

Advancement of Big Data Analytics Capabilities in Construction Industry: A Resource-Based Theory and Dynamic Capabilities Perspective

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Abstract

The potential of big data analytics (BDA) to boost productivity and performance is reshaping business models in various industries, including construction. As construction data continues to grow exponentially, BDA's role in driving a competitive edge becomes increasingly critical. Through advancements in big data technology, big data analytics capabilities (BDAC) have emerged as essential tools for construction organisations to transform their organisational resources into competitive advantages. However, while existing studies highlighted the benefits of BDA in construction, they paid little attention to the specific capabilities required to leverage these advantages from a strategic management perspective. Hence, this study aims to identify the BDAC that enables construction organisations to strategically leverage their resources for BDA adoption. To achieve this aim, the study employed a systematic review approach, following the PRISMA methodology, which identified 781 relevant publications from the Scopus and Web of Science databases. Following a set of inclusion and exclusion criteria, 58 articles were incorporated in the review to identify the critical dimension of BDAC, grounded in resource-based theory (RBT) and dynamic capabilities theory (DCT), alongside literature on BDA. Findings were then validated through semi-structured interviews with big data experts in Malaysia's built environment, which supports the outcomes. This study identified eight dimensions of BDAC, which were further categorised into three domains: technological capability, human capability, and organisational management capability, necessary for the conceptualisation of BDAC. The findings offer specific capability domains necessary to foster BDA adoption among construction organisations, potentially shifting their competitive strategies through innovative use of BDA.

1. Introduction

The era of big data is rapidly transforming the way organisations harness information. With innovative technologies, businesses can now efficiently extract valuable insights from massive amounts of data that comes from diverse sources at an unprecedented speed [1]-[4]. Gaining valuable insights from data has taken centre stage in the business world through big data technologies. The empowerment of big data has transformed the mode of today's businesses [5], [6] by enabling the effective utilisation of data [7]. Big data helps organisations improve their decision-making processes and capabilities, which can ultimately lead to significant shifts in organisational productivity and business growth. Big data also aims to drive business improvement, provided that organisations have the competence and capability to effectively host and manage big data technologies. Moreover, it strengthens organisations' competitive advantage [8]-[12] by enabling data-driven strategies and innovations that are difficult for competitors to replicate. Big data analytics (BDA) is a vital tool for businesses to improve efficiency, enhance customer satisfaction, and boost profitability. It helps data analysts make accurate decisions by utilising analytical tools and techniques to leverage available data [13]. BDA's widespread applicability has led to its adoption across various industries like banking, education, healthcare, manufacturing, finance, and insurance [1], [14]-[16], [49], [51].

Despite the hype surrounding big data, the construction industry is no exception to this movement, embracing big data to leverage its potential benefits [17]-[19]. This industry is known as a data-intensive sector where large volumes of data arise from the adoption of modern technologies within multiple construction stages. This aligns with the big data context, which is constantly moving towards the adoption of big data due to the existence of the 3V characteristics (volume, velocity, and variety) of data produced within the construction sector [19]. The availability of modern technologies adoption, such as the internet of things (IoT), modular construction, cloud computing and building information modelling (BIM), significantly contributes to the digital data surge and creates real-time data, which leads to a variety of construction data [17], [20], [21]. The delineation between these big data characteristics, given the heterogeneous and dynamic nature of construction data, along with the large-scale and complex nature of construction projects, has prompted the construction industry to adopt the big data paradigm [16].

As the construction data grows exponentially, the role of the BDA in driving a competitive edge is increasingly critical. However, the adoption of BDA in the construction industry remains in its early stages [17], [18], [22]. The construction industry's inherent complexity stems from its multifaceted nature, which encompasses detailed designs, the coordination of diverse stakeholders, complex supply chains, and fluctuating environmental factors. Recognising the challenges posed by this complexity, researchers have acknowledged the potential of big data technology to greatly enhance data decision-making capabilities [17], [23], [24]. In construction, the current focus has been on the technical aspects of big data, which involves a significant exploration of the process and technology that highlight the benefits of BDA. However, there has been minimal attention on the organisational level, which focuses on leveraging data as a key organisational resource strategically. In light of this perspective, this study identified specific BDAC across various fields required in the construction industry to fully harness these advantages from a strategic management perspective.

2. Literature Review

2.1 Big Data Analytics Capabilities (BDAC)

The notion of BDAC refers to the organisation's ability to harness the power of massive volumes of data, extract useful insights and drive informed decision-making [5]-[25]. The primary goal of BDAC is to transform the data into actionable insights [10] that can guide decision-making and enhance organisational performance and competitive advantage [11]. For instance, the availability of vast amounts of data from sources like social media, transactions, and sensors provides organisations with rich information on customer preferences, behaviours, and market conditions. By analysing this data, organisations can gain insights that improve customer engagement and inform strategic decisions [26]. Developing BDAC requires the integration of key elements, including technical expertise, a robust data management system, and suitable software tools to manage large datasets effectively. Without these foundational elements, organisations may struggle to analyse big data effectively and extract valuable insights [27], [28].

2.2 Theories on Big Data Analytics Capabilities (BDAC)

While big data technology continues to advance, scholars in the strategic management body of knowledge suggest that organisations should prioritise their data as key resources, rather than solely relying on technology to gain actionable insights from the utilisation of BDA. To maximise the potential of big data, organisations must develop strong capabilities in integrating, managing, sharing, and analysing data in various formats to meet diverse value-creating needs [29], [30]. Scholars further emphasized that organisations must develop distinctive, firm-specific

capabilities that are difficult to replicate, focusing on isolating core resources that synergistically allow organisations to develop BDAC [5], [10].

Furthermore, BDAC facilitates the integration and analysis of diverse data sources into a singular, cohesive bundle of conceptual concepts, thereby tailoring it to the business over an extended period. In such a way, BDA can be seen as heterogeneous and immobile resources [31], [32], which renders it inaccessible to competitors in the market and poses significant economic challenges for internal development [33]. BDAC are regarded as resources that are inimitable, rare, non-substitutable and valuable, enabling organisations to leverage technology and expertise to collect and analyse data so that meaningful insights can be developed to support decision-making, improve supply chain efficiency and strengthen market performance [34].

2.3 Resource-Based Theory (RBT)

The significance of the interaction between resources and capabilities in understanding how organisations create value is well-supported by various strategic management theories, including the Resource-Based Theory (RBT) and followed by the Dynamic Capabilities Theory (DCT). According to RBT introduced by [35], organisations can leverage their unique resources to gain a competitive edge over their competitors. RBT has been widely acknowledged as one of the most prominent and used strategic management theories in explaining how organisations achieve and sustain a competitive advantage by combining various and diverse resources within their organisation [30]. Specifically, RBT proposes that organisations possess both tangible and intangible resources, but only valuable, rare, inimitable, and non-substitutable resources can generate a competitive advantage [35]. Resources are tradable assets and non-specific organisation assets [36], while capabilities are non-tradable abilities to integrate and deploy resources [10], [30]. Developing robust capabilities, driven by strategic resources, is crucial for superior performance [37].

Several types of resources have been proposed in the extant literature. The categorisation of organisational capabilities into tangible, human skills, and intangible resources has been extensively utilised in capacity literature [31], [38]. The capability places equal focus on tangible, human skills and intangible resources to generate and disseminate insights effectively across the business [5], [30], [39]. Hence, building on RBT, BDAC is further defined as the ability of the organisation to capture and analyse data to generate insights by effectively deploying its data, technology, and talent through organisational operational processes, roles, and structures [10].

In the realm of big data, it is crucial to identify the various types of resources, as their integration across diverse business processes can serve as a source of competitive difference [40]. When these resources and their related activity systems exhibit complementarities, the outcome is more likely to result in a competitive advantage [38]. The RBT, used in IT, marketing, and business, recognises the importance of leveraging organisational resources [31], [32], [34], [41]. Studies have examined the relationship between BDAC and performance outcomes [8] and how organisations strategically create business value by integrating it with other critical resources [10], [29], [33], [34].

2.4 Dynamic Capabilities Theory (DCT)

Existing literature has expedited the adoption of dynamic capabilities theory (DCT) by highlighting that the static perspective of RBT is insufficient for elucidating how organisations can utilise their resources and capabilities in dynamic marketplaces. DCT is an extension of the RBT in strategic management, which focuses on how organisations can gain and sustain competitive advantages in dynamic marketplaces [42]. DCT focuses on integrating, building and reconfiguring internal and external organisational resources and capabilities to create new competitive advantages. The theory posits that, based on a foundation of rare, valuable, inimitable, and non-substitutable resources, organisations should cultivate dynamic capabilities to continually reconstruct and adjust their resources [43]. While RBT views data as a valuable information resource, it does not focus on the processes needed to unlock its full potential [5]. DCT can effectively mitigate the shortcomings of RBT concerning BDAC. DCT emphasises the development of new forms of competitive advantage by integrating, building, and reconfiguring internal and external capabilities [30], [44]. DCT enables big data to be leveraged as a value-creating resource, continually reconfiguring its multi-purpose potential to ensure that insights are shared throughout the organisation and effectively applied to various strategic requirements. DCT can help managers develop strategies to adapt to change while maintaining competitive survival by reconfiguring processes, structure, and resource base. Thus, DCT serves as an appropriate lens for understanding how BDAC can strategically unleash the potential of BDA to empower the construction organisation's competitive advantage.

3. Research Methodology

A systematic review was performed using the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) methodology to examine the literature and synthesise existing scholarly evidence across multiple disciplines within the BDA paradigm, ensuring transparent reporting of the review's objectives, rationale,

and methodology. This study employed a systematic review as it provides a structured approach for searching, screening, selecting and reporting appropriate publications for the topic under study [45], [46]. Two searches were conducted on different journal databases, namely Scopus and Web of Science (WoS). These two search engines were selected to ensure a sufficient number of publications for the review. The systematic review for this study began with a search for the keywords “big data capabilities” and “big data analytics capabilities,” using the search string as of October 5, 2024. The searches yielded 781 publications. Subsequently, review articles, conference papers, books, book chapters, non-English publications, and irrelevant studies were excluded. After removing duplicates and evaluating publications and abstracts based on inclusion and exclusion criteria, 58 full-text papers were selected for review, as shown in Fig. 1 and subjected to content analysis to address the research questions.

To further validate the dimension of BDAC as presented in Table 1, a semi-structured interview was conducted in November 2024 with experts in the construction industry specialising in big data. The interviewees were provided with a set of questions in advance to offer an overview of the research. These experts possess substantial experience and knowledge of BDA within Malaysia's built environment and are deeply involved in developing big data frameworks for the construction sector. This indicates that the interviewees possess a strong and relevant background to participate in this study, which aims to determine the critical dimension of BDAC for Malaysian construction organisations.

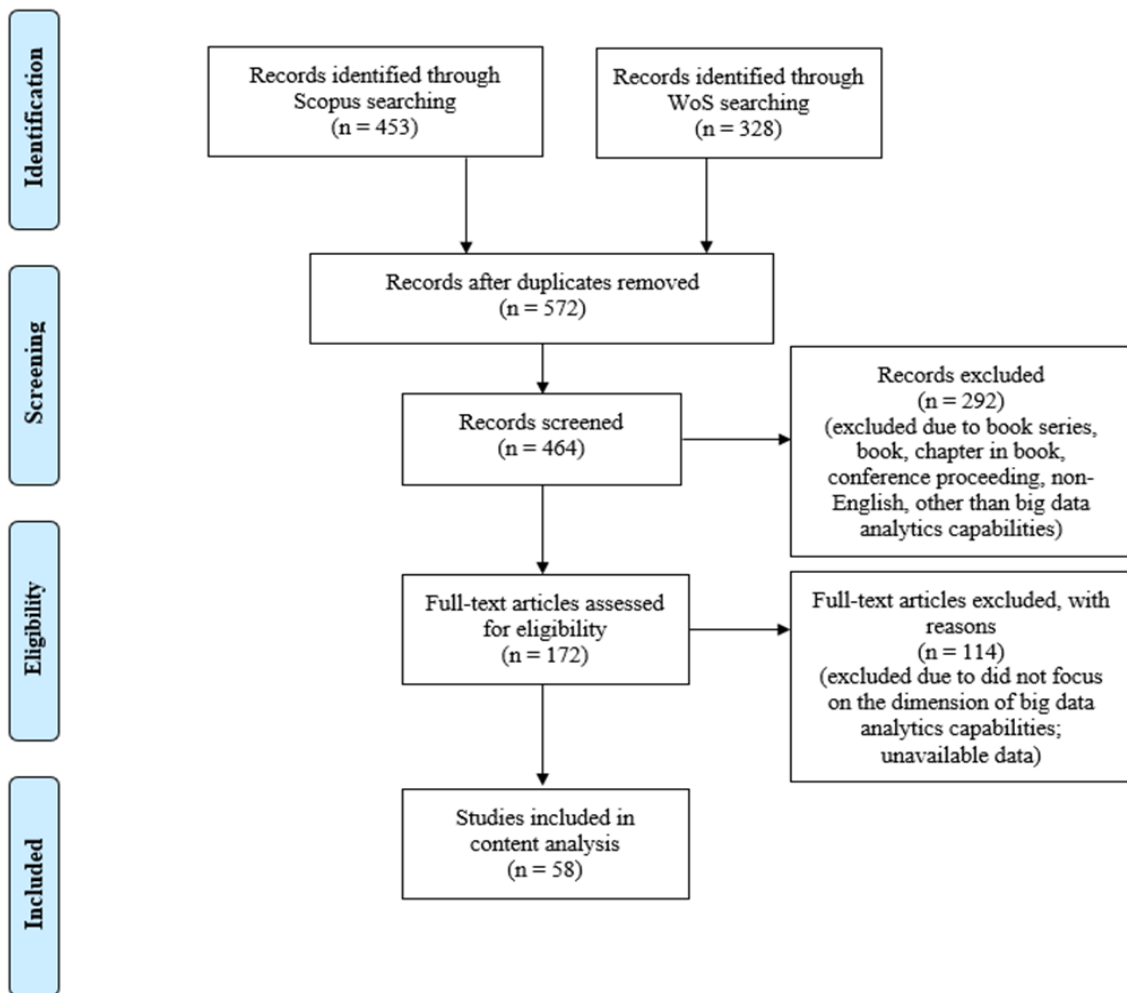


Fig. 1 PRISMA flowchart

4. Results and Discussion

4.1 Dimension of Big Data Analytics Capabilities (BDAC)

A review of selected publications reveals that previous studies typically categorise BDAC into three primary domains: technological, human, and organisational management capabilities. Each domain contributes distinct dimensions to BDAC, as shown in Table 1. Specifically, eight BDAC dimensions were identified within the frameworks of Resource-Based Theory (RBT) and Dynamic Capability Theory (DCT): data, technology, basic

resources, analytical skills, managerial skills, data-driven culture, organisational learning, and business strategic knowledge. These dimensions are widely supported by scholars across various disciplines. For instance, technological and management capabilities have been identified as essential for BDAC in the manufacturing sector, as reported by [47]. In addition, talent related capabilities have also been recognised as necessary by scholars in this field [48], [49]. From a sustainability perspective, it has been shown that both human (skills and knowledge) and non-human (data, resources, infrastructure, organisational learning, and data-driven culture) capabilities positively influence the adoption of BDA [50]. In information systems research, BDAC are conceptualised through three constructs: tangible resources (data, technology, basic resources), human skills (technical and managerial skills), and intangible resources (data-driven culture and organisational learning) [10], [11]. This alignment of BDAC dimensions is similarly observed across other industries, such as tourism, banking, healthcare, and education [44], [51], [52]. Beyond these established constructs, in digital business knowledge, particularly through business model facilitation, has additionally been recognised as a relevant BDAC dimension within the tourism context to strategically support business growth [53]. Within the construction sector, BDAC is conceptualised by considering data, people, technology and relevant skills as fundamental capability elements [54]. This perspective is further strengthened by the inclusion of environmental dynamism and organisational strategy, both of which enhance the understanding of capability building in relation to changing conditions and strategic direction [23].

Table 1 Dimension of big data analytics capabilities (BDAC)

Domain of BDAC	Dimension of BDAC	Sub-dimension of BDAC	Reference
Technological Capability	Data	Data sources	[5], [10], [23], [34], [55], [56]
		Structured & unstructured data	[54]
		Data integration	[5], [55], [57]
		Data quality	[10], [44], [58]
	Technology & Infrastructure	Data visualization	[54], [59]
		Data infrastructure (Hadoop, Apache Cassandra, etc.)	[2], [5], [23], [27], [39], [60]-[63]
		Database for data storage	[5], [23], [49]
	Basic Resources	Time resource	[5], [10], [23], [39], [52], [54], [57], [64], [65]
		Financial resource	[5], [10], [23], [39], [52], [54], [57], [64], [65]
	Human Capability	Analytical Skills	Data analytics competencies
Data processing techniques			[44], [67]
Training supports			[5], [49]
Managerial Skills		Organizational strategy	[5], [23], [39], [44]
		Business knowledge	[5], [23], [44], [49], [51], [55], [65], [68]
		Management support	[5], [10], [23], [39], [49], [51], [54], [58], [59], [69]
Organisational Management Capability	Data-Driven Culture	Data-based decision making	[5], [10], [23], [39], [49], [51], [54], [58], [59], [69]
		Business value	[10]
	Organizational Learning	Data governance	[10]
		Adaptability to technological change	[8], [11], [39], [44], [49], [50], [51], [54], [69]
	Business Strategic Knowledge	Business agility and process	[53]
		Business model	

4.1.1 Data Dimension

In the context of BDA, core resources are the data itself. The diversity and breadth of data sources that contemporary organisations leverage within the aspect of strategic management are highly important [10]. It encompasses the quality, diversity, accessibility and strategic alignment of data collected and utilised by an organisation. This dimension recognises data's essential role in creating business value by ensuring its completeness, accuracy, reliability, timeliness and perceived value [11], [23]. Effective data dimension involves managing both structured and unstructured data types across various sources to derive and create the business value as well as enhance decision-making [5], [54]. Additionally, organisations interested in creating BDA capabilities must integrate their internal and external data [34], [55]. Organisations should determine what data is generated, how it is produced and where it originates within their business processes, as indicated by [23]. This approach helps ensure that the data supports the company's goals and desired results, even if it comes in different formats.

4.1.2 Technology Dimension

The technology dimension refers to the collection of advanced digital infrastructure, systems, and tools essential for storing, processing, and analysing vast amounts of diverse and fast-moving data. This includes both hardware and software components, such as data warehouses, real-time processing systems, and data integration platforms, which are designed to handle unstructured and structured data formats [5], [60]. To derive valuable insights from data, organisations invest in technologies like Hadoop, Apache Cassandra, and real-time visualisation tools, which enhance traditional data management approaches, making large-scale data accessible and actionable for informed decision-making [10], [39]. Furthermore, the technology dimension emphasises the need for compatibility between big data platforms and an organisation's operational needs, with IT architecture often adapted to provide a single source of truth, enabling improved transparency, standardisation, and data governance [2], [11]. The application of machine learning techniques, both supervised and unsupervised, for clustering and classifying data, along with the visualisation of analytics insights, is also a vital part of a robust technology dimension, contributing to sustainable digital transformation and a competitive edge [23], [54].

4.1.3 Basic Resource Dimension

Basic resources are essential resources that organisations must allocate to build and sustain their BDAC. This dimension encompasses both tangible and intangible investments, such as financial resources and time allocation to complete the BDA project. Given the nascent state of BDA technology and its associated practices, many organisations lack a standardised implementation framework, meaning that substantial investments in both time and funding are critical for the gradual realisation of BDA's business value [10], [65]. In this context, financial resources directly fund BDA initiatives, and employee work hours enable experimentation and adaptation [5], [11], which further facilitate the integration of BDA capabilities into core business functions.

4.1.4 Analytical Skills Dimension

The analytical skills dimension encompasses the specialised knowledge and capabilities needed to harness big data technologies for meaningful insights. Core competencies include expertise in data processing and analytical techniques, which are essential for working with large datasets [49], [66]. Big data analysts operating in the construction sector are expected to possess technical competencies relevant to big data, as the integration of expertise in construction processes and data analytics is considered essential [23]. In order to build and maintain these capabilities while keeping pace with technological advancements, organisations should be prioritized on employee development through structured training, ongoing support, and access to workshops and industry standard tools [5].

4.1.5 Managerial Skills Dimension

The dimension of managerial skills encompasses organisation-specific, tacit competencies that managers cultivate through ongoing relationships and experiences within the organisation, enabling them to align with and advance the organisation's goals and visions. These skills, embedded in the organisational culture, guide decision-making and daily operations, especially in big data contexts [44]. Effective managerial skills include not only the ability to interpret and apply insights from technical teams to meet strategic objectives but also a strong understanding of business knowledge and the potential applications of big data. Managers in this dimension must demonstrate adaptability to change, foreseeing and adjusting to evolving needs across business units, customer demands, and partnerships. Additionally, fostering trust and collaborative relationships between big data managers and other functional leaders strengthens organisational capabilities, creating a unique competitive advantage that is challenging for other organisations to replicate [11], [65].

4.1.6 Data-Driven Culture Dimension

The data-driven culture dimension represents the extent to which an organisation embraces data-based decision-making, with strong management support and a focus on achieving business value from big data initiatives. Organisational culture plays a crucial role in fostering sustained performance and, increasingly, in the success of BDA adoption [10], [11]. A data-driven culture encourages all organisational members, ranging from top executives to frontline employees, to rely on data insights rather than intuition or hierarchical opinion when making decisions [23], [50], [70]. In this type of culture, top management is actively committed to using BDA to create value, signalling support across all levels and promoting collaboration between functional departments [2]. Additionally, the organisation should establish processes that facilitate easy access to data, promote transparency, and foster cross-functional collaboration, thereby cultivating a digital-oriented mindset that empowers employees to incorporate data into their everyday tasks [5]. This holistic commitment to a data-driven culture ultimately enables the organisation to fully realise the potential of its data, aligning BDA investments with business value creation and enhancing the overall success of big data projects.

4.1.7 Organisational Learning Dimension

The organisational learning dimension refers to an organisation's capacity to continually adapt and reconfigure its resources in response to changing external conditions, which fosters a sustainable competitive advantage. High-intensity organisational learning enables organisations to not only retain and leverage existing knowledge but also to actively explore, store, share, and apply new insights as technologies evolve [57], [66]. This continuous learning culture supports the development of BDAC, as it combines established knowledge with insights from big data to guide informed decision-making [70]. Organisational learning involves openness to extending knowledge, ensuring that employees are adaptable and responsive to new technological advancements [11]. Furthermore, effective data governance practices, such as transparency about data access restrictions and the structured management of data resources, can enhance the organisation's ability to exploit new knowledge in alignment with BDA goals [10], [52]. By embedding continuous learning, resource configuration, and knowledge exploitation into the organisational culture, organisations can capitalise on big data insights, positioning themselves to navigate technological shifts and achieve sustained business value.

4.1.8 Business Strategic Knowledge Dimension

The business strategic knowledge dimension encompasses an organisation's ability to align its strategic objectives with big data and digital initiatives. This dimension focuses on the strategic directions of the business alignment. BDAC is expected to make organisations maintain their sustainability in implementing business digitisation through their effective business framework within the big data paradigm [53]. Additionally, business agility and a supportive organisational culture are crucial in fostering adaptability, enabling organisations to respond to internal and external changes while driving BDA adoption [23]. This combined focus on strategic business alignment and business agility strengthens the organisation's business model, enabling it to meet dynamic business requirements, innovate, and create long-term value to organisations that invest in BDA.

4.2 Validation of Big Data Analytics Capabilities (BDAC) Critical Dimensions: Findings and Outcomes

The findings from the PRISMA method, shown in the Table 1 above, were corroborated with big data experts in the construction industry to seek a validation by the critical dimensions of BDAC identified. Based on these findings, the critical dimension of BDAC is shown in Fig. 2 below, highlights eight critical dimensions of BDAC necessary for construction organizations to embrace for successful BDA adoption. Three experts on big data technology in construction were interviewed and explained to provide insights on the study's outcomes, relating their own understanding on BDAC with the critical dimensions identified through the systematic review. The first expert (E1) agreed that all the dimensions listed in Figure 2 are critical for evaluating and conceptualizing BDAC in the construction environment. E1 also pointed out that many construction stakeholders are unaware of the capabilities they need to invest in big data technology, emphasizing the importance of understanding all aspects and dimensions of these capabilities. This perspective is consistent with previous studies that have expressed similar views on the importance of capability awareness in supporting big data adoption [5], [57].

The second expert (E2) stressed the importance of technological capabilities, suggesting that construction organizations should prioritize their data and technology dimensions first. While human capabilities are also essential, E2 believed that a data-driven culture and organizational learning are the most critical aspects within organizational management capabilities. This view is consistent with previous research, which highlighted data, technology, technical skills, managerial skills, data driven culture and organisational learning as essential dimensions in conceptualising BDAC at the organisational level [49]. The third expert (E3) believed, emphasizing

on data, technology, and financial resources must be considered when developing technological capabilities, followed by analytical and managerial skills. E3 also emphasized the need to understand the culture of a data-driven approach, coupled with adaptability to technological change and strategic business knowledge, to help construction stakeholders understand their investments in adopting BDA. E3 further confirmed that the eight critical dimensions identified in the study encapsulate the capabilities construction organizations need to fully embrace big data technology. In summary, the experts' opinions were aligned, supporting the conclusion that the eight critical dimensions of BDAC identified in this study are essential for construction organizations to successfully adopt and integrate big data technology.

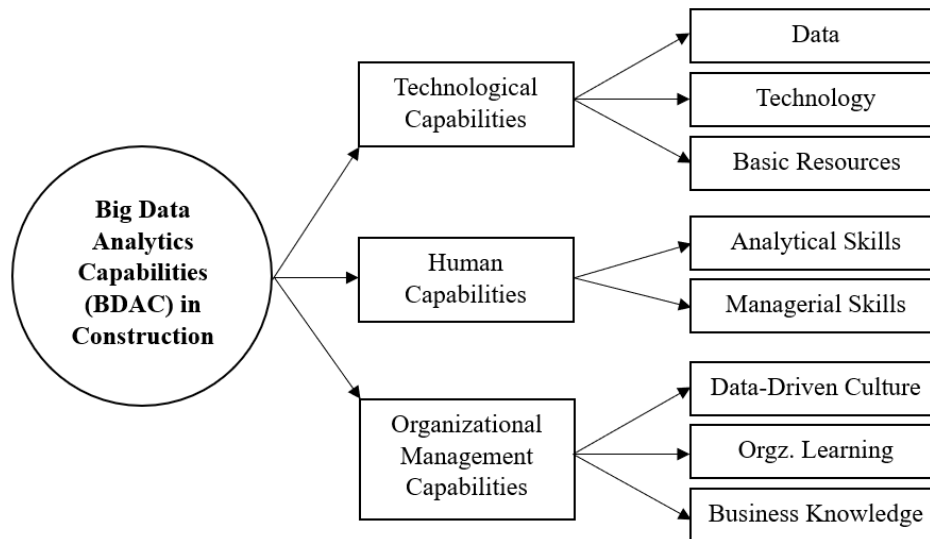


Fig. 2 Critical Dimensions of Big Data Analytics Capabilities (BDAC) in Construction

4.3 Conceptualisation of Big Data Analytics Capabilities (BDAC) in the Construction Industry

In the context of the construction industry, the contribution of BDA can be facilitated in various construction disciplines, such as construction supply chain management, performance optimisation, safety management, risk management and prediction, and other areas. For the successful adoption of the BDA application in the construction industry, construction organisations must be capable of strengthening their resources and capabilities. The identification of technological capabilities (data, technology, and basic resources dimension) is expected to enable construction organisations to fully comprehend and understand the nature of construction data generated throughout the lifecycle of construction projects. It is crucial for construction organisations to determine the source of their data first, which will then guide the subsequent steps in adopting BDA [23], [54]. Additionally, the integration of BDA technology and flexible infrastructure is key for construction businesses. BDA infrastructure enables construction organisations to manage large and diverse construction data streams and formats, uncovering valuable insights and making it a cornerstone in today's data-driven environment [55], [63].

Furthermore, possessing strong human capabilities (analytical and managerial skills) is expected to enable construction organisations to embrace the knowledge and skills needed to extract value from BDA and make informed decisions in this dynamic paradigm [65]. Organisations must take responsibility for providing training that equips employees with the necessary analytical skills to analyse relevant data and select the appropriate BDA infrastructure. This ensures they can implement the right technical solutions tailored to the organisation's needs [61]. These capabilities can also encourage construction stakeholders to collaborate with BDA experts, helping to drive the adoption of BDA within construction organisations.

Finally, the organisational management capability (data-driven culture, organisational learning and business strategy knowledge) is critical for driving construction organisations toward building their data-driven capabilities, leading to increased business agility and more adaptable business models [10], [53]. These capabilities are also expected to encourage construction organisations to invest in digital technology and enforce its use, as well as the application of construction data, within the construction environment.

5. Conclusions

BDAC plays a crucial role in facilitating the adoption of BDA in the construction industry, enabling construction organisations to leverage data-driven insights for improved decision-making, which in turn positively impacts the industry's productivity and performance. This study identified eight dimensions of BDAC, including data,

technology, basic resources, analytical skills, managerial skills, data-driven culture, organisational learning and business strategic knowledge, which were rooted in the perspective of RBT and DCT. These dimensions were established through a systematic review and further validated by experts in big data within Malaysia's built environment. The findings highlight a gap in BDAC research specific to the construction industry and offer practical insights for organisations looking to enhance their competitive strategies. By building on these BDAC dimensions, construction organisations can create a stronger foundation for data integration, improve operational efficiency, and adapt more effectively to industry changes. Ultimately, these capabilities foster a data-driven culture that encourages innovation, supports business agility, and positions construction organisations to capitalise on emerging opportunities through BDA.

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Conflict of Interest

The authors declare that the work reported in this study was not affected by any conflicting financial interests or personal connections.

Author Contribution

*The authors confirm contribution to the paper as follows: **Study conception and design:** Nuremira Ibrahim, Shamsulhadi Bandi, Zafira Nadia Maaz, Norhazren Izatie Mohd, Masoud Gheisari; **Data collection:** Nuremira Ibrahim, Shamsulhadi Bandi, Zafira Nadia Maaz; **Analysis and interpretation of results:** Nuremira Ibrahim, Shamsulhadi Bandi, Norhazren Izatie Mohd; **Draft manuscript preparation:** Nuremira Ibrahim, Shamsulhadi Bandi, Zafira Nadia Maaz, Norhazren Izatie Mohd, Masoud Gheisari. All authors reviewed the results and approved the final version of the manuscript.*

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