Strategic value creation through big data analytics capabilities: A configurational approach

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***Abstract*— Despite the documented potential of Big Data Analytics Capabilities (BDAC), it is by no means clear how they support the capacity of firms to purposefully create, extend, or modify their resource bases, i.e., dynamic capabilities (DC). This study extends current literature by exploring and elucidating various contingent big data capabilities, resources, and conditions that lead to the formation of these DCs in today's turbulent business environment. We use a qualitative approach using a cross-interview study method. Hence, we collected data through semi-structured interviews with field domain experts. In total, 27 interviews were held with key and senior informants from different firms. Co-authors analyzed the obtained data through the use of qualitative coding techniques. Our results show that there are various contingent BDAC resource solutions that drive, moderate, and condition the development of DCs. These outcomes also show that no single antecedent condition explains DCs in practice. These insights are important for firms that are becoming more data-driven. Outcomes are valuable for practice as firm executives now have insight into the process and main BDA capabilities they can focus on while planning, initiating, and evolving big data analytics projects and their digital business strategies.**

Keywords*— *Big data analytics capabilities, dynamic capabilities, configuration theory, qualitative coding, IT value creation.

I. INTRODUCTION

Scholars and practitioners have investigated the conditions and pathways through which firms can incorporate information technology (IT) and data-driven business opportunities into their competitive digital business strategies [1-3]. It is, therefore, not surprising that firms across a wide range of markets and industries are exploring and exploiting big data as a strategic IT investment [4, 5]. This significant development is also displayed by Gartner, who argues that by 2020, there will approximately be 21 billion of connected sensors that will generate enormous amounts of data [6]. Today's business and IT leaders place a high priority on the role of IT to deliver meaningful insights so that it supports them in the process of making better decisions based on facts, rather than instincts and presuppositions. Big data tools and applications comprise a particularly interesting set of options, especially for high-velocity markets, and can promote sense-making, solution development, decision supporting, and even real-time forecasting [7]. In general, big data analytics (BDA) can be considered the application of advanced analytics and statistical techniques for varying large-scale data sets [8].

There are many classifications of 'big data' in the literature, business reports, and white papers that share a common denominator. Hence, we define 'big data' as the enormous amounts of diverse observational data which support different types of business decisions [9]. It comes without saying that big data provides firms with a nexus of ventures. Notwithstanding big data's potential, we see that firms are also struggling with the many challenges that come along its deployment. These struggles are also supported by recent literature that questioned the success rate of big data projects and how to lead to a sustained strategic value [2]. These challenges and possible obstacles include choosing the right technical infrastructure hardware, software functionalities, data maintenance, and data quality (e.g., completeness, the validity of data, consistency, and accuracy).

Big data analytics capabilities (BDACs) gained considerable attention in both the academic and the business environment [10, 11]. BDACs are the multi-dimensional and complementary competencies that collectively enable firms to transform their current business models and value-added processes by effectively orchestrating and deploying its data, technology, and talent[12, 13]. BDACs enable firms to improve existing products or services through more precise identification of customer feedback and real-time operational monitoring[14]. Also, BDACs allow firms to sense customer needs, seize business opportunities that were previously not identified, and reconfigure existing ways of operating based on the insight that big data analytics indicates [12]. Literature has also shown that firms could enhance marketing, production, and delivery processes and adequately facilitate in the speed to which firms can respond and by improving their evolutionary fitness to the environment [15].

Hence, we motivate this work through the various related factors that have been described up until now. In the academic and practitioner literature, conceptions and interpretations differ on BDAC. Consequently, there is no consensus on how firms can genuinely embrace, adopt, and deploy data-driven innovations, and the business shifts they entail [8, 11]. Second, the primary focus and approach of BDA studies are on the technical level, including analytics infrastructures and tools to support insight extraction rather than leveraging such technologies for competitive gains [1]. Successively, many scholars disregard other vital facets and organizational aspects, which should be incorporated into strategy and operations thinking. Third, many studies follow a reductionist approach, through which seemingly complex effects are represented through simple sets of cause and effect relationships [12]. Also, most research is somewhat fragmented, which makes it challenging to evaluate the business value. For instance, [16] identify data storage and data transport as essential aspects of the value of big data.

On the other hand, [17] focus on aspects related to the characteristics of data itself, while [18] place the spotlight on the human element of big data, and specifically on the importance of the data scientist. Also, many studies neglect the presence (or absence) of enabling factors (and thus also

hindering factors) like data and information governance practices [19, 20]. Lastly, and most importantly, by developing a strong BDAC, firms will be in a better position to identify customer needs and develop tailored marketing strategies, and even customized products and services.

We have early anecdotal evidence that a firm' BDAC enables firms to sense the competitive environment and respond promptly, thus providing them with a dynamic capability (DC) and a first-mover advantage. However, more research is required to understand the conditions and mechanisms through which data-based insight translates into action. However, it is, currently, by no means clear how BDACs facilitate these DCs using specific combinations of resources and capabilities and under different conditions and modes of operation [21]. This insight is essential, as contemporary firms need to unfold the potential of BDACs into their business strategies, organizational routines, and processes [22]. The above-described circumstances leave us with many unanswered questions. Specifically, what is the role of a particular BDA capability and resource given specific conditions and environmental circumstances? What type of complementarities can we identify among the BDA capabilities? As a matter of fact, what are these capabilities? Moreover, what kinds of mechanisms need to be in place to develop and enhance the firm's DCs?

We contend that a more fine-grained configurational approach is needed to answer these questions and to understand the manner through which BDAC can add strategic value for firms that operate in competitive environments. We build this argument based on the foundations of resource-synchronization and DC theories. These theories are appropriate because they consider the targeted use of firm assets and resources (including IT) as a differentiating and value creating force within organizations [23] under different environmental and market conditions [24]. Against this background, the objective of this research is twofold. First, to identify a coherent set of concepts and notions that collectively comprise what is referred to in the literature as BDACs. Second, we try to explore and elucidate the various contingent capabilities, resources, and conditions that lead to the development of multifaceted DCs. In effect, the guiding research question for this work is:

'What combinations of big data analytics capabilities in practice lead to the formation of dynamic capabilities,' and 'what are enabling factors that condition the contribution of these particular capabilities?'

Our work tries to address the guiding question by using the following structure. First, we provide an overview of the theoretical foundations of our study. Then, we proceed with the methods, with a focus on our critical literature review to identify building blocks of BDA capabilities and on the possible catalysts and hindrances. We also outline our data collection efforts and outline the profiles of our respondents as well as the case firms. Our results section shows that there is equifinality in outcomes. This outcome means—through a 'holistic' view—that different combinations of BDACs capabilities, resources, and conditioning factors yield the formation of DCs. We conclude with a discussion on both the practical and theoretical implications of the study and highlight some critical limitations that could guide future research.

II. Background

A. Resource-based view and dynamic capabilities

We ground our work on the resource-based view of the firm (RBV), as well as the widely acknowledged dynamic capabilities view (DCV). A vast majority of IT-business value research grounded their claims and arguments on the RBV [25]. The RBV provides a solid foundation upon which firms can identify and evaluate all relevant resources (including IT assets, infrastructure, resources, and capabilities) toward their importance and deploy them to achieve and sustain competitive advantage [25, 26]. The RBV is grounded in economic scholarship concerned with firm heterogeneity and conditions of imperfect competition. The notion of resource in contemporary research was subsequently further split to encompass resource-picking and capability-building [27]. Amit and Schoemaker [28] also define firms' resources as tradable and non-specific firm assets, and capabilities as non-tradable firm-specific abilities to integrate, deploy, and utilize other resources within the firm. Hence, firm resources represent the input of a production process, while firms' capability is the capacity to deploy these particular (IT) resources to improve productivity. The RBV provides valuable ways for information systems (IS) research to think about how IT contributes to firm performance and how to create business value [29]. These studies, in particular, acknowledge that the process of leveraging IT resources in combination with other organizational resources is a source of competitive advantage and value creation.

Although the RBV perspective may provide some critical insights on the necessary types of IT resources that a firm must own or have under its control, it does not explicitly address and define how they collectively should be leveraged to derive business value. Also, another shortcoming of the RBV perspective is that it does not take into consideration the competitive environment when examining the value of IT resources. The DCV addressed these particular shortcomings as a means for firms to evolve in changing environments and maintain a competitive edge [30]. The DCV enables the examination of the organizational capabilities towards which firm resources should be directed to achieve competitive performance gains [31]. The DCV has been one of the most influential theories and perspectives in the study of strategic management and attempts to explain—by extending the RBV—the processes through which a firm evolves in changing environments and maintains a competitive edge [32]. Due to conditions of high environmental uncertainty, market volatility, and frequent change, scholars have raised questions regarding the rate to which traditional operational and existing 'resource-based' capabilities erode and cease to provide competitive gains [33].

Based on the idea that firms must be able to be stable enough to continue to deliver value in their distinctive way, and agile and adaptive enough to restructure their value proposition when circumstances demand it, there is a well-documented distinction between ordinary (operational or zero-order) and dynamic capabilities [34]. However, the resources owned or controlled by the firm are imperative in determining what types of capabilities a firm can develop, and of what value they will be. In the context of IS literature, several studies have examined how IT and architectural assets and resources infused in organizational capabilities can help firms renew or reconfigure their existing mode of operating [35-37], what is essential is to infuse IT investments into the

organizational fabric to derive sustained competitive value [38].

We regard a firm's DCs as the general ability to use resources—processes explicitly to integrate, reconfigure, gain, and release resources—to match and even create market change [31]. The DCV generally assumes that DCs positively influence a firm's adaptive behavior, nature, and a competitive edge. However, this relationship seems a bit more complicated, as there are factors in play that condition the development of DCs and their business value [39]. For instance, there are situations where firms are better off not investing in the development of DCs as the particular benefits may be overturned by associated development and maintenance cost [40]. Likewise, the degree of environmental turbulence and heterogeneity influences the contributions of DCs [41]. Recent work has synthesized an empirically validated the main routines that underpin DCs and suggested to measure DCs using the following measurable routines: (1) 'sensing' the environment, (2) 'seizing' business opportunities, and (3) 're-configuring' the firms' intangible and tangible assets to maintain competitiveness [42].

B. Configuration theory

Next, to the above theoretical foundations, we highlight the essence of configuration theory. This theory sheds light on how complementary BDA practices bundled together lead to the formation of DCs and how we can project the most effective configurational solutions. Hence, configuration theory aims to identify patterns and combinations of variables and reveal through a 'holistic' lens how their synergistic effects lead to specific outcomes [43]. Configurations occur by different combinations of causal variables that affect an outcome of interest [44]. In contrast with mainstream variance and process theories applied in information systems research, configuration theory supports the concept of equifinality, meaning that the same outcome can be a result of one or more sets of configuration patterns [43]. Thus, different configurations of these (BDA) capabilities can yield superior development capacities and performance, also depend on the level of environmental turbulence. Related to our focal problem, i.e., the formation of DCs using complementary BDACs, an example could be adopting a particular activity (e.g., investing in organizational learning) that has a higher payoff when simultaneously adopted with a complementary activity (e.g., fostering a data-driven culture enterprise-wide). This configurational approach has gained increased attention and acceptance within a wide variety of research fields, including IS, sustainability, innovation, and management [45-47].

III. Method

A. Selection of key concepts

We employed a review approach to unfolding the primary building blocks of BDA capabilities and on the possible catalysts and hindrances in attaining business value. Within the scope of our study, we tried to identify those concepts that underlie the dimensions of the theories used within the context of big data. Also, we wanted to explore what conditioning factors are essential when considering and deploying BDAC in firms. For this, we reviewed the foundational literature on IT business value which builds on the resource-based view and the dynamic capabilities view of the firm including [48, 49], as well as the latest literature in the domain of big data analytics capabilities [10, 12, 14, 50] and other enablers and hindrances of value creation [21, 51]. Tables 1 and 2 show the results of our literature review and identification of concepts. We used the outcomes of this review to develop our interview guide and prepare for the interviews.

TABLE 1 OVERVIEW OF BIG DATA ANALYTICS CAPABILITIES

Big data analytics resources and capabilities	Key sources
Tangible resources	
- *Technology:* New technologies are essential to handle the large volume, diversity, and speed of data accumulated by firms. Further, firms employ novel approaches for extraction, transformation, and analysis of data.	[52], [10]
- *Data:* Firms tend to capture data from multiple sources, independently of structures, and continuously. Aspects concerning data such as quality, sources, methods for curating are important in deriving business value.	[15], [51]
- *Financial:* Financial resources can be considered as direct investments in support of these technologies or working hours allocated to experimentation by utilizing the potential of big data.	[10], [12]
Human Skills	
- *Technical Skills:* Technical skills refer to the know-how that is necessary to leverage the new forms of technology and to analyze the varied types of data to extract intelligence from big data.	[52], [10]
- *Managerial Skills:* Managerial skills pertain to competencies of employees to understand and interpret results extracted from big data analytics and utilize them in meaningful ways.	[10], [53]
Intangible resources	
- *Organizational Learning:* Organizational learning concerns the degree to which employees are open to extending their knowledge in the face of new emerging technologies.	[54]
- *Data-driven Culture:* A data-driven culture describes the degree to which top management is committed to big data analytics, and the extent to which it makes decisions derived from intelligence.	[52], [10]

TABLE 2 OVERVIEW OF ENABLING/HINDERING FACTORS

Enablers and hindrances in dynamic capability development	Key sources
- *IT Governance:* The importance of governance of IT has been documented in past empirical literature with decisions about appropriation rights significantly affecting the value of IT resources.	[55]; [56]
- *Lag effects:* There is substantial empirical evidence that the impact of IT investments needs to be considered under the prism of time lags.	[48, 57, 58]
- *Environmental factors:* The competitiveness, dynamism, and rate of technological change of the environment may have a substantial effect on the value IT delivers.	[48, 59]

B. Cross-interview study

The cross-interview study approach is well-suited for our exploratory study to investigate organizational issues [60] and allows us to present plentiful evidence and a clear statement of theoretical arguments [61]. This approach enabled us to explore differences within and between cases and to gain a better understanding of the phenomena at hand [62]. In particular, we gained a better and more in-depth understanding of how BDA resources and capabilities add value to the development of DCs in practice. The multiple cases approach allowed us to apply a form of replication logic through which

we treat all incorporate cases as a series of experiments that confirm or negate emerging conceptual insights [63].

C. Data collection

We performed our data collection through face-to-face semi-structured interviews with field domain experts from a wide variety of firms operating in different markets and industries, i.e., public, private, industry, and consulting. We pre-defined some of the central questions and themes, following our critical literature review and tried to get as many insights possible from the responses of the key informants [64]. We selected the companies and interviewees carefully using a convenient and non-probabilistic technique to gain obtain rich insights concerning the focal study problem. We managed to identify experienced and knowledgeable respondents that work in diverse markets and industries that all deal with turbulent markets. We sought firms for our sample that either just recently started with big data deployments (with a minimum of 2 years of deployment to assess BDAC's pay-off) or had invested considerable time and effort in gaining value from big data. Also, we included the condition that each firm had a (sub) department explicitly focusing on big data. We screened our cases for these criteria. So, our final selection of our respondents includes CIOs, IT managers, and big data analysts and strategists from firms that are considered established in their market in the European region, with most companies being based in Norway, the Netherlands, Italy, and Germany. Table 3 provides a high-level overview of the profile of our respondents and the case organizations.

TABLE 3 PROFILE OF RESPONDENTS

	Frequency	Percentage
Years of employment		
2-4 years	7	26%
5-7	9	33%
More than 8 years	11	41%
Number of employees		
8-500 employees	13	48%
500-16.000 employees	14	52%
Profile		
CIO	12	44%
Data analyst/strategist	4	15%
IT manager	11	41%

We followed a semi-structured study protocol for each interview during our data collection process to minimize response bias [65]. We held the interviews in a conversational style. We opened each interview with a broad discussion on their role within the firm, how these key informants perceive the value of big data and then proceeding on to the themes of the interview guideline. In total, 27 interviews were held with key and senior informants from different firms and departments through which we obtained additional secondary company-related documents. Each interview lasted approximately one hour and a half leading to a total of 56 person-hours. As accustomed to doing, we gained (signed) consent to record the interviews so that we could transcribe them and use them for further analysis.

D. Coding analyses

We used qualitative coding techniques to explore and elucidate the various contingent capabilities, resources, and conditions that lead to the development of multifaceted DCs. These techniques allowed us to systematically analyze, organize, and visualize the data [66]. On different occasions, we synthesized, critically reviewed, analyzed, structured and recorded all obtained data on different occasions using both deductive and inductive coding and classification techniques, i.e., a hybrid approach [64, 67]. Hence, we used pre-defined codes for the BDACs and enablers and hindrances in dynamic capability development, as we outlined in Table 1 and 2. We, then, applied this analytical approach iteratively to all cases to identify whether or not, particular BDACs and enabling factors were present in the case organizations and subsequently contributed to the formation of a particular DC. This approach allowed us to gain as much insight as possible [68]. Using the synthesis from these analyses jointly with the critical literature review results and the interview transcripts, we clustered the identified and isolated concepts into a tabular phase-based structure. This procedure enabled us to be iterative in the process of identifying the relevant concepts and notions that applied to each of the 27 cases. Finally, we aggregated findings and inductively identified common patterns that we present following a configurational approach [43], as we outline in section 4.2. Two co-authors independent executed the coding process by the defined themes using NVivo. Hence, the coders read all transcripts independently to find specific factors related to the required resources of a BDAC, as well as the relation with enabling or hindrance factors. We continued the coding process until we reached the inter-rater reliability of the two coders (matched in pairs) that was higher than 90 percent [69].

IV. FINDINGS

A. Extracted big data analytics capabilities and enabling factors

This obtained structure from the analyses allowed us to represent the processing logic by which managers from DCs can obtain business value in practice. Through our critical reviews and in-depth analyses, we profoundly synthesized what the literature refers to as big data analytics capabilities. Following the classification framework of Grant [70] these are a) 'Tangible,' b) 'Human Skills,' and c) 'Intangible,' resources. Tangible resources include 'Technology' (that deal with large volumes of data), 'Data' (from multiple sources, independently of structures and continuously) and 'financial resources' (i.e., the direct investments in support of these technologies). Human skills involve both 'Technical' (i.e., know-how to leverage new forms of technology and to analyze data) as well as 'Managerial skills' (competencies to understand and interpret results extracted from big data analytics and use them meaningfully). Intangible resources include both 'Organizational Learning,' i.e., the degree to which employees are open to extending their knowledge in the face of emerging technologies), and 'Data-driven Culture' (i.e., the degree to which executives are committed to big data analytics).

In essence, the notion of a BDA capability extends the view of big data to include all related organizational resources that are important in leveraging big data to their full strategic potential. Next, to these resources and capabilities, we also identified key enablers and hindrances—through our critical review and substantiated by the interviews—that are relevant in the process of DC formation. Hence, we identified 'IT governance' that has been documented in past empirical literature with decisions about appropriation rights significantly affecting the value of IT resources and the alignment of business and IT. Possible 'Lag effects' so that need to perceive IT investments under the prism of time lags. Finally, 'Environmental factors,' i.e., environmental

dynamism, and rate of technological change of the environment may have a substantial effect on the value BDAC.

B. Findings through the tenets of configuration theory

Through the analysis of all 27 cases, we identified the contingent resources and capabilities, across the sequence of DCs. We articulate the interrelationships among variables through a 'holistic' lens [43]. Moreover, we accentuate a process-oriented view on how firms can use, align, and deploy BDA resources and capabilities to generate a firm's capacity to create, extend, or modify their resource bases. In doing so, we mapped the coding solutions (of grouped firms) in the form of this tabular phase-based structure. Hence, we denote our solution in Table 4 using black circles (●) for BDAC resources that are important and implemented in the big data strategy toward the development of DCs. Blank circles (○), on the other hand, indicate the absence of this particular resource or condition. A presence of black circles for enablers and hindrances, suggests that they were important in the cultivation of DCs and thus in realizing business value from big data investments. Blank circles for enablers and hindrances suggest the opposite, i.e., they are not important. For the sake of simplicity, we did not 'weight' the presence of factors and distinguished between the central and less critical elements for a particular solution. Blank spaces indicate that a capability or condition is insignificant or a do not care situation, i.e., the condition might be either present or absent. Furthermore, we clustered all solution between SMEs (8-500 employees) and large firms (500-16.000 employees). As the resulting configurational model is grounded in complementary resources, capabilities, and working mechanisms, it is consistent with the RBV of the firm [71], and recent literature on BDA [10, 12, 72, 73]. We illustrate the process-oriented view and logic in a simplistic sequential way for our research purpose. In practice, these DCs interact in the process of reconfiguring assets and capabilities.

C. Configurations leading to the formation of dynamic capabilities

Our results show that there are no single antecedent conditions (important and implemented absence, or irrelevant) that in isolation, drive or form DCs; quite the opposite. Table 6 shows all solutions that portray different combinations of BDA capabilities and resources, enabling factors, and different environmental conditions that drive the formation of DCs cost-effectively. Specifically, there are ten solutions across the sequence of DCs. Accordingly, there are three different possible outcomes for achieving high levels of 'Sensing' and three for 'Seizing.' Finally, there are four solutions for the final DC, i.e., 'Reconfiguring.' Our coding analyses unfold that—in most synthesized solutions—environmental uncertainty as well as competitor decisions to embrace new technologies (big data), are significant factors that effect on the contribution toward DCs.

1) Sensing configurations

Concerning 'Sensing' we see that this ability is dependent—at least for two of the three solutions—upon governance mechanisms (for large firms, see solutions II and III). Particularly for larger firms, this is something to be expected, as it makes them more accountable regarding investment decision-making and will guide them in decision-making processes across various organizational levels and hierarchies. We learned from the interviews that for large firms, the process of acquiring, storing, managing, and processing big data in an ad hoc manner is not very efficient and ultimately very costly. Something striking for SMEs, i.e., the solution I, is that governance is not considered as significant. Instead, the technical skill-set and the continuous availability of data from multiple sources are considered crucial. Typically, IT governance does not discriminate against a firms' size and scale. It seems that SMEs in the modern data-driven era outperform others when primarily investing in the know-how to leverage new forms of technology and efficaciously co-evolve with environmental changes.

2) Seizing configurations

Our coding outcomes showcase that there are also three solutions (IV, V and VI) within 'Seizing.' Hence, firms of solution IV (that applies to large firms) show a high presence and implementation of tangible resources, and also governance is considered important. Firms representing solution V, representing large firms, shows agility in both tangible resources as well as human skills, while the focus is on accentuating and strengthening the already present data-driven culture and knowledge extension capability. Also, for these firms, non-financial investments in BDAC drive the deployment toward DCs. Finally, within the 'Seizing' process, firms of solution VI, which were in the SME size-class, continued to show the presence of technological and financial resources as well as slight focus to extend employee knowledge in the face of emerging technologies.

3) Reconfiguring configurations

The final four solutions (solution VII-X) apply to 'Reconfiguring.' For the two solutions that apply to SMEs (solutions XIII and X), we see that the presence of 'data' is essential. Hence, these particular firm need to have real-time data while they are deploying and reconfiguring firms' tangible and intangible assets. This way, they are even more equipped to adapt to unforeseen circumstances. Larger firms (solutions XII and IX) demonstrate a strong presence of the infrastructure to deal with the enormous volume's, diversity, and speed of accumulated data. We also learned from the interviews that these firms require both organizational change and a robust technical environment to drive DCs. Our coding procedure unfolds that firms need to exploit talent, user skills, and innovative technologies, to drive and enhance the process of reconfiguring.

TABLE 4 CLUSTERS OF CONFIGURATIONAL SOLUTIONS LEADING TO DYNAMIC CAPABILITIES

	Sensing			**Seizing**			**Reconfiguring**			
	I	II	III	IV	V	VI	VII	VIII	IX	X
Org. context										
Large firms		●	●	●	●		●		●	
SMEs	●					●		●		
Resources										
Tangible										
Technology			○		●	●	●	●	●	
Data	●	●	○	●	●			●	●	
Financial		●	●	●		●	●			
Human Skills										

Technical Skills	●	○			●	●	●	●		
Managerial Skills		●	●		●		●			
Intangible										
Organizational Learning			●		●	●				
Data-driven culture		●	●	●	●		●			
Enablers										
IT governance	○	●	●	●			●	●		
Lag effects		●					●			
Environment	●	●		●	●		●	●		

V. Discussion and Conclusion

Our results provide both academics and practitioners with an understanding of how DCs can be formed and enhanced in different ways. We now address our core contributions to theory and practice and end our work with the limitations and the conclusion.

A. Contributions to theory

This study makes contributions to theory in several different ways. First, we provide a more in-depth understanding of the process through which complementary BDA capabilities and resources add value to firms. Hence, we showed that firms could enhance the value of the development of DCs under different patterns and interrelations among BDACs. So, our results corroborate the claim made by El Sawy et al. [74] that individual resources cannot be individually optimized to achieve better performance. In this line of thought, we contributed to the emerging literature of capturing the business value of BDA investments [10, 12, 52]. Even more, we complement the current IT and business transformation literature that recognizes that competence in leveraging IT-based resources in the competitive landscape is a source of competitive advantage [35, 75]. Our study offers a more fine-grained approach to various technology-driven capability and IT-business value studies [38, 76, 77] that argue that it is necessary for firms to invest in all the necessary (situational) IT resources. In particular, our study unfolded the organizational, social, technical, and relational aspects are essential in our particular study context. Therefore, this study lays a foundation for configurational research that extends current literature that predominantly focused on BDACs as technical capabilities. Finally, our results show that firms need to take both internal and external forces into account when planning and deploying big data and digital strategy. These outcomes extend the modern literature on the situational role of IT and digital capabilities for firms in turbulent environments [59, 75, 76].

B. Contributions to practice

Regarding practical implications, our study extends previous conceptual and empirical studies [2, 73, 78, 79], that contended that firms should embrace BDA to build superior capabilities for firm competitiveness and create business value. Hence, this study unveils to managers the potential process and core-resources they should focus on when delving into big data analytics investments and programs. Here, we also offer evidence of the potential hurdles that need to be overcome by firms. These particular insights will guide managers and executives in their decision-making processes concerning IT governance policies and big data analytics deployment schemes. Although it might seem tempting to invest lots of time and resources on driving all BDAC processes, we now argue that managers are better off at gauging resources toward specific solutions under possible financial and time-related restrictions. This way, firms will maintain alignment of their BDA initiatives with business needs, goals, and objectives under certain market conditions in which they operate.

Based on our conversations with field experts and IT executives, we also believe that big data initiatives must cut across the entire firm, and executives and decision-makers have a crucial role in creating awareness and foster a data-driven culture that is essential for most organizations. We propose that managers should make an honest assessment—in understanding their current BDA capabilities—and the emerging gaps they will need to close to seize and obtain more value from BDA investments. Such an assessment will also help to bring the most critical stakeholders on board. This way, key stakeholders know why BDACs are essential and how they are expected to contribute to a firm's ability to sense, seize and reconfigure internal and external competencies and resources to address the rapidly changing environment.

C. Limitations

Like most research, we report the most significant limitations of our study. First, we only did interviews to obtain a deep and rich understanding of BDACs in practice. Our work forms a decent foundation for future research so that our work and results can be extended, validated, and even deductively be assessed. Insights from a harmonious large-scale quantitative analysis could, therefore, be promising, but beyond what this study can address. This particular route provides academics and practitioners with a granular approach toward identifying even more conditions and limitations to which BDA and the associated capabilities can add value. Such a quantitative approach is even more important because our identified enablers and hindrances in leveraging BDACs are relevant, but not exhaustive. Another limitation is that we did not elaborate extensively on the absence of particular resources or conditions in the various solutions. Also, we currently did not compare across market segments, industries, and different countries. These types of analyses are also promising. Also, a longitudinal approach could enrich our configurational perspective by offering insights into the evolving BDAC configurations. Last but not least, future research could examine various inertial forces in different forms, including political, economic, and socio-technical [80] and how firms could mitigate these inertia forces that manifest at various hierarchical and organizational levels.

D. Conclusions

We motivated our work by the fragmented BDAC literature, inconclusive evidence concerning the mechanisms through which BDAC facilitate the formation of DCs, and many unquestioned answers concerning the business value form BDAC. We now boldly claim that we have accomplished our twofold objective. First, we synthesized a coherent set of BDACs. Second, we pertinaciously showed that firms that promptly respond and adapt to changes require combinations of BDA capabilities and resources, and certain enabling conditions. As a final note, we see in practice, that big data, if leveraged successfully, provides executives and business managers with a strategic tool, which provides real-time

insights to guide future directions. The process of leveraging big data is, however, a significant challenge as big data is not a magical panacea contrary to what some might argue. Big data still needs to be coordinated and infused into daily operations and firm-wide capabilities and integrated within firm-wide initiatives to ensure organizational success. We, therefore, call for further valuable research that substantiates our configurational BDAC perspective to build and create sustained business advantage through dynamic capabilities.

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