010). Our research presents a first step into this direction. By providing a clearer understanding of some of the factors underlying this

complex phenomenon, we attempt to open the black box of causality in the performance-reputation relationship. In our theoretical account, there are important contingencies that derive from the *nature* of the respective stakeholder group's relationship with the firm. Taking into account the type of stakeholder group based on which reputation is measured constitutes a significant contingency factor, which alters the dynamics of the reputation-performance relationship in certain cases but not in others. Our findings have important implications for the reputation literature. On the one hand, they show that a broad definition of reputation, aggregated over several diverse stakeholder groups, runs the risk of combining countervailing forces while likely overweighting the most pertinent groups. In our case, the aggregate *overall* category showed remarkably similar results to those of *investors*, while being notably different from the three other stakeholder groups, *customers, suppliers,* and the *general public.* This suggests that reputation studies should pay close attention to whose take on reputation they truly measure, as the level of analysis changes the dynamics of the relationship they theorize about. Empirically, we provide a novel modelling technique that accounts for the potentially causal direction of the performance-reputation relationship endogenously. This provides a promising avenue for future research, as the techniques can readily be extended to other explanatory frameworks than the ones used in this study.

Our study also provides insights regarding moderating effects and boundary conditions of the causal relationship between organizational reputation and firm performance. Regarding boundary conditions, we show how the likelihood of a causal effect differs significantly between stakeholder groups. This suggests that behavioral investigations of the reputation-performance relationship need to note the stakeholder-specification of their models. Specifically, causal accounts of the performance-reputation relationship must consider *by whom* the reputation is held. In doing so, we contribute to the stakeholder-centric view or organizational reputation (e.g., MacMillan, Money, Downing, & Hillenbrand, 2005; Mishina et al., 2012). We also extend recent evidence by studies looking into audience-specific reputation effects (Ertug, Yogev, Lee, & Hedström, 2015).

We also contribute to stakeholder theory (Parmar et al., 2010) by introducing a novel mechanism about stakeholder influence on firm performance. Prior contributions in stakeholder theory

are often normative and conceptual (Donaldson & Preston, 1995; Gioia, 1999; Phillips, Freeman, & Wicks, 2003). From our results, one can see how stakeholders can and do affect firm performance, even if they are voiced in a rather indirect manner though opinions in printed form. This shows that a stakeholder perspective matters not only to firms if they are directly addressed and pressured (e.g., McDonnell & King, 2013) but that firms should constantly monitor the reputation they have with their stakeholders, while taking account of the precise needs and goals of each stakeholder group.

Finally, the digital transformation has informed our methodological approach. Management scholars have started acknowledging digitalization's potential to open up troves of new data to be used in scholarly research (George et al., 2016), such as the large-scale textual data we use in our study. These and other new methodologies allow researchers to identify and study previously unattainable mechanisms. Our study suggests that capturing these previously unattainable mechanisms can lead to new insights that make us challenge and rethink our theoretical assumptions. We therefore encourage the further use of unstructured digital data to explore the digitalization phenomenon and to derive or test theoretical propositions on its effects on organizational decision making.

4.6.2 Limitations and Future Research

While our analysis provides detailed insights into the causal relationship between performance and reputation, it also revealed that there are significant differences between the experiences of different firms. While our model accounts for the stakeholder-level effects, it leaves firm-level explanations largely unexplained. Future research could adapt our empirical approach to test firm-level behavioral accounts in a similar dynamic causal setting. Moreover, our results suggest that there are spillover effects between certain stakeholder groups. Reputation scholars have hypothesized about such effects before. For example, Lange et al (2010) suggest that Fortune rankings, which primarily reflect the views of the financial community, are a signal to other stakeholder groups, such as the general public. While our study sheds light on the contingency effects that distinct stakeholder groups present for the reputation-performance relationship, it does not account for potential interactions between these stakeholder groups. Moreover, our analysis is focused solely on firm-external stakeholders, a limitation that stems from our data source. Future research could address this by including further data sources to

take account of reputation held by firm-internal stakeholder groups, e.g., by studying intra-firm correspondence between employees or by using qualitative research methods. Finally, we focus on a single industry. While we are confident the automobile industry is a well-suited context for stakeholder-level analysis, it may be possible that firms in other industries have different relationships with their stakeholders.

4.7 Conclusion

Our study investigates the causal relationship between organizational reputation and firm performance. Drawing on the stakeholder literature, we suggest that the level of trust in the stakeholder-firm relationship has important implications for the odds of a causal relationship between reputation and performance in both directions. Our empirical analysis, which models the causal direction endogenously using vector-autoregressive models, provides partial support for this behavioral account. Our results suggest that the locus and depth of the stakeholder-firm relationship increase the odds of an effect from reputation on firm performance, but not the other way around. Given the growing interest into more stakeholder-centered approaches in reputation studies (Lange et al., 2010) and multiple calls for research into the dynamic causal relationship between reputation and performance (Rindova & Martins, 2012; Money et al., 2017; Lange et al., 2010; Bergh et al., 2010), we believe that our paper is a first step towards a better understanding of the complex performance-reputation relationship.

5 Overall Discussion

This dissertation focuses on the role of stakeholder sentiment in strategic decision making. The three articles provide views, theories, and evidence on how management and organizational research can benefit from the integration of stakeholder-centric sentiments into its domains. The results of the first study demonstrate how decision makers' attention is not limited to explicit organizational goals, such as profitability, but that they also evaluate the diffuse goals of their stakeholders. Decision makers' attention toward stakeholder goals persists is conditions of high profitability as well as when profitability aspiration levels are missed. The study extends research on organizational goals and problemistic search with a sentiment-based aspiration level. This moves these theories toward a broader goal perspective that is more commensurate with management decisions in real life.

The second article studies decision making in complex environments. In the context of corporate capital allocation decision, it shows how *expert sentiment*, a subgroup of stakeholder sentiment, informs corporate decision making conditionally on the quality of the firm's external information environment. The results confirm the study's behavioral account, which suggests that firms increase their capital allocation to business unit's when the expert sentiment toward that business's product-technology domain improves, *ceteris paribus* the business unit's financial fundamentals and prospects. This effect was found to be conditional on the sentiment's underlying determinacy (or clarity) and quantity of information. Reductions in either factor diminish the effect of expert sentiment on corporate capital allocation. These results show how decision makers in the digital age can benefit from analytics in order to reduce the complexity of their environment.

The third and final study connects stakeholder sentiment's role in decision making to firms' financial performance. It shows that the complex causal relationship between firms' reputation and financial performance is contingent on the stakeholder group considered. Stakeholder groups with a stronger relationship with the firm—as measured by their distance to the firm and the depth of their relationship—show a higher probability of having a causal effect on that firm's financial performance, based on their reputation perception of the firm, compared to stakeholder groups with a weaker relationship to the firm. However, the strength of the stakeholder relationship had no effect on the

probability of finding a causal effect in the opposite direction, from financial performance on the groups' reputation of the firm. Researchers have frequently debated whether reputation or financial performance comes first. However, these results shed a new light on this debate, which may not be as old as that of the chicken and the egg, but that has held a similarly challenging puzzle to researchers of organizational reputation. Together the three articles present a more complete picture of an evolving decision making process in the tradition of the BTOF.

5.1 Theoretical Contributions

The three articles in this dissertation contribute to the ongoing debate on how stakeholder theory can inform formative theories in strategic management, notable those in the tradition of the behavioral theory of the firm. As each theory constitutes its own complex microcosm, each paper in this dissertation also makes its own specific contributions. However, as this section explains, there is an overarching collective contribution that the dissertation makes on the basis of the three individual papers. As a whole, the dissertation sheds new light on the evolving subject of stakeholder sentiment and its role in strategic management research. The proliferation of stakeholder views, opinions, and aspirations affects fundamental assumptions in literature streams associated with the BTOF, such as decision making in complex information environments (Atuahene-Gima & Li, 2004; Forbes, 2007), goal formation and aspiration levels (Shinkle, 2012; Bromiley & Harris, 2014; Greve & Gaba, 2017), and problemistic search (Posen et al., 2017). It also affects related organizational theories such as organizational attention to multiple goals (Gaba & Greve, 2019) and organizational reputation (Rindova et al., 2005; Pfarrer et al., 2017).

The dissertation as a whole answers recent calls for research into the role of digitalization and big data for strategic management (George et al., 2014; 2016). It also responds to calls from stakeholder theory scholars to consider and integrate a broader goal-perspective into the various branches of strategic management research (Laplume et al., 2008). It clarifies definitional issues in the literature on sentiment, which has been pointed out as a shortcoming by prior studies (Li & Hovy, 2017; Piryani, Madhavi, & Singh, 2017; Rathore et al., 2017). Moreover, it extends the application of sentiment to a

wider range of stakeholder groups and integrates the concept of sentiment into behavioral theories. For practitioners, the dissertation presents a compendium of new tools, methods, and approaches to guide them in the new digital landscape and suggests new avenues for strengthening the firm-stakeholder relationship.

Moreover, the dissertation contributes to behavioral theory and decision making at large, by shedding light on how strategic decisions in complex informational environments can benefit from a closer integration of stakeholder-centric information and technologies. One of behavioral theory's most fundamental assumptions is that information availability affects organizational decision makers' information processing and judgment (Cyert & March, 1963; Rerup, 2009). Prior theory describes a "paradox of information" (Hansen & Haas, 2001), namely that given greater information availability, organizational decision makers tend to restrict their attention due to their information-processing limitations. Our findings provide evidence challenging this proposition. In the digital age, senior managers have access to advanced analytical tools to process the vast amounts of data they face, , which enables them to reduce the complexity of their environment while retaining a potentially higher quality information environment. From this perspective, increased information availability becomes an important driver of managers' decision making.

The dissertation shows several ways through which decision makers consider sentiment-based information in their decision-making processes. This includes stakeholder sentiment at large, reflecting stakeholders' diverse views, opinions, and aspirations, but also subordinate concepts, such as the more specific expert sentiment, which captures experts' collective wisdom. Decision makers respond to sentiment's underlying information quality, such as reflected in the level of disagreement between experts or the discrepancy between the firm's performance toward certain stakeholder groups relative to its aspiration levels. In exploring this, the dissertation provides theoretical arguments for and initial evidence of organizations' more comprehensive information processing and judgement. Moreover, it proposes a more nuanced consideration of stakeholder perspectives in the digital age than previous behavioral theory studies have generally suggested (e.g., Rowley et al., 2017).

At large, our contributions to the behavioral theory of the firm and related theories also

demonstrate the wide applicability of stakeholder sentiment to fill existing and emerging gaps in the literature. In doing so, we also contribute to stakeholder theory. By introducing a novel mechanism about stakeholder influence on firm risk taking and by developing new ways of measuring stakeholders' views, opinions, and aspirations, we aim to contribute a novel testable mechanism to stakeholder theory (Parmar et al., 2010). Prior contributions in stakeholder theory are often normative and conceptual (Donaldson & Preston, 1995; Gioia, 1999; Phillips et al., 2003). This dissertation shows how firms react to stakeholder perspectives, even if voiced in a rather indirect manner, such as through opinions in periodicals and publications. The dissertation shows how this measure affects firm behavior and explains how it relates to financial performance. This suggests that firms account for stakeholders not only if they are directly addressed and pressured (e.g., McDonnell & King, 2013). The individual papers in this dissertation provide a foundation for further theorizing on how firms' diverse stakeholders can be integrated into formative management and organizational theories, such as the BTOF. Moreover, they suggest a methodological basis for how firms and researchers can approach stakeholder demands in practice. In doing so, the results suggest that firms should regularly monitor their stakeholders' sentiment and integrate them into their decision-making processes.

Furthermore, the dissertation has implications for the literature on sentiment, sentiment analysis, and opinion mining (Piryani et al., 2017; Rathore et al., 2017). Prior studies primarily used sentiment to analyze the decisions of consumers or investors (Blasco et al., 2012; Hennig-Thurau et al., 2014). In the field of Management, sentiment was used primarily to study negative events, such as scandals (Bednar et al., 2013; Shipilov et al., 2019; Durand & Vergne, 2015) and to estimate firms' reputation (e.g., Deephouse, 2000; Castellucci & Ertug, 2010). We extend the sentiment literature by showing that sentiments also affect organizational decision making processes. Our key conceptual contribution in this context is connecting the sentiment literature with behavioral theory arguments, particularly regarding decision making in organizations. This theoretical integration allows for mutual enrichment. For instance, whereas prior studies on sentiment were mostly limited to the average sentiment (Hennig-Thurau et al., 2013) or negative words counts (Tetlock et al., 2008), my studies show that additional dimensions, such as the sentiment's determinacy may also inform decisions. Further, in demonstrating that sentiment analysis can be broken down over distinct stakeholder groups, we show

that a wide range of theories can benefit from this method in their analyses.

Finally, digital transformation has also informed our methodological approach. Management scholars have started acknowledging digitalization's potential to revolutionize the methods we apply in scholarly research (George et al., 2016). In this dissertation, we have used large-scale textual data as well as machine-learning algorithms for our analysis. Digital methodologies and data sources such as these allow researchers to identify and study a wide range of mechanisms that were previously unattainable. The approach taken by this dissertation suggests that scholars can gain new insights by employing advanced methodological approaches. It thus seeks to encourage the use of unstructured digital data and advanced methodologies to explore the digitalization phenomenon and to derive and test novel theoretical propositions.

5.2 Limitations and Future Research

While our study presents a broader and more diverse account of stakeholder influences and provides an attempt at integrating them into formative management theories, it does not fully measure up to the ideals set out by stakeholder theory. Due to the limitations of our dataset, I am not able to capture all relevant stakeholder groups in our analysis. Future research could attempt an even broader approach, by integrating additional relevant stakeholder groups into their analyses. This could be achieved by tapping other data sources. For example, employees could be integrated by analyzing firm-internal communications exchanged via emails or messaging services. Similarly, there are a range of platforms and applications that enable direct modes of communication between firms and stakeholders, which could enable an even deeper understanding of some of the stakeholder groups that we had integrate into our analysis. In addition, more complex natural language processing-methods could be used to extract deeper insights from textual data. This could extend stakeholder-centric approaches beyond the binary classification of satisfaction (positive or negative). Using such methods to extract concrete goals would be more in line with the core propositions of stakeholder theory (Laplume et al., 2008). Moreover, we do not account for spillover effects between stakeholder groups, which future research could attempt through more complex methodologies. In sum, stakeholder theory stands to

benefit from further research capturing the inherent complexities and dynamics that exist in stakeholders' interactions with the firm as well as with each other.

Another limitation exists with regard to the mode of analysis. Since our studies are all based on a certain level of aggregation, we do not observe cognition and individual behavior directly. For example. We do not observe how individual decision makers interact with stakeholder sentiment. Experimental settings and qualitative research can go deeper into explaining these processes and thus open up the *black box* of the firm further. While our large-scale research approach allowed us to integrate new mechanisms into our theorizing on firm-internal processes, it did not allow us to investigate internal decision making processes directly. Future research could use laboratory studies and field experiments to explore digitalization's impact on decision-makers' behavior and decision processes in organizations in greater detail.

6 Conclusion

This dissertation comprises three studies on stakeholder sentiment and its complex relationship with firms and organizations and their decision makers. Firmly rooted in the strategic management literature, it provides an integration of more stakeholder-centric modes of analysis with behavioral and organizational theories. In extending the application of sentiment analysis to diverse stakeholder publications, it opens up the black box of the firm-stakeholder relationship, sheds light on the complex information environment managers face, and clarifies stakeholders' role in organizational goal setting and problemistic search. In doing so, this dissertation provides a synergistic picture of several formative theories in management, striving to advance our understanding of organizational decision making in the digital age.

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