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Big data analytics capability, marketing agility, and firm performance: a conceptual framework

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ABSTRACT

This study proposes that the proficient use of big data enables organizations to respond swiftly to market opportunities and threats, leading to positive business outcomes. Drawing on research from marketing, information technology, and management, the study builds a conceptual framework that outlines the relationships between big data analytics capability, marketing agility, and firm performance and pinpoints the contingencies that shape these relationships. While highlighting the importance of agility in harnessing big data for a firm's success, the study offers avenues for further research and valuable insights for managers looking to invest in big data.

Introduction

The growing digitalization of customer interactions has led to widespread investments in big data processing technologies (Bean, 2021; Cutten & Cousins, 2021; Rust, 2020). Nevertheless, numerous companies fall short in reaping the benefits of their big data investments (Kiron, 2016; Kune et al., 2020; Vidgen et al., 2017). This shortfall often stems from a failure to assess and develop the essential resources required for the effective utilization of big data (Gupta & George, 2016; Wamba et al., 2017). Frequently, these inadequately addressed resources encompass talent, corporate culture, and other social and organizational factors (Dubey et al., 2019; Vidgen et al., 2017). However, even when organizations appropriately develop their resources that are specific to big data, this alone may not lead to enhanced performance (Chakravarty et al., 2013). Instead, these resources must actively support actions and processes that are intimately linked to firm performance (Elia et al., 2022).

The dynamism of the global market environment has recently underscored the importance of agility for companies in regard to being able to sense and respond to market opportunities and threats in an innovative manner (Accenture, 2020; Zhou et al., 2019). To this end, research has suggested that contemporary companies must pursue agility in their big data investments in order to create value and competitive edge (e.g. Akter, Hani, et al., 2022; Chakravarty et al., 2013; Kitchens et al., 2018); anecdotal evidence suggests that agile companies have outperformed their slower peers by utilizing contemporary technologies (PWC, 2020). This is further emphasized by recent developments in artificial intelligence (AI), which could potentially bring disproportionate rewards to those who are agile in realizing its opportunities (Fosso Wamba, 2022).

Extant research on the relationship between big data and agility has advanced our understanding by establishing agility as a potent mechanism for transforming big data into value in terms of firm performance (e.g. Kitchens et al., 2018; Shirazi et al., 2022; Tseng, 2023). Nevertheless, three noteworthy research gaps need attention. First, extant research has mainly focused on organizational factors that affect the consequences of big data usage (see, e.g. Kitchens et al., 2018; Tseng, 2023) without adequately accounting for the contemporary external contingencies. Second, there has been a disproportionate emphasis on the tangible aspects of big data resources (i.e. data and technologies) enhancing agility and firm performance (see, e.g. Akter, Hani, et al., 2022b; Liang et al., 2021), while social and organizational factors have received less attention. Third, despite the undisputed role of the marketing department in managing the customer interface (Sridhar & Fang, 2019) and its heavy reliance on modern technologies (Moorman & Day, 2016), prior research has not adequately acknowledged its significance in leveraging big data for sensing and responding to market events. The inconsistent use of concepts to describe agile marketing in previous research has hindered the accumulation of generalizable knowledge on the topic (see, e.g. Hajli et al., 2020; Kalaignanam et al.,

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2021; Liang et al., 2021). To conclude, there is a clear need to consolidate the findings from diverse research streams within a unified framework and examine the mechanisms and external contingencies through which big data investments impact agility and firm performance.

To address the abovementioned research gaps, this paper builds on the concepts of big data analytics capability (BDAC) and marketing agility (MA) and examines how resources specific to big data impact MA and firm performance. Drawing from prior research on marketing, information technology, and management, we explore the mechanisms through which these resources affect MA and the external contingencies that moderate the relationships of BDAC, MA, and firm performance. For the purposes of this study, BDAC is defined as a "firm's ability to assemble, integrate, and deploy its big data-specific resources" (Gupta & George, 2016, p. 1054). These resources encompass tangible, intangible, and human assets. In turn, MA is defined as "the extent to which an entity rapidly iterates between making sense of the market and executing marketing decisions to adapt to the market" (Kalaignanam et al., 2021, p. 36), and it is associated with marketing excellence and competitive advantage (Homburg et al., 2020).

By delving into the mechanisms through which big data resources affect MA, this paper contributes to the literature by building a framework that explains how BDAC impacts MA and firm performance. Additionally, our framework accounts for crucial external contingencies including market turbulence, complexity and hostility, industry-specific technology intensity, and regulatory environments. Based on this framework, we develop several research propositions about the relationships between BDAC, MA, and firm performance. This paper offers an extended understanding of the key external contingencies and the role of social and organizational resources in creating value from big data; it also establishes MA as a key value actuator for BDAC. Furthermore, we summarize and synthesize the fragmented prior literature on BDAC and MA to offer comprehensive foundations for future research in this area. For practitioners, this article helps marketing leaders understand how big data initiatives create significant returns by providing guidance on which resources to develop and how they can be leveraged to generate value.

Key concepts and extant research

In this section, we introduce our key concepts, BDAC and MA. Conceptually, BDAC represents an organization's ability to effectively harness big data, formulated from a unique combination of resources specific to big data (Gupta & George, 2016). In contrast, MA refers to a process in which the organization members sense market signals and make marketing decisions accordingly. To qualify as being *agile*, this process must be rapid and iterative (Kalaignanam et al., 2021). Resources specific to big data assist an organization's members in market sensemaking and making marketing decisions as the resources provide enhanced data aggregation and analysis capabilities (Hajli et al., 2020; Shirazi et al., 2022). The subsequent sections will delve into the theoretical foundations of BDAC and MA.

Big data analytics capability

Big data is characterized by the data's volume, velocity, variety, veracity (the four Vs), and even value (Wedel & Kannan, 2016). *Big data* refers to the exponential growth rate of data (Hashem et al., 2015) and massive, complex, real-time datasets (Gupta & George, 2016) that require non-traditional processing methods (Shah & Murthi, 2021). Big data analytics (BDA) is a concept used to describe techniques and technologies that enable the management, processing, and analysis of big data to create business value and gain competitive advantage (Chen et al., 2012; Wamba et al., 2017). Research on BDA emphasizes that a set of resources that are specific to big data is needed to actuate the value of big data (Gupta & George, 2016; Mikalef et al., 2019b; Wamba et al., 2017). In turn, BDAC refers to proficiency in utilizing the combination of tangible, intangible, and human big data resources (Gupta & George, 2016). More specifically, tangible resources include data, technology, and basic resources; intangible resources include data-driven culture and the intensity of organizational learning; and human resources include managerial and technical skills (Gupta & George, 2016). *Basic resources* refer to time and investments, whereas *the intensity of organizational learning* denotes the "ability to explore, store, share, and apply knowledge" (Gupta & George, 2016, p. 1051).

Similarly, Erevelles et al. (2016) made a distinction between physical resources (i.e. the technologies processing big data), human resources (i.e. professionals who extract insights from big data), and organizational resources (i.e. the structures supporting the utilization of big data) when describing BDAC. They underscored the importance of ignorance, understanding what one does not know, and creative intensity in generating dynamic and adaptive capabilities from big data resources. Wamba et al. (2017) considered BDAC to be composed of infrastructure flexibility, management, and analytics personnel capabilities, elements that were derived from IT capability research. Their conceptualization differed in emphasizing the managerial aspects and omitting cultural ones. Table 1 summarizes the concepts related to BDAC. All the

Table 1. Concepts related to big data analytics capability in prior research.

Concept	Definition
Big data analytics capability	"a firm's ability to assemble, integrate, and deploy its big data-specific resources" (Gupta & George, 2016, p. 1054)
Big data analytics	"data sets and analytical techniques in applications that are so large (from terabytes to exabytes) and complex (from sensor to social media data) that they require advanced and unique data storage, management, analysis, and visualization technologies" (Chen et al., 2012, p. 1166)
Data analytics	"information technologies and processes that support reporting, statistical analyses, and data mining" (Ghasemaghaei et al., 2017, p. 96)
Marketing analytics	"methods for measuring, analyzing, predicting, and managing marketing performance with the purpose of maximizing effectiveness and return on investment" (Wedel & Kannan, 2016, p. 108)
Business analytics	"a process that employs various techniques to analyze and interpret different forms of data to enable better decisions and improve firm performance" (Delen & Zolbanin, 2018, p. 188)
IT capability	"ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities" (Bharadwaj, 2000, p. 171)

analytical constructs imply improved decision-making through the use of data, and BDAC is only distinguished from these constructs by its capacity to process unstructured (Wang & Hajli, 2017) and real-time datasets (Xu et al., 2016). IT capability and BDAC are composed of similar assets – such as management, infrastructure, and personnel capabilities (Wamba et al., 2017) – but the former largely resides in the IT department. Given the closely linked concepts in prior research, it is important to detect both their similarities and differences. In our analysis, we build on the conceptualization developed by Gupta and George (2016) that includes the tangible, intangible, and human resources that are most often associated with BDAC (Ciampi et al., 2021; Mikalef et al., 2018).

Marketing agility

The concept of MA was initially introduced by Poolton et al. (2006) and more recently conceptualized by Kalaignanam et al. (2021) as a combination of four key elements: sensemaking, marketing decisions, speed, and iteration. Other researchers have identified flexibility, sensing, and responsiveness as the key features of MA (Khan, 2020; Zhou et al., 2019). It is generally accepted that the elements of MA (in any combination) lead to increased market responsiveness (Asseraf et al., 2019; Gomes et al., 2020; Zhou et al., 2019) and quick adaptation to market changes (Kalaignanam et al., 2021). Kalaignanam et al. (2021) defined the four elements of MA as follows: *Sensemaking* refers to organization members interpreting and comprehending their environment and acting based on collectively formulated views. *Marketing decisions* are proactive and reactive decisions made at all levels of the marketing organization. *Speed* and *iteration* describe how the process is carried out and are the distinctive features that make marketing "agile." MA is a step-by-step process wherein the company notices an unexpected event, interprets its implications, and makes decisions that are then revised after observing the market's response. The combination of these four elements is unique to MA. Other related concepts, such as adaptive agility (Chakravarty et al., 2013) and market capitalizing agility (Lu & Ramamurthy, 2011) may involve combinations of partly similar elements (see Table 2).

MA has its theoretical roots in the resource-based view (RBV) of the firm (Asseraf et al., 2019), which perceives the firm in terms of its resources rather than its products (Wernerfelt, 1984). Founded on RBV, Teece and Pisano (1994) introduced the concept of *dynamic capabilities*, a term that refers to "adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences toward changing environment" (p. 537). Agility as a firm's capability fits within the dynamic capabilities framework and is used to denote flexibility and responsiveness in aligning strategic decision-making according to market conditions (Teece et al., 2016). MA draws from these earlier concepts while incorporating a marketing viewpoint and focusing on detecting and responding to market developments (Li et al., 2019; Osei et al., 2019; Vaillant & Lafuente, 2019). International MA is a similar construct with an international element applied to multinational firms (Gomes et al., 2020). Hagen et al. (2019), Homburg et al. (2020), and Kalaignanam et al. (2021) do not define MA as a capability but rather as a rapid and iterative process of conducting marketing decisions based on market information. In this article, we adapt their approach and consider MA to be a set of marketing actions conducted in a certain manner rather than an organizational capability.

Extant research on the relationships between BDAC, MA, and firm performance

Prior research has separately demonstrated the positive effects of both BDAC (Oesterreich et al., 2022) and MA (Hagen et al., 2019; Khan, 2020; Zhou et al., 2019) on firm performance. To date, however, no extant research has investigated the effects of BDAC and MA on firm performance in a unified model. In this paper, we

Table 2. Concepts related to marketing agility in prior research.

Concept	Definition
Marketing agility	"The extent to which an entity rapidly iterates between making sense of the market and executing marketing decisions to adapt to the market" (Kalaignanam et al., 2021, p. 36)
Organizational agility (i.e. firm agility)	"the ability to detect and respond to opportunities and threats with ease, speed, and dexterity" (Tallon & Pinsonneault, 2011, p. 464)
Operational agility	"Operational agility reflects the ability of firms' business processes to accomplish speed, accuracy, and cost economy in the exploitation of opportunities for innovation and competitive action" (Sambamurthy et al., 2003, p. 245)
Partnering agility	"the ability of organizations to leverage their network partners' knowledge and capabilities to assist in identifying problems and capturing opportunities to improve their performance" (Akhtar et al., 2018, p. 308)
Customer agility	"the degree to which a firm is able to sense and respond quickly to customer-based opportunities for innovation and competitive action" (Roberts & Grover, 2012a, p. 580)
Entrepreneurial agility	"Entrepreneurial agility implies an ability to anticipate and seize market opportunities proactively and thus allows a firm to modify its positioning and strategies and organize new business approaches to gain early advantages in changing conditions" (Chakravarty et al., 2013, p. 978)
Adaptive agility	"the firm detects and responds to market dynamics in a defensive manner, such as protecting itself and remaining resilient, generally in an attempt to recover from disruptions in market forces rather than in response to any fundamental change in the internal structure or organization" (Chakravarty et al., 2013, p. 978)
Market capitalizing agility	"a firm's ability to quickly respond to and capitalize on changes through continuously monitoring and quickly improving product/service to address customers' needs" (Lu & Ramamurthy, 2011, p. 933)
Operational adjustment agility	"a firm's ability in its internal business processes to physically and rapidly cope with market or demand changes" (Lu & Ramamurthy, 2011, p. 933)
Content marketing agility	"the ability to adapt digital content marketing efforts quickly to latent changes in the industry and optimize content creation and delivery through iterative, data-driven experimentation" (Terho et al., 2022, p. 308)
Market agility	"the firm-wide ability to stay alert to changes that occur in the dynamic business environment and quickly deploy resources to respond creatively" (H. Li et al., 2021, p. 701)
Enterprise agility	"the ability of firms to sense environmental change and respond readily" (Overby et al., 2006, p. 122)
Business process agility	"Responsiveness to changes in demand, new product development, change in product mix, product pricing, market expansion, supplier selection, IT adoption, and diffusion" (P. P. Tallon, 2008, p. 26)
Strategic agility	"the ability to exploit, or create to one's advantage, changing patterns of resource deployment in a thoughtful and purposeful but also fast and nimble way rather than remain hostage to stable pre-set plans and existing business models" (Doz, 2020, p. 1)
International marketing agility	"international firms' ability to respond rapidly to changes in its international markets and competitive conditions" (Asseraf et al., 2019, p. 295)

propose that MA mediates the relationship between BDAC and firm performance as organizations can rapidly and iteratively respond to market-based opportunities and threats by effectively utilizing big data. This position is supported by many studies that have used closely related concepts (see Table 3). Although these studies have generally demonstrated the importance of agility as a mediator of capabilities related to big data, they are insufficient in three important areas: (a) they lack an in-depth analysis of the role of human resources and intangible big data resources, (b) they overlook important moderators, and (c) they utilize heterogeneous key concepts; these insufficiencies limit the applicability of their findings. Therefore, there is a need for a more structured and comprehensive understanding of the relationship between BDAC and MA as drivers of firm performance.

The conceptual framework

The basic tenet of this paper is that BDAC (composed of a distinct combination of resources specific to big data) positively impacts MA, which in turn improves firm performance. Market complexity (Y. Chen et al., 2014; Khan, 2020), turbulence (Liang et al., 2021; Zhou et al., 2019), hostility (Chen et al., 2014), the regulatory environment (Oesterreich et al., 2022), and the industry's technology intensity (Tambe, 2014) moderate these relationships. While the combination of resources specific to big data is vital for BDAC development, our framework takes a distinct approach by examining their influence on MA individually. This allows for a more in-depth exploration of the precise mechanisms through which big data resources impact MA. The conceptual framework is presented in Figure 1, and the conceptual propositions are outlined in Table 4. The framework is explicated in more detail in the following subsections (3.1–3.3).

BDAC as the antecedent of MA

MA has been recognized as a source of competitive advantage in turbulent business environments (Liang et al., 2021; Zhou et al., 2019). In today's business landscape, there is an unprecedented wealth of market information available, with its volume continually on the rise (Balducci & Marinova, 2018). Despite its accessibility, the sheer magnitude of data makes it challenging to identify crucial market signals (Sheth & Kellstadt, 2021). Moreover, information rapidly becomes outdated due to the accelerating pace of data generation (Constantiou & Kallinikos, 2015). Companies that excel in efficiently transforming this vast pool of big data into actionable insights and decisive actions demonstrate superior agility compared with their less data-centric counterparts

Table 3. Extant research on the relationship between big data analytics capability (BDAC) and marketing agility (MA).

Article	The key concepts used	The study focus and shortcomings in the description of how BDAC creates agility and affects firm performance
Hajli et al. (2020)	Customer agility includes two dynamic capabilities: sensing and responding. Data aggregation tools make it possible to collect big data and combine data from various sources. Data analysis tools help interpret information encapsulated by big data.	The study examined the impact of data aggregation and analysis tools on new product success and suggested that both direct and indirect effects are mediated by customer agility. The effects were later quantitatively validated by Shirazi et al. (2022). However, both studies concentrated on the effect of tangible big data resources (data and technologies) and did not emphasize the value of human and intangible factors. Furthermore, they only considered environmental turbulence as a moderator.
Kitchens et al. (2018)	Big data analytics is a dynamic capability required in the contemporary competitive and changing environment, generating strategic agility. IT-enabled agility enables advanced customer analytics and is composed of customer agility and operational agility, which are dynamic capabilities supported by IT infrastructure.	The study suggested that to achieve a competitive advantage, companies need to generate agility by identifying, collecting, and integrating data across functional silos and deploying analytics that sense and respond to market events in a dynamic environment. However, human and intangible resources were not discussed, and the focus was on the role of information technologies. The context was the dynamic market environment, and other contingencies were not addressed.
Liang et al. (2021)	Marketing analytics includes the collection, management, analysis, and usage of data to create insights for decision-making and optimization. Market agility is a dynamic capability that enables an organization to sense changes and opportunities in the market and rapidly adapt and respond to them.	The study showed that market agility mediates the effect of marketing analytics on firm performance. The effect of marketing analytics on market agility is enhanced by interdepartmental coordination and market turbulence, but the benefits of marketing analytics might be mitigated by success traps. However, market analytics concerns the act of using tangible resources. Human and intangible resources were only briefly discussed. The study did not consider technological intensity or the regulatory environment as moderators.
Akter, Hani, et al. (2022)	Marketing analytics capability involves the collection, storage, processing, and analysis of data on a cloud-sharing platform to generate insights into marketing effectiveness. MA refers to the simplified structures and processes that enable quick decision-making to execute growth activities through constant iteration.	The study investigated the impact of marketing analytics capability on marketing effectiveness. It showed both direct and indirect effects mediated by MA. Market turbulence weakened the effect of marketing analytics and MA on marketing effectiveness. However, the study context was limited to the use of cloud-sharing platforms and did not discuss human and intangible resources. It only considered market turbulence as a moderator. Furthermore, it used marketing effectiveness instead of firm performance as the outcome.
Tseng (2023)	Big data analytics refers to the effective use of big data tools. Customer agility includes two dynamic capabilities: sensing and responding.	The study examined customer agility's mediating effect between the effective use of big data and new product success. It suggested different mediating paths through sensing and responding capabilities. However, it focused on the use of technology and did not consider human and intangible resources nor discuss any contingencies.
Li et al. (2022)	Digitalization capabilities describe how digital technologies facilitate data integration and processes. Agility is composed of market capitalizing agility and operational adjustment agility.	The study investigated how the dynamic capabilities enabled by digital technologies impacted firm performance in the business environment under the influence of the COVID-19 pandemic. The results suggest that agility mediates the effect of digitalization capabilities on firm performance. However, the study did not consider human and intangible resources nor focus on the use of technologies. It did not incorporate any moderators, and the context was the business environment under the influence of the COVID-19 pandemic.
This paper	Big data analytics capability & Marketing agility	This study provides a conceptual framework for how BDAC resources impact MA and further how MA impacts firm performance. It also discusses the key moderators. The key concepts used in this study differ from those used in previous research, emphasizing the holistic capability of utilizing big data and operating an agile marketing organization.

BDAC = big data analytics capability; MA = marketing agility.

(Shirazi et al., 2022; Tseng, 2023; Zheng et al., 2022). Nowhere is this more evident than in the realm of marketing, which, together with sales, serves as the interface with customers, providing valuable insights into their behavior and preferences (Sridhar & Fang, 2019). Skillful utilization of this data allows companies to craft personalized and targeted products, services, marketing campaigns, and customer service (Huang & Rust, 2021). Crucially, BDAC does not automatically enhance MA but, instead, necessitates a deliberate choice to direct big data resources toward rapidly and iteratively sensing and responding to market information (Lu & Ramamurthy, 2011; Tallon et al., 2019).

The antecedents of MA, as described by Kalaignanam et al. (2021), are categorized as employee, leadership, team, and organizational factors. These factors have many similarities with the big data resources that form BDAC: managerial attributes, personnel skills, the team

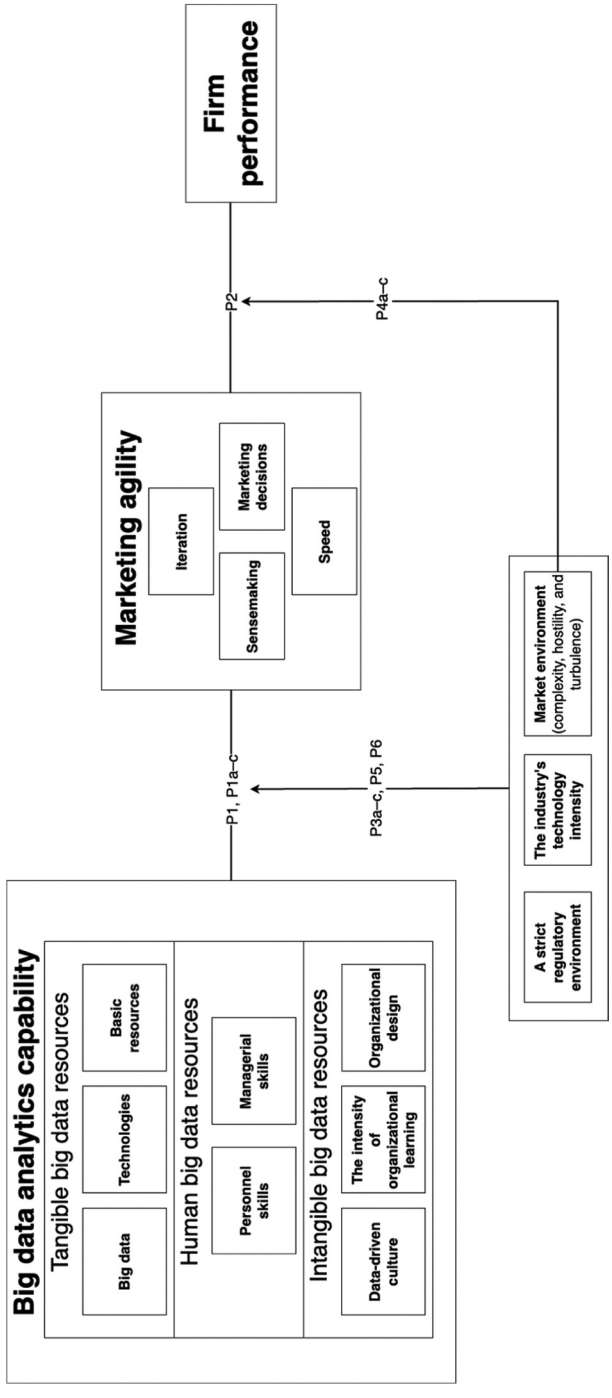

Figure 1. The conceptual framework.

Table 4. A summary of the propositions.

Proposition	Resource	Description	Key literature
P1: BDAC has a positive impact on MA		BDAC enhances the four elements of MA (speed, iteration, sensemaking, and marketing decisions) through the efficient utilization of tangible, human, and intangible big data resources.	Gupta and George (2016); Kalaignanam et al. (2021)
P1a: Tangible big data resources have a positive impact on MA.	Data	The volume, variety, and velocity of big data enable more real-time decision-making, use of machine learning, and a holistic market view, although its veracity creates challenges.	Balducci and Marinova (2018); Du et al. (2021); Ng and Wakenshaw (2017); Sheth and Kellstadt (2021); Vidgen et al. (2017)
	Technologies	Integrated technological infrastructure with the capacity for real-time processing of big data, utilization of AI, automation, and visualization support agile processes.	Hajli et al. (2020); Huang and Rust (2021); Lu and Ramamurthy (2011); Pigni et al. (2016); Wedel and Kannan (2016)
	Basic resources	Investments need to support experimental practices over heavy upfront capital initiatives and the creation of integrated IT infrastructure.	Kalaignanam et al. (2021); Kopalle et al. (2020); Lu and Ramamurthy (2011); Troisi et al. (2020)
P1b: Human big data resources have a positive impact on MA.	Personnel skills	Technical, relational, and business knowledge support agile traits of risk tolerance, experimentation, and the utilization of BDA tools for agility. Cross-functional BDA teams nurture agile practices.	Aimé et al. (2022); Akhtar et al. (2019); Ghasemaghaei et al. (2017); Kalaignanam et al. (2021)
	Managerial skills	Analytical and cooperative skills, business knowledge, and technical experience help to successfully lead an agile marketing organization. They also support collaboration with IT and data interpretation, which increases agility.	Gupta and George (2016); Kalaignanam et al. (2021); Li et al. (2021)
P1c: Intangible big data resources have a positive impact on MA.	Data-driven culture	A culture that values data-based decision-making is associated with increased market sensing, faster and better-informed decisions, proactive anticipation/utilization of market opportunities, and increased risk tolerance/experimentation.	Ciampi et al. (2021); Dremel et al. (2020); Ghosh et al. (2021); Lin and Kunnathur (2019); Mikalef et al. (2019a); Wong and Ngai (2023)
	Intensity of organizational learning	The working methods associated with BDA, the agile method, and growth hacking support agile experimentation and subsequent learning and are suitable for agile marketing teams.	Homburg et al. (2020); Kalaignanam et al. (2021); Troisi et al. (2020); Vidgen et al. (2017)
	Organizational design	A decentralized organizational structure, target-oriented budgeting, and long-term incentives (which help form strong BDAC) are important in agile marketing organizations.	Erevelles et al. (2016), Kalaignanam et al. (2021); Kopalle et al. (2020); Tallon et al. (2019)
P2: MA has a positive impact on firm performance.		MA enhances firm performance through improved innovation, new product success, marketing program adaptation, time to market, market penetration, early economic return, and risk profile.	Asseraf et al. (2019); Hagen et al. (2019); Khan (2020); Zhou et al. (2019)
P3a: Market turbulence positively moderates the impact of BDAC on MA.		BDAC improves a company's capacity to sense and respond to changes in a turbulent market environment.	Liang et al. (2021); Mikalef et al. (2019b)
P3b: Market complexity positively moderates the impact of BDAC on MA.		BDAC improves a company's capacity to make sense of the complex market environment.	Chen et al. (2014)
P3c: Market hostility negatively moderates the impact of BDAC on MA.		An unfavorable economic, political, societal, and competitive environment impairs the utilization of BDAC for agility.	Chen et al. (2014)
P4a: Market turbulence positively moderates the impact of MA on firm performance.		Agile marketing organizations can quickly and iteratively answer to changes in a turbulent market environment.	Ashrafi et al. (2019); Zhou et al. (2019)
P4b: Market complexity positively moderates the impact of MA on firm performance.		Market complexity increases the effect of MA on firm performance due to better adaptation to unpredictable environments.	Khan (2020)
P4c: Market hostility negatively moderates the impact of MA on firm performance.		Market hostility diminishes the value of agile investments in fiercely competitive environments.	Chen et al. (2014); Li (2022)
P5: An industry's technology intensity positively moderates the impact of BDAC on MA.		The tech intensity of an industry positively moderates the effect of BDAC on MA since companies have better access to technical talent and data.	Felipe et al. (2020); Müller et al. (2018); Tambe (2014)
P6: A strict regulatory environment negatively moderates the impact of BDAC on MA.		Whether the company is in a developed or developing country impacts how BDAC affects MA due to different regulations and legislation. However, the moderating effect is likely to be case-specific.	Mora Cortez and Hidalgo (2022); Oesterreich et al. (2022)

BDA = big data analytics; BDAC = big data analytics capability; MA = marketing agility.

operating model, organizational culture/structure, technologies, and other resources. Hence, the development of these resources, and consequently BDAC, contributes to creating an agile marketing organization. Hence, P1 is as follows:

P1. BDAC has a positive impact on MA.

These resources fall under three main resource categories of BDAC (tangible, human, and intangible resources). In the following subsections, we elaborate on how each resource impacts MA.

Tangible Big Data Resources

Data, technologies, and basic resources are tangible big data resources. Data represent the information that a company can extract from various internal and external sources, and technologies are systems and techniques intended for processing big data (Gupta & George, 2016). Prior research has found that investments in big data and related technologies enhance an organization's agility (e.g. De Luca et al., 2021; Lu & Ramamurthy, 2011).

Big Data. The effect of big data on agility is profound; the volume allows for the use of machine learning algorithms, the variety enhances market sensing, and the velocity enables real-time decisions (Brewis et al., 2023; Gupta et al., 2020; Hair & Sarstedt, 2021; Kitchens et al., 2018). Technologies have enabled the gathering of data from a variety of sources (Blasco-Arcas et al., 2022) – including the Internet of Things (IoT), user-generated content (UGC), and click streams – which grant businesses with a comprehensive understanding of the market landscape (Du et al., 2021; Ng & Wakenshaw, 2017) and can be leveraged to expedite the time to market and gain a first-mover advantage (Lin & Kunnathur, 2019). However, a *MIT Sloan Management Review* (Kiron, 2016) survey revealed that most companies face difficulties collecting data and they struggle to make use of the data they possess. Collecting data that the organization is unable to utilize wastes resources due to data-management requirements, and may hurt agility (Kalaignanam et al., 2021). Thus, the use of internal data can be optimized before collecting external big data (Yang et al., 2020) that often have unstructured, hard-to-process formats (Jabbar et al., 2020). Digital data streams, such as UGC and IoT data, represent voluminous, constantly updating data sources that support real-time algorithmic decision-making and predictive models (Balducci & Marinova, 2018; Jabbar et al., 2020; Pigni et al., 2016). Nevertheless, the validity and reliability of big data are often challenged due to redundant, biased, and unactionable information (Constantiou & Kallinikos, 2015). Additionally, the shelf life of big data is poor due to its real-time nature (Sheth & Kellstadt, 2021). Consequently, data quality is one of the biggest obstacles in generating agility (Kune et al., 2020) as datasets need to be cleaned and revised before analysis (Sivarajah et al., 2017), which may take up to 90% of analysts' time (Vidgen et al., 2017).

Technologies. *Big data technologies* refer to tools that allow the real-time aggregation, processing, and visualization of voluminous and unstructured datasets (Wang & Hajli, 2017; Wedel & Kannan, 2016). These technologies reduce response time (Jabbar et al., 2020) and are essential for time-sensitive applications (Grover, 2022). Data-aggregation tools help to integrate disparate data sources for better interoperability and accessibility (Bain & Company, 2021; Overby et al., 2006), which are crucial for making coherent, informed, and timely decisions across an organization (Kalaignanam et al., 2021; Scuotto et al., 2022). Data visualization improves agility when relevant data streams are integrated, helping managers make informed decisions quickly (Medeiros & Maçada, 2022; Pigni et al., 2016; Tseng et al., 2022; Wang & Hajli, 2017). User-friendly analytics tools that provide frequently updated information help to utilize insights for market actions and iteratively improve internal processes (Del Vecchio et al., 2021; L. Li et al., 2022). While all analytics methods enhance market sensing and decision-making, advanced analytics (such as predictive, prescriptive, and AI), have been found to be superior in increasing an organization's agility in sensing and responding to external market forces (see, e.g. Chatterjee et al., 2021; Fosso Wamba, 2022; Loureiro et al., 2021; Mikalef et al., 2021). Notably, although AI can process the volume and velocity of big data (Babin et al., 2021; Mora Cortez & Johnston, 2017) and execute recurring tasks and sophisticated analytical methods rapidly while learning with every iteration (Bezuidenhout et al., 2023; Huang & Rust, 2021; Kumar et al., 2021; Manis & Madhavaram, 2023; Ngai & Wu, 2022), human intervention is important in mitigating algorithmic bias (Akter, Hani, et al., 2022). Importantly, automation drives agility (Grover, 2022), but marketing leaders struggle to trust AI to make important decisions (Elkin & Neufeld, 2021), partly because complex algorithms are difficult to comprehend (Kalaignanam et al., 2021).

Basic Resources. IT departments are often responsible for data governance and making decisions regarding data and technology investments (Kitchens et al., 2018). The efficient use of IT resources to support business strategies and work processes is called *IT capability*, which is found to increase organizational agility

through integrated infrastructures (Lu & Ramamurthy, 2011), the flexible utilization of resources (Chen et al., 2014; Ravichandran, 2018), the acceleration of internal activities, the capitalization of external opportunities (Mangalaraj et al., 2023; Mikalef & Pateli, 2017), the rapid testing and deployment of new and revised applications (Story et al., 2021; Tallon et al., 2019), and retiring legacy systems (Queiroz et al., 2018). Notably, IT capability has only been found to improve firm performance through organizational agility (Chakravarty et al., 2013; Y. Chen et al., 2014; Felipe et al., 2020), which implies that IT investments need to be directed toward dismantling information silos as reactive investments enforcing siloed structures only limit agility (Lu & Ramamurthy, 2011; Overby et al., 2006). BDA investments should consider talent and organizational factors because they enable the value of technologies and are harder to copy compared with tools and data (Oesterreich et al., 2022).

Big data technologies not only enable companies to access real-time and comprehensive market information but also facilitate efficient internal knowledge-management processes. This elevates the organization's capacity for rapid sensemaking and marketing decisions in an iterative manner. Hence, P1a is as follows:

P1a. Tangible big data resources have a positive impact on MA.

Human Big Data Resources

Gupta and George (2016) suggested that human big data resources require technical and managerial skills, but other studies have highlighted that BDAC also includes knowledge about business, social relations, and business analytics (Mikalef et al., 2018). Therefore, instead of *technical skills*, this study uses *personnel skills* to describe this resource. Possession of skills specific to big data helps organizations become more agile (Kalaignanam et al., 2021), and are required to operate tangible resources and nurture intangible ones (Gupta & George, 2016). The required marketing skills are also changing with the rise of big data and AI (Aimé et al., 2022; Akter, Dwivedi, et al., 2022; Elhajjar, 2023; Joshi & Giménez, 2014; Vlačić et al., 2021); CMO surveys have suggested that analytical expertise is becoming more important than creativity (Deloitte, 2022), and market insights have become the most important "hard skill" (Gartner, 2021).

Personnel Skills. According to Kalaignanam et al. (2021), knowledge about and comfort with technology tools, willingness to experiment, and the capacity to cope with uncertainty are important attributes for employees working in an agile marketing organization. They continue to observe that, at the very least, the core agile marketing team should have knowledge of AI and machine learning. A fit between people, data, and tasks is necessary to avoid frustration, suboptimal decision-making, and unnecessary time consumption (Ghasemaghaei et al., 2017; Shree et al., 2021). Hence, BDA skills are essential, not only in utilizing marketing technologies for sensing and responding to market cues but also in identifying and conveying important insights (Akhtar et al., 2018). Additionally, information processing skills help unravel uncertainty (P.-Y. Huang et al., 2014). Agile marketing personnel should be trained to be oriented toward speed and iteration without many requirements for conscientiousness (Kalaignanam et al., 2021). Fast delivery and experimentation are characteristics of BDA teams' agile method (Dremel et al., 2020), which helps them adopt an agile marketing mind-set. These teams are often multidisciplinary (Akhtar et al., 2018), which enhances the organization's sensemaking (Kalaignanam et al., 2021) when they use their diverse skills to identify and process useful information and collaborate with other teams (Calvard, 2016; ZareRavasan, 2021). Despite the increasing demand for BDA skills (Bain & Company, 2021), many companies lack such talent (Statista, 2020), which poses a significant challenge to their agility (Grover, 2022). To address this problem, companies may train their current employees and hire or outsource tech-savvy professionals (Ghasemaghaei et al., 2017; Joshi & Giménez, 2014; L. Li et al., 2021). McKinsey (2021) found that top performers were likelier to fill their talent gaps through hiring. However, most CMOs use outsourcing to fill talent gaps quickly (Gartner, 2021).

Managerial Skills. Marketing leaders with prior technology and analytics experience are better equipped to lead agile marketing organizations (Kalaignanam et al., 2021) and collaborate with IT to increase operational alignment with other departments, which increases MA (Lee & Liu, 2022; Li et al., 2021). Nevertheless, according to a CMO Council study (2022), only one in four marketing organizations have an effective relationship with IT. Analytics skills help to implement data-driven decisions faster and grasp opportunities in volatile markets (Li et al., 2021). According to McKinsey (2021), top-performing companies are likelier to have technology-savvy leaders and poor data interpretation skills are identified as a major obstacle (Kiron, 2016). Other important agile managerial attributes are strategic sensitivity, good relations with other senior leaders, and the capacity to evaluate established routines and quickly reconfigure resources (Gomes et al., 2020; Kalaignanam et al., 2021; Osei et al., 2019). These are well-aligned with big data managerial skills, which

include business and analytics knowledge and strong relationships with other managers (Gupta & George, 2016). BDA is also associated with an increased capacity for resource reconfiguration (Cao et al., 2019; Lin & Kunnathur, 2019). Moreover, managers should be agile in their approach to technology, continuously adjusting their usage based on market signals while maintaining a low threshold for testing new tools (Al Nuaimi et al., 2022; Mero et al., 2022; Tallon et al., 2019). In IT, skilled managers can be hired to ensure that IT capabilities are directed toward agility (Chen et al., 2014).

Market information can be more rapidly processed and distributed when managers have technical expertise. Furthermore, analytics-savvy managers are likelier to make data-driven decisions and exploit market opportunities faster. Technical experience may also predict better adjustments to agile working methods. Thus, P1b is as follows:

P1b. Human big data resources have a positive impact on MA.

Intangible Big Data Resources

According to Gupta and George (2016), *intangible big data resources* include a data-driven culture and the intensity of organizational learning. In addition, organizational design is suggested as an asset that facilitates cooperation to utilize big data (Erevelles et al., 2016). Together, these resources create a tendency toward BDA actions, which are necessary for acquiring other big data resources (Del Vecchio et al., 2021). They have also been associated with agility in prior research (e.g. Homburg et al., 2020; Medeiros & Maçada, 2022; Wong & Ngai, 2023).

Data-Driven Culture. Data-driven culture values data over experience and title in decision-making (Gupta & George, 2016) and emphasizes belief in the business potential of big data (Kiron, 2016). A data-driven culture is associated with increased market sensing and the use of analytics for making better-informed and faster decisions (Medeiros & Maçada, 2022; Wong & Ngai, 2023; ZareRavasan, 2021). It has also been found to contribute to risk tolerance and an experimental mindset (Kopalle et al., 2020; Pigni et al., 2016). These aspects support the creation of an agile culture that shares the same values and is oriented toward speed and experimentation (Kalaignanam et al., 2021; Khan, 2020; Zhou et al., 2019). Furthermore, BDAC supports an entrepreneurial orientation, which mostly shares the same features (Ciampi et al., 2021) and is linked to proactively anticipating and seizing market opportunities (Chakravarty et al., 2013). Data-driven organizations have been found to outperform their competitors (Akhtar et al., 2019; McAfee & Brynjolfsson, 2012), but despite massive investments in big data, many struggle to become data-driven due to siloed organizations with siloed data, rigid business processes, and change resistance (Bean, 2021; Mikalef et al., 2019b; Sleep et al., 2023). The literature highlights the importance of managerial support, skills, and strategic alignment in the widespread utilization of big data for agile sensing, seizing, and reconfiguring of market opportunities (Cao et al., 2019; Ghosh et al., 2021). It also considers success traps as obstacles to the efficient utilization of data (Liang et al., 2021).

The Intensity of Organizational Learning. *The intensity of organizational learning* refers to the extent to which an organization pursues learning through the exploration and exploitation of data (Gupta & George, 2016). Such activities are well aligned with the processes of an agile marketing organization that pursues learning through experimentation and recommends that teams follow the agile method (Kalaignanam et al., 2021). *Growth hacking*, "a process of rapid experimentation across the sales funnel to learn the most effective way to scale sustainable customer adoption" (Troisi et al., 2020, p. 6), is another working method for utilizing big data that fits with a rapid and iterative way of working and is likely to support MA (Homburg et al., 2020). Through experimentation with BDA, agile and growth hacking methods can increase customer understanding and market responsiveness (Troisi et al., 2020). However, they must be widely understood in the organization for efficient cooperation with agile marketing teams (Kalaignanam et al., 2021). Agile teams are often cross-functional and self-managing (Aghina et al., 2022). This serves the skill diversity needed when working with big data and supports knowledge sharing (internally, in the team [Akhtar et al., 2019] and with channel partners [Roberts & Grover, 2012b]) and helps in receiving authorization, which are crucial to ensuring speed in delivering solutions (Kalaignanam et al., 2021).

Organizational Design. Organizational structures and processes must support the rapid transformation of insights into actions (Erevelles et al., 2016). Grover (2022) stated that rigid structures can impede companies from capitalizing on data to gain agility. To foster an experimental approach, separate organizational units with dedicated budgets may be necessary (Kopalle et al., 2020), as evidenced by growth hacking and agile teams. Tallon et al. (2019) suggested that decentralized organizational structures (as opposed to centralized settings) may improve the utilization of real-time information

and agility. Other literature has indicated that decision-making in agile marketing organizations is delegated to the unit that performs the related actions, and resources are flexibly allocated to priority areas (Homburg et al., 2020; Khan, 2020; Zhou et al., 2019). Kalaignanam et al. (2021) further recommended tying budgets to goals and business value instead of channels, products, or markets. Additionally, long-term incentives (Kopalle et al., 2020) and employees' freedom to experiment with their ideas with a sense of ownership (Mikalef et al., 2021) are important. Reduced bureaucratic constraints and distributed decision-making structures enable teams to make quick decisions and embrace risk-taking (Kalaignanam et al., 2021). Despite the potential drawbacks of centralization, a Gartner survey suggested that companies are increasingly transitioning toward fully centralized structures by combining similar functions, particularly in B2C or hybrid (B2B – B2C) companies (Witzky, 2022). The primary motivations for this trend are better prioritization, collaboration, and workflow.

Data-driven culture accelerates speed and enhances the quality of marketing decision-making by increasing the understanding and utilization of data. Intensive organizational learning helps create a virtuous cycle of experimentation and optimization that enhances the iterative nature of sensemaking and marketing decisions. Furthermore, an organizational design that dismantles information silos and supports experimentation enables agile marketing processes. Hence, P1c is as follows:

P1c. Intangible big data resources have a positive effect on MA.

The Consequences of MA

MA has been independently associated with firm performance, both directly (Pinho et al., 2022) and when mediated by innovation capability (Zhou et al., 2019), new product advantage (Asseraf et al., 2019), marketing program adaptation (Khan, 2020), time to market, and customer satisfaction (Aghina et al., 2022). The studies behind these findings regard firm performance as marketing effectiveness, perceived big data performance, competitive advantage, new product success, and performance compared with competitors (in terms of profitability, market share, sales growth, etc.) (Asseraf et al., 2019; Homburg et al., 2020). According to Hagen et al. (2019), agile marketing leads to decreased time to market, enhanced market penetration/customer acceptance, early economic return, and a positively altered risk profile. Agile marketing achieved using analytics on a cloud-sharing platform has also been connected to these outcomes (Akter, Hani, et al., 2022). In studies investigating other agility constructs, analytics-induced agility is associated with similar firm performance indicators (e.g. Ashrafi et al., 2019; De Luca et al., 2021; Hajli et al., 2020; Sultana et al., 2022; Tseng, 2023), although Elia et al. (2022) did not establish a connection between proactive adaptation (agility) and organizational performance. In the IT capability literature, organizational agility has been tightly connected to firm performance (e.g. Chakravarty et al., 2013; Chen et al., 2014; Felipe et al., 2020). These findings indicate that agile marketing activities, especially when supported by analytics, are important for an organization's success. Consequently, P2 is as follows:

P2. MA has a positive impact on firm performance.

Moderators

Market Turbulence, Complexity, and Hostility

Market complexity (Khan, 2020), market turbulence (Ashrafi et al., 2019; Zhou et al., 2019), and technological turbulence (Ashrafi et al., 2019) have been found to strengthen the effect of agility on firm performance, implying the importance of agility in a competitive and unpredictable environment. Similarly, BDAC's effect on agility is stronger in a complex and dynamic environment since big data resources can be leveraged to capture and utilize data to increase an organization's responsiveness (Chen et al., 2014; Liang et al., 2021; Mikalef et al., 2019a). Controversially, other research has found that market turbulence has a negative moderating effect between MA and marketing effectiveness (Akter, Hani, et al., 2022) and no moderating effect on IT capability's impact on agility (Chen et al., 2014). The latter could be attributed to uncoordinated efforts to reorganize the IT infrastructure for emerging business needs (Chakravarty et al., 2013). In summary, BDAC seems to contribute to agility and firm performance in a complex environment through its capacity for companies to quickly make sense of their surroundings. However, the effect is not as clear in a turbulent environment since technology investments might create rigidities (Chakravarty et al., 2013). Market turbulence might require a relatively informal approach for sensing, seizing, and transforming opportunities that is manifested in the actions of individual employees (Mero & Haapio, 2022). These actions can be supported by well-organized big data resources. Market hostility has been suggested to decrease the impact of IT capability on agility due to unfavorable economic, societal, and political factors (Chen et al., 2014). Furthermore, fierce competition might diminish the returns of digitally enabled agility (Li, 2022). Conversely, Müller et al. (2018) only detected increased productivity from using

BDA tools in companies that operate in highly competitive industries. Therefore, P3a–P4c are as follows:

P3a. Market turbulence positively moderates the impact of BDAC on MA.

P3b. Market complexity positively moderates the impact of BDAC on MA.

P3c. Market hostility negatively moderates the impact of BDAC on MA.

P4a. Market turbulence positively moderates the impact of MA on firm performance.

P4b. Market complexity positively moderates the impact of MA on firm performance.

P4c. Market hostility negatively moderates the impact of MA on firm performance.

An Industry's Technology Intensity

Although tangible BDA assets are suggested to enhance agility and firm performance, Müller et al. (2018) and Tambe (2014) stated that this only applies in industries where companies have access to substantial data assets and a labor force equipped with BDA skills. They found that companies in tech- and data-intensive industries were able to increase productivity, whereas tangible BDA assets did not have the same effect elsewhere. Felipe et al. (2020) found that IT capabilities have a greater positive effect on organizational agility in tech-intensive industries, but that the effect of agility on firm performance is not contingent upon the industry. Other research has also found a positive effect of BDACs on agility and firm performance in other industries, such as the automotive and manufacturing industries (e.g. Dremel et al., 2020; Hossain et al., 2022), although the effect might be stronger for tech companies. For example, Grover (2022) noted that creating a BDA infrastructure that supports agility is harder for non-digital companies. The findings seem to imply that these companies need to put considerable effort into creating BDACs to improve agility, although the impact of agility on firm performance is not dependent on the industry (Felipe et al., 2020). Thus, P5 is as follows:

P5. An industry's technology intensity positively moderates the impact of BDAC on MA.

A Strict Regulatory Environment

In a meta-analysis of the social and technical factors involved in creating business value from BDA, Oesterreich et al. (2022) found that companies in developing countries can reap more value from BDA than those in developed countries. The reason for this is that regulations and legislation limiting the use of BDA in developing countries lag behind those of developed countries, which leaves more options for companies to benefit from the data. Hence, the moderating effect of location is logical since regulation and legislation may limit the usability of data (Kalaignanam et al., 2021; Mikalef et al., 2021) and require extensive data privacy and security actions (Marston et al., 2011). By contrast, Mora Cortez and Hidalgo (2022) suggested that the capacity to capture real-time digital data only contributes to firm performance in developed countries, where skills and regulations are more mature. They noted that regulation increases customer acceptance of data utilization. However, as skills are not location-bound, unlike regulations limiting the use of data, we could infer that companies operating in less regulated environments have more opportunities to use BDA. Hence, P6 is as follows:

P6. A strict regulatory environment negatively moderates the impact of BDAC on MA.

Discussion

While there are considerable potential benefits to leveraging big data, some firms struggle to do so effectively to improve firm performance (Kiron, 2016). To harness the power of big data, organizations must develop resources specific to big data that are tailored to their needs (Mikalef et al., 2019b). However, this alone might not suffice as these assets may not directly translate into profitable actions (Chakravarty et al., 2013). Existing literature has recognized the positive impact of MA on firm performance in turbulent environments (Zhou et al., 2019), but it has scarcely discussed the factors leading to MA (Kalaignanam et al., 2021). In this paper, we bridge this gap by proposing that BDAC serves as a potent antecedent to MA, ultimately enhancing firm performance. Furthermore, we identify several external contingencies that affect the strength of the relationships between BDAC, MA, and firm performance. In the following, we discuss the key implications of the study for both theory and managers seeking to extract value from big data initiatives.

Theoretical contributions

This paper organizes the diverse literature on BDAC and MA to clarify their relationships and advance the discussion on big data and agility. It offers three significant theoretical contributions. First, we introduce a new theoretical framework (Table 4) linking BDAC, MA, and firm performance to elucidate how big data can be effectively transformed into firm value. Previous literature has extensively investigated the effect of BDAC on firm performance (Erevelles et al., 2016; Gupta & George, 2016; Wamba et al., 2017). Similarly, the effects of MA on firm performance are relatively well

understood (Pinho et al., 2022; Zhou et al., 2019). In contrast, our framework creates links between BDAC and MA and clarifies the value mechanisms through which their combination fosters firm performance. Thus, we pave the way for future research to develop a more detailed understanding of how the value of big data analytics can be realized through agile processes.

We deduce that investing in big data is insufficient to increase performance. Rather, investments in IT infrastructure corrode value when value-creation mechanisms are not thoroughly considered (Chakravarty et al., 2013). BDA investments that increase both process-oriented and market-oriented agility enhance not only an organization's efficiency and productivity but also its capacity to sense and seize market opportunities (Aydiner et al., 2019; Lu & Ramamurthy, 2011). The capacity to rapidly and iteratively sense and respond to unexpected market events by leveraging big data resources contributes to competitive advantage and improved firm performance (Homburg et al., 2020; Tseng, 2023; Zhou et al., 2019).

Second, to the best of our knowledge, our framework is the first to address all aspects of big data resources, in contrast to prior research that predominantly focuses on tangible resources while neglecting the role of social and organizational factors (e.g. Akter, Hani, et al., 2022; Hajli et al., 2020; Kitchens et al., 2018). Prioritizing human and intangible big data resources may even be a more effective approach until the capacity for advanced analytics is achieved (Oesterreich et al., 2022). By examining the impact of each big data resource on MA separately, our approach provides a more detailed view of how BDAC is related to agile marketing processes.

Regarding tangible resources, big data nurtures agility through its volume, variety, and velocity, thus enhancing rapid decision-making and providing holistic market knowledge (Balducci & Marinova, 2018). Similarly, the capacity of contemporary technologies to integrate big data and provide advanced analytics, automation, visualization, and AI supports agile processes (Wedel & Kannan, 2016). Basic resources, such as investment of time and money, favor agility when they support experimental practices (Kalaignanam et al., 2021). Concerning human resources, personnel with technical and relational skills, along with business knowledge and entrepreneurial traits, can leverage tools and data for experimentation, which is fundamental for agility (Akhtar et al., 2019). Managers with analytical and cooperative skills, business knowledge, and technical experience are better suited for leading agile organizations and cooperating with IT, which is crucial for facilitating technological developments to support agility (Kalaignanam et al., 2021). Regarding intangible resources, a data-driven culture is associated with increased market sensing, faster and better-informed decisions, utilization of market opportunities, and increased risk tolerance and experimentation (Wong & Ngai, 2023). The intensity of organizational learning is connected to agile methods and growth hacking, both of which are suitable for agile project management. Finally, organizational design favors agility when the structure is decentralized, budgets are target-oriented, and experimentation is supported by long-term incentives (Kopalle et al., 2020; Tallon et al., 2019).

However, we acknowledge that big data resources create more value in combination (Wamba et al., 2017). For instance, data and technologies need to be accompanied by the skills required to utilize them (Ghasemaghaei et al., 2017), which in turn requires the strategic intent to develop those skills (Vidgen et al., 2017). Such intent is enforced by favorable managerial perceptions of BDA (Cao et al., 2019). Notably, the insights developed by BDA cannot be utilized without a data-driven culture and managers' analytical skills (Medeiros & Maçada, 2022). Thus, developing these resources in unison to generate agility is pivotal in creating returns from BDA investments.

Third, our framework summarizes the external contingencies for the relationships between BDAC, MA, and firm performance from earlier literature and proposes additional moderating conditions. Thus, the framework offers a comprehensive perspective on the external contingencies and emphasizes the significant impact of the business environment on extracting value from big data. Prior literature has acknowledged that market turbulence and complexity moderate the impact of MA on firm performance (Khan, 2020; Zhou et al., 2019). However, we propose that these factors, along with the industry's data intensity and strict regulatory environment, also serve as contingencies between BDAC and MA. Moreover, we suggest that market hostility moderates the relationships between BDAC, MA, and firm performance. To elaborate, investments in big data resources to enhance rapid and iterative sensemaking and marketing decision-making processes would yield better returns in a turbulent market environment (Zhou et al., 2019). These investments can help form a holistic picture of the business environment (Mikalef et al., 2019a), which would likely also result in better returns in a complex market (Khan, 2020). In a hostile environment, the utilization of BDAC for agility might be more difficult, and acquired capabilities need to be swiftly utilized to benefit from a transient competitive edge (Chen et al., 2014; Li, 2022). Companies outside

of data-intensive industries may experience difficulties in creating value from their BDA investments (Müller et al., 2018), although a competitive advantage might be easier to reach. Data-intensive industries can be more competitive in terms of big data resources, leading to faster normalization of the acquired capabilities (Tambe, 2014). Companies operating locally in areas with loose data privacy and security regulations can capture more data and utilize it more freely (Oesterreich et al., 2022). However, customer data should be managed ethically and safely from customers' perspectives to avoid damaging the company's reputation (Mora Cortez & Hidalgo, 2022).

Managerial implications

Most marketing organizations either only control decisions about marketing communications or are reduced to acting as service providers (McAlister et al., 2022). Therefore, it is not surprising that in the age of big data, AI, and other contemporary, largely technical phenomena, marketing leaders might struggle to capitalize on this development (Kune et al., 2020). However, as a company's demand generator and its customers' interface (Sridhar & Fang, 2019), the marketing department may recognize significant opportunities to assume a more prominent role among the company's profit centers through the utilization of big data. This study offers important implications for marketing leaders to exploit the value of big data for their organizations. In the following, we highlight the implications for managers regarding big data and technologies, data-driven culture, and the business environment.

First, marketing is a highly technology-dependent function (Moorman & Day, 2016), and to remain competitive, marketing organizations must have a comprehensive understanding of their market environment, act swiftly on emerging patterns, and use automation to reduce human interference when it does not add value (Grover, 2022; Mustak et al., 2021; Syam & Sharma, 2018). Contemporary customers expect companies to utilize their data effectively and ethically in real time for targeted and personalized interactions (CMO Council, 2022). Therefore, organizations that can capture data streams, transform them into insights and use them for customer-oriented offerings and communications while optimizing and automating the process have a distinct advantage over their competitors. Consequently, we encourage marketing leaders to take an active role in shaping the strategy concerning data and technologies to ensure that such development considers the marketing aspect. Moreover, other managers involved in data management are urged to consider how to ensure that technological development increases responsiveness to market indicators.

Secondly, managers may be inclined to address the need for utilizing data for increased responsiveness and customer orientation by regularly updating and complementing their technology stack, a recommendation that might also come from their technology vendors seeking to benefit from an increased development budget. However, if the company's internal technical skills and talent for translating these investments into tangible outcomes are not elevated, they risk ceding control to their partners. In the long run, this approach may prove costlier than investing in the organization's human resources. Furthermore, the technologies and data might be underutilized if a culture of data-driven decision-making and experimentation is not fostered. Company culture often mirrors the priorities of managers and the executive team, underscoring the importance of their support. Additionally, the organizational structure may create information silos that need to be dismantled to achieve the transparency necessary for a data-driven culture. In conclusion, we recommend that managers utilize incentives, target-oriented budgeting, organizational restructuring, and rigorous knowledge-sharing practices, among other strategies, to foster data-driven and entrepreneurial culture. Additionally, they should prioritize the development of the organization's internal big data resources to derive value from data.

Third, managers are encouraged to factor in external contingencies when investing in big data. Targeting big data investments for agility becomes especially crucial in turbulent and complex markets as they alleviate uncertainty and enhance responsiveness. In data-rich and technologically mature industries, investing in advanced technologies, (such as those able to process unstructured and real-time data) enhances competitiveness. Other companies should prioritize conventional solutions unless they have access to valuable big data for their business and sufficient technical talent. Companies in locations with favorable big data regulations should consider customer-data sensitivity and find a balance between personalization opportunities and customer expectations.

Limitations and future research

This study conceptualized how marketing organizations create agility and improve firm performance by developing big data resources; however, it has not done so without limitations. As the research model is conceptual, it requires empirical validation. Future research could use the created propositions about the relationships between

Table 5. Future research opportunities.

Focus	Research Question
BDAC → MA	Do big data resources have a separate, positive effect on MA, or do they need to be combined? Which resources are the most important? Do some resources need to be developed before others?
	Is the utilization of big data resources for agile marketing easier for SMEs than for large enterprises?
	Are companies actively utilizing the opportunities available in a low-regulatory environment? Are strict regulations forcing companies to be more agile in utilizing their big data resources?
	Amid the various external contingencies, what internal factors within the organization influence the relationship between BDAC and MA?
BDAC → firm performance	What other mechanisms, aside from agility, are important in creating value from big data investments?
	Should big data investments be directed toward value-creation mechanisms other than agility in more stable markets?
	Is the accumulation of big data resources important for companies in less data-intensive industries?
MA → firm performance	Is agility an important target in environments that are not turbulent and complex, or should a company in these settings aim to enhance efficiency with its BDA investments rather than focusing on agility?
	Does MA produce similar firm performance improvements for SMEs and large enterprises?
	Are any firm performance metrics negatively affected by MA?

BDA = big data analytics; BDAC = big data analytics capability; MA = marketing agility; SME = small and medium-sized enterprises.

the key concepts and moderators to validate the model. Furthermore, as the research on the effect of BDAC on MA is scant, many of the findings are derived from similar concepts. The consequences and antecedents of different concepts may not be completely generalized regarding BDAC and MA; thus, the model's validity requires empirical testing.

Prior research has examined the impact of big data on firm performance, yet numerous intriguing research opportunities remain. This paper explores the role of MA in creating firm value from big data, acknowledging that while agility is a crucial factor for realizing big data benefits, it is not the sole determinant (Hallikainen et al., 2020; Wang et al., 2022). Future research should discover and test other potential mechanisms for creating value from big data as all companies possess data that is mostly underutilized (Kiron, 2016). Furthermore, the contingencies for creating value from BDAC-enabled agility need to be further investigated. For example, is agility an important target in business environments other than those that are turbulent and complex, or should companies drive efficiency with BDA investments instead of having agility as a target (see, e.g. Aydiner et al., 2019; Teece, 2014)? Which of an organization's internal factors influence the relationship between BDAC and MA? Moreover, this study did not consider firm size, which is likely to affect how BDAC is developed and used for value (Mikalef & Pateli, 2017). When an industry's data intensity potentiates the benefits of BDAC (Müller et al., 2018; Tambe, 2014), a fundamental question arises: should companies in data-poor industries invest in big data resources at all?

The relationship between BDAC and MA prompts several questions. Do big data resources have an independent, positive impact on MA, or do they need to be combined (as suggested by Gupta & George, 2016)? These resources are inherently interconnected as data-driven culture necessitates data and technologies rely on individuals who understand their significance. For instance, could analytics skills foster agility in the absence of analytical tools? Is there a specific priority order for developing big data resources? Moreover, do SMEs and large enterprises differ in how they harness big data resources to achieve agility? SMEs may benefit from their smaller size, potentially making them more flexible in developing these assets, while larger enterprises typically possess greater resources. Also, are strict regulations prompting companies in less-regulated regions to actively exploit their regulatory advantage? Alternatively, do stringent regulations compel companies to use these resources more efficiently, thereby enhancing their agility?

Finally, this study considered firm performance as a set of financial and relative indicators that compare the company with its competitors or itself. Agility powered by big data is likely to have differing effects on these separate metrics. Hence, an idea for future research would be to investigate whether there are performance metrics that are not affected by MA (or that even decrease due to MA). Additionally, it would be interesting to compare the impact of MA on firm performance between SMEs and large enterprises. These suggestions for future research are listed in Table 5.

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