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AJBR
Asian Journal of Business Research Volume 14 Issue 3, 2024
ISSN 2463-4522 e-ISSN 1178-8933 DOI: 10.14707/ajbr.240180

Research Paper

Big data capabilities, strategic flexibility and competitive performance: Evidence from Vietnam tourism and hospitality

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Abstract

This study aims to investigate the impact of big data capability and strategic flexibility on competitive performance. Structural equation modelling software Smart PLS 4.0 was used to analyse a sample of 138 tourism and hospitality enterprises in Vietnam. Empirical findings show that big data capabilities positively impact competitive performance. Strategic flexibility mediates the link between big data capabilities and competitive performance. Indeed, both reactive and proactive strategic flexibility positively mediate the relationship between big data capability and competitive performance. Moreover, compared to proactive strategic flexibility, reactive strategic flexibility has a more robust mediating effect on the link between big data capabilities and competitive performance. This research contributes to the literature by showing that big data capability and strategic flexibility are the strongest predictors of competitive performance in hospitality and tourism enterprises. The implications for the development of big data analytics capabilities combined with a flexible strategy to achieve improvements in competitive effectiveness in the hotel and tourism industry are suggested.

Keywords: Big data capabilities, Strategic flexibility, Competitive performance, Proactive strategic flexibility, Reactive strategic flexibility.

Publication Details: Received 1 November 2023; Revised 27 April 2024, 15 July 2024; Accepted 23 October 2024

Introduction

With the rapid advancement of the Internet in the mid-1990s, a significant surge in data generation has sparked academic discussions regarding the effective utilization of "big data" to foster the development of governance, business and society. The tourism industry has witnessed the generation of a substantial volume of data through digital tourism platforms, facilitating seamless connectivity between enterprises and consumers (Helble and Fink, 2022). The Covid-19 pandemic has accelerated the digitalization process and the adoption of big data, concurrently witnessing a notable surge in the adoption of big data analytics within the tourism and hospitality sector (Li et al., 2018). The unpredictable and volatile nature of the crisis, coupled with the necessity to update information on tourism and related concerns to promote smooth travel options, has led to the increasing importance of using big data in this field (Helble and Fink, 2022). Such advancements present unprecedented opportunities to leverage big data capabilities to achieve sustainable development objectives of the tourism and hospitality industries. The tourism sector relies extensively on information, necessitating the ability to analyze big data to establish connections among stakeholders, provide comprehensive solutions for hospitality and tourism services, and identify and analyze trends such as customer preferences, behaviors and temporal patterns (Ali et al., 2019). Big data capabilities have emerged as a crucial technology for the tourism industry due to its advantages to businesses such as better revenue management, enhanced customer experience management, more effective market research, and refined marketing strategies. Leveraging the correct big data from these interactions gives businesses a diversified perspective on customers and competitors. (Mariani and Baggio, 2022). Big data capabilities enable data storage and retrieval optimization, unlock the potential of big data to reveal trends and subsequently make them understandable to decision-makers. If these capabilities are developed, enterprises will have access to valuable information about trends, behaviours, and prospects and the ability to create strategic flexibility in response to market fluctuations (Han and Zhang, 2021). Strategic flexibility plays a pivotal role in enabling enterprises to effectively respond to environmental changes, allocate resources adaptably, and enhance risk management effectiveness which helps them maintain their competitive advantage (Kaufman, 2015). Furthermore, the development of big data systems, coupled with technological capabilities, empowers businesses to take a proactive approach and effectively respond to external environmental shocks (Duanmu et al., 2018). By harnessing the power of big data, enterprises can revolutionize their operations by effectively mobilizing and allocating resources. This practice enables them to proactively introduce new products to the market, thereby establishing a solid foundation for sustainable competitive advantage and ultimately enhancing their business performance (Antonio et al., 2018).

The subject of big data capabilities, strategic flexibility and competitive performance has been explored in some individual studies, there remains a lack of in-depth research, particularly in the mediating roles of proactive and reactive strategic flexibility in relationship between big data capability and competitive performance in hospitality and tourism enterprises. To address these research gaps, this study aims to examine the impact of big data capabilities on competitive performance via strategic flexibility. Furthermore, this study aims to provide empirical evidence that enhancing big data capabilities can improve the competitive performance of tourism and hospitality businesses. This study contributes to the current big data capabilities

literature in several ways. Firstly, it provides further evidence on the role of big data capabilities including big data integration capability, big data analytic capability and big data prediction capability to competitive performance. Secondly, it examines the mediating role of proactive and reactive strategic flexibility in the link between big data capabilities and competitive performance. Thirdly, this study approaches big data capabilities as a second-order construct comprising big data integration capability, big data analytic capability and big data prediction capability. Last but not least, it identifies factors that are specific to the hospitality and tourism industry, contributing to improve the enterprises' competitive performance.

Literature Review

Dynamic Capability Theory

Dynamic capability theory, developed by Teece et al. (1997) based on Barney et al. (2001)'s resource theory, defines dynamic capability as the ability to integrate, build, and reconfigure an enterprise's potential to respond to environmental changes. Aimed at creating, expanding, and modifying enterprise resources sustainably for better business performance, according to Helfat and Peteraf (2009), the dynamic capabilities framework includes: (1) using absorptive capacity to detect and pursue perceived opportunities in the internal and external environment; (2) learning to identify capabilities requiring improvement, development, and reconfiguration into new knowledge; (3) using integrated capabilities to implement necessary changes consistent with operational capabilities; and (4) coordinating the use of reconfigured capabilities and continuing to seek internal and external opportunities, as proposed by Peteraf and Maritan (2007). Dynamic capability theory confirms the abilities of businesses to grasp environmental changes, thereby carrying out capacity restructuring activities to align with environmental demands.

Big Data Capabilities

Big data capabilities are defined as the ability to collect, integrate, analyze, and visualize an organization's data sources (Wang and Hajli, 2017). By leveraging the combination of big data technology and the accompanying infrastructure, big data capabilities transform information into knowledge and become a competitive force for enterprises (Kiron, 2013). Large volumes of data about customers and stakeholders are collected, analyzed and stored to produce insightful information for exploring values or enhancing the understanding of business operations and corporate strategic direction (Wixom et al., 2013). This study approaches big data capabilities from the perspective of Van Rijmenam et al. (2019) who considered big data capability as the dynamic competencies of enterprises to refine, integrate, and restructure internal and external big data sources to support business strategic decisions and shape the competitive advantage of enterprises (Schroeck et al., 2012).

Strategic Flexibility

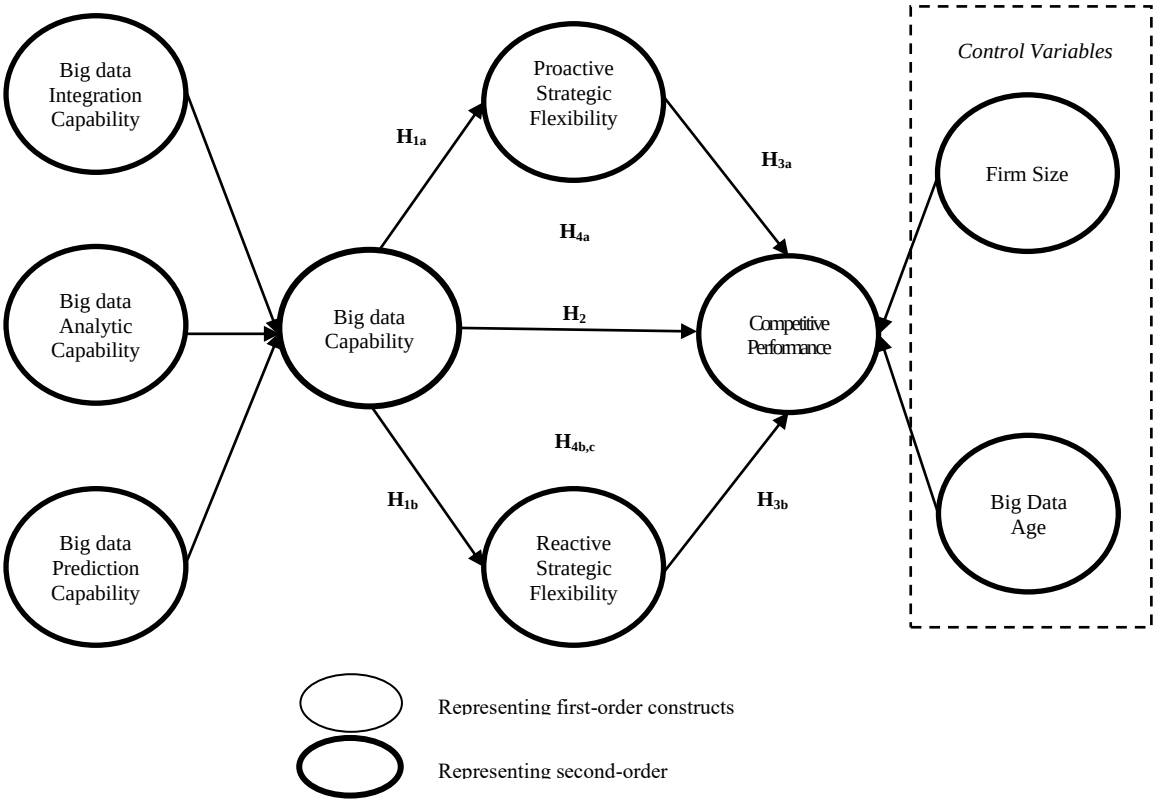
Strategic flexibility refers to the ability of an organization to reallocate resources or adjust existing processes and strategies to achieve versatility in response to changes in business environment (Zhou and Wu, 2010). Strategic flexibility, or the ability to

react quickly in a proactive or reactive way, allows companies to manage risk and achieve better performance (Grewal and Tansuhaj, 2001). Strategic flexibility has numerous elements, making it a multifaceted construct (Grewal and Tansuhaj, 2001). Strategic flexibility encompasses both proactive (predictive) and reactive (adaptive) flexibility (Johnson et al., 2003). Proactive strategic flexibility involves the ability to anticipate and proactively respond to changes in the business environment, while reactive strategic flexibility refers to the ability to adapt and react quickly when unexpected changes occur (Johnson et al., 2003). Thus, strategic flexibility demonstrates firms' adaptability to external and internal stimuli (Gerald et al., 2020; Holweg, 2005) associate flexibility with the ability to respond effectively and quickly to various challenges in order to satisfy the environmental demands and changes.

Competitive Performance

A company's competitive performance is determined by its ability to surpass the performance of its key competitors (Chen et al., 2017). Competitive performance could be measured in terms of profitability, return on investment, market share growth, and increase in customer satisfaction with respecting to the organization's competitors (Danielsen and Olsen, 2021). Mikalef et al. (2020) emphasize that an organization's competitive performance could be achieved through effectively managing strengths developed from environmental response strategies, such as big data engagement.

Figure 1: Research model



Big Data Capabilities and Strategic Flexibility

Enterprises often face challenges in meeting resource demands and adapting to changes in the business environment, facilitating the need for strategic flexibility to reallocate existing resources or find new resources for the organizations (Marshall et al., 2015). Big data capabilities are divided into three dimensions: big data acquisition integration capability, big data analysis capability and big data prediction capability. Big data acquisition integration capability relates to utilize diverse data platforms and comprehensive infrastructure to achieve the integration of resources, professional filtration, storage, process, and value extraction from complex structured big data, while guiding internal and external market strategies, enhancing the market value of the enterprise. The analytical capability involves extracting value from vast amount of data and gaining new insights. Big data analytic helps businesses understand product activities and user feedback to optimize user experiences, retain customers, analyze internal business processes, and optimize directions based on large data sets. The predictive and deep understanding capabilities of big data enable companies to gain real-time insights into the environment and market demands, anticipate environmental changes, and subsequently adjust production plans and service processes in a timely manner, benefiting market expansion and revenue growth (Chen et al., 2021). Flexibility involves effectively managing the risk and uncertainty in the environment in proactively or reactively (Akhtar and Sushil, 2018). Big data capabilities are deemed to be essential for businesses to attain a state of flexibility. These capabilities enhance data quality, which enables organizations to make strategic directions, adjust their strategies and quickly respond to opportunities and challenges arising from the external environment (Chen et al., 2012). Big data capabilities provide valuable insights for decision-making at both the strategic and operational levels (Tippins and Sohi, 2003). The opportunities gained from big data segmentation enable enterprises to integrate internal and external resources and conduct an in-depth environmental analysis to formulate specific strategies (Wang et al., 2021). Strategic flexibility refers to an organization's ability to quickly understand the current situation, to enable organizations to respond to the environment by leveraging the most advantageous resources (Adrian et al., 2018). Managers and policymakers benefit from information technology and the capacity of big data to collect data more rapidly and efficiently. However, as the volume of data increases, the challenges associated with analyzing, managing and utilizing that data become more apparent (Jum'a et al., 2022). Based on the above discussion, the following hypotheses are proposed:

H1a Big data capabilities have a positive effect on reactive strategic flexibility.

H1b Big data capabilities have a positive effect on proactive strategic flexibility.

Big Data Capabilities and Competitive Performance

Previous studies have reported the crucial role of big data capabilities in supporting the development of other organizational capabilities and enhancing business performance (Maroufkhani et al., 2019). Moreover, big data capabilities involve leveraging data management and information technology to gain business insights (Kiron, 2013). When applied, big data can offer a competitive advantage and enhance financial performance (Akter et al., 2016; Mikalef et al., 2020). Specifically, big data capabilities contribute to enterprise performance and competitive advantage through

various aspects, such as improving product and data quality (Shan et al., 2018), employing digital decision analysis model (Ghasemaghaei, 2019), detecting market dynamics (Wielgos et al., 2021), forecasting customer demand (Liu et al., 2021), tracking supplier errors (Almohri et al., 2019), and driving new production improvements (Mikalef et al., 2020). Prior works suggested that big data capabilities not only enhance the current market share but also contribute to the future growth rate of companies, making their performance more competitive (Monferrer et al., 2015). In addition, Ransbotham et al. (2016) highlight that enterprises which are at the forefront of adopting big data capabilities are more likely to launch new products and services compared to those that are slower in adopting such capabilities. This ability to introduce new offerings can contribute to high performance (Wamba et al., 2017). Big data plays a crucial role in converting data from potential factors of production into actual means of production (Chen et al., 2021; Mikalef et al., 2020). By leveraging big data, enterprises can extract valuable information from large and diverse datasets, enable them to make more informed decisions, resulting in stronger performance than their competitors. Following these arguments, we hypothesize that:

H2 Big data capabilities has a positive effect on competitive performance.

Strategic Flexibility and Competitive Performance

As described by Osita-Ejikeme and Amah (2022), flexibility refers to the capacity to rethink and reorganize elements to adapt successfully to the environment. Strategic flexibility involves acknowledging and accepting both external and internal environmental forces. It aims to identify novel and efficient approaches to address these forces (Yuan et al., 2010). Zahra et al. (2008) define strategic flexibility as the extent to which an organization can modify its strategy to respond to external opportunities, changes and threats. The link between proactive and reactive flexibility deserves close attention because of its ability to prevent further action and minimize risk. In this sense, strategic flexibility can be considered one of the most critical assets of a successful organization because it enables them to maintain a competitive advantage (Arshad et al., 2018), to reallocate resources as required (Sanchez, 1995) to foster creativity and innovation (Li et al., 2016), and enhance overall organizational performance (Brozovic, 2018). In fact, strategic flexibility helps enterprises not only acquire additional resources for competitive operations but also effectively manage their existing resources. This enables them to achieve competitive performance even in fluctuating markets (Zhou and Wu, 2010). Moreover, strategic flexibility represents the mindset that embraces change in response to the uncertainty and unpredictability of customer behavior, competitors, and other stakeholders. This mindset enables businesses to explore new business models and enhance their competitive performance (Nadkarni and Herrmann, 2010). In particular, enterprises with proactive strategic flexibility possess the capacity to compete with their rivals by supplying new products and services, thus continuously innovating to deliver enhanced value to customers (Eryesil et al., 2015; Wang et al., 2012).

H3a Reactive strategic flexibility has a positive effect on competitive performance.

H3b Proactive strategic flexibility has a positive effect on competitive performance.

Mediating Role of Strategic Flexibility

The ability of an organization to adapt and adjust in response to changes in the business environment and consumer behaviour plays a significant role in achieving continuous growth and maintaining a competitive edge (Onyokoko and Needorn, 2021). Adopting integrated platforms, including big data, offers a way to forecast changes and effectively support businesses in adapting by promoting flexible procedures, connectivity, and collaboration both within and outside the organization (Ashrafi et al., 2019). Through the analysis of unique and valuable data, big data provides a wealth of information that enables enterprises to make flexible, strategic decisions and quickly adapt without solely relying on management experience (Wamba et al., 2017), (Rialti et al., 2019). Big data capacity serves as a primary source of competitive advantage and performance (Morabito, 2015). By skillfully leveraging market information, organizations can make decisions that satisfy client needs and maintain a competitive edge. Big data capabilities have overcome previously rigid decision-making processes (Ciampi et al., 2021). It enables the alignment of strategic objectives, information and technological resources to address challenges and control information that supports the strategic decision-making process (Ryabchikov and Ryabchikova, 2021). Several studies have confirmed that in the context of complex competition, the high capacity for big data analysis capacity provides enterprises with an advantage by enabling a deep understanding of the market (McAfee and Brynjolfsson, 2012; Mikalef et al., 2020). As competitors continue introducing new modes of competition, effective management of big data analytics capabilities becomes crucial in identifying unique competitive advantages for businesses (Wilden and Gudergan, 2015). Li and Liu (2014) argued that enterprises operating in highly competitive environments need to constantly adjust their business strategies to effectively address consumer needs, market changes, competitive pressures, and market demands. Thus, in condition of intense competition, enterprises with superior big data capabilities can generate new insights that enable them to devise new business models, thereby creating a new form of competitive advantage and achieving outstanding market performance. Additionally, the ability to analyze big data increases flexibility, which allows businesses to be proactive or react differently. Specifically, companies that invest in big data analysis to enhance their potential to address unexpected situations may arise in the future. Therefore, they must collect data on stakeholder advocacy and changes to inform management decisions. Consequently, big data capabilities are closely associated with proactive rather than reactive strategic flexibility (Chen et al., 2017).

H4a Reactive strategic flexibility partially mediates the relationship between big data capabilities and competitive performance.

H4b Proactive strategic flexibility partially mediates the relationship between big data analysis management capabilities and competitive performance.

Control Variables

In previous studies, firm size and big data age are considered as control variables in the context of big data (Ashrafi et al., 2019; Seddon et al., 2017). We included firm size, as larger firms may have more resources than smaller firms, which may affect the relationship between strategic flexibility and a firm's performance (Tippins and

Sohi, 2003). In other words, large firms can invest in different activities that support information technology, such as employee training. We also controlled big data experience (big data age) because it refers to the time since adoption of big data applications considering the knowledge and experience that organizations gain from working with big data over time. Big data experience may affect the performance (Elbashir et al., 2013).

Methodology

Sampling and Data Collection

A convenience sample was used to select typical businesses in line with research objectives. Data were collected through a self-administered online questionnaire. The questionnaire survey was distributed directly to managers and directors of hotel and tourism businesses in Vietnam from March to May 2023, assuming that these people have a deep understanding their enterprises' business strategies and big data capabilities. Respondents are assured that the empirical results are only for academic purposes and are promised confidentiality during the questionnaire survey. The sample comprised 200 executives and directors of tourism and hospitality businesses, from whom 159 responses were completed (yielding a response rate of 79.5%) (Table 1). After removing 21 invalid responses due to missing answers or providing the same answer to all questions, 138 valid responses remained for further analysis. In terms of scale, small-scale hotel and tourism enterprises accounted for 34.06%, medium-sized enterprises accounted for 47.10%, and the remaining 18.84% were large enterprises. In terms of the type of enterprises, 65.94% operated as joint-stock companies, while 34.06% were limited liability companies. Based on the duration of using big data, 76 enterprises had been running for less than 3 years (accounting for 55.07%), 39 enterprises had maintained big data activities for 3-5 years (28.26%), and only 23 enterprises (16.67%) had applied big data for over 5 years.

Table 1: Demographics of the firms (n = 138)

	Category	n	%
Gender	Male	93	67.39
	Female	45	32.61
Age (Years)	18-30	3	2.17
	31-35	26	18.84
	36-40	63	45.65
	41-45	30	21.74
	Over 45	16	11.59
Education	Secondary school qualification	22	15.94
	College qualification	38	27.54
	Undergraduate degree	59	42.75
	Postgraduate degree	19	13.77
Firm size (Employees)	Less than 100	47	34.06
	100-200	65	47.10
	More than 200	26	18.84
Big data age	<3 years	76	55.07
	3-5 years	39	28.26
	Over 5 year	23	16.67

Respondent's position	CEO/ President	58	42.03
	Director	9	6,52
	Manager	59	42.75
	Head of IT	12	8.70

Measures

Constructs and items were adopted from prior research, and some adjustments were made to fit the context of Vietnam's tourism and hospitality industry. Big data capabilities are treated as a second-order variable that consisting of three dimensions: big data acquisition and integration capacity, big data analysis capacity, and big data forecasting capacity. The first two dimensions were measured with 5 items each, taken from Chen et al. (2021) and Lin and Kunnathur (2019). The last dimension was measured with 4 items from Chen et al. (2021). Proactive and reactive strategic flexibility were measured with 5 and 4 items respectively from Fan et al. (2013). Competitive performance was measured with 5 items from Wang et al. (2012). The study measures the questionnaire items using a 5-point Likert scale from 1 to 5 rating from strongly disagree to strongly agree.

In addition, enterprise-specific factors such as size and experience are used as relevant control variables due to their potential impact on strategic flexibility and firm performance (Akter et al., 2016). Companies with fewer than 100 employees are classified as small (coded as "1"), while companies with fewer than 200 employees are considered medium-sized (coded as "2"). Companies with more than 200 employees are classified as large-scale (coded as "3"). The company's experience of using big data was measured by inquiring about the number of years the respondents had applied it for business purposes. Companies with less than 3 years of experience were coded as "1", those with 3-5 years as "2", and those with over 5 years as "3". The specific scales are described in Appendix 1.

Data Analysis

The research utilizes Partial Least Square (PLS) to verify the adequacy of the proposed research papers. This method offers a proficient approach to examining and quantifying the relationship between customers (sub-variants and strange variables), making it suitable for investigating predatory migration (Henseler et al., 2015). The first-order variables are tested for reliability through indicators: the outer loadings should be greater than the recommended level of 0.5; the reliability of each scale (Cronbach's alpha) is greater than 0.7; the composite e reliability (CR) exceeds 0.5, the total variance extracted (AVE) is proposed to be greater than the required value of 0.5, and the HTMT correlation coefficient is less than the threshold level of 0.9 (Hair et al., 2014) (Henseler et al., 2015). To analyze the second-order variable of big data capabilities, which is formed by three first-order variables including big data acquisition and integration capacity, big data analysis capacity, and big data forecasting capacity, the study employs the repeated indicators approach and the two-stage approach. The repeated indicators approach is used to assess the suitability of the first-order constructs, and the two-stage approach is employed to measure the higher-order construct.

Results

Reliability and Validity Testing

Table 2 presents the reliability and validity results for this study's measures. Internal consistency reliability is often tested using Cronbach's alpha value. In this study, all Cronbach's alpha values exceed 0.7, indicating good reliability of the measures. Construct validity, which includes convergent and discriminant validity, was also tested. Composite reliability (CR), outer loadings and average variance extracted (AVE) are often used to test the convergent validity of the measures. The results in Table 1 demonstrate that all CR, outer loadings and AVE values meet the required thresholds. All AVE values are greater than 0,5 with the lowest value being 0.583 and the highest value being 0.729. The CR values have a minimum of 0.822, and the outer loadings range from 0.679 to 0.900, indicating good convergent validity in this study.

Table 2: Construct reliability and validity

Variables	Items	Outer loading	Cronbach's alpha	CR	AVE
Big data acquisition and integration capability (BDIC) (Chen et al., 2021)	$BDIC_1$	0.776	0.821	0.822	0.583
	$BDIC_2$	0.810			
	$BDIC_3$	0.705			
	$BDIC_4$	0.790			
	$BDIC_5$	0.732			
Big data analysis capability (BDAC) (Chen et al., 2021)	$BDAC_1$	0.840	0.859	0.865	0.641
	$BDAC_2$	0.820			
	$BDAC_3$	0.828			
	$BDAC_4$	0.804			
	$BDAC_5$	0.705			
Big data prediction capability (BDPC) (Chen et al., 2021)	$BDPC_1$	0.905	0.848	0.856	0.690
	$BDPC_2$	0.881			
	$BDPC_3$	0.744			
	$BDPC_4$	0.783			
Reactive strategic flexibility (RSF) (Fan et al., 2013)	RSF_1	0.786	0,784	0.823	0.606
	RSF_2	0.863			
	RSF_3	0.774			
	RSF_4	0.680			
Proactive strategic flexibility (PSF) (Fan et al., 2013)	PSF_1	0.851	0.906	0.913	0.729
	PSF_2	0.834			
	PSF_3	0.887			
	PSF_4	0.899			
	PSF_5	0.793			
Competitive performance (CP) (Wang et al., 2012)	CP_1	0.771	0.847	0.856	0.623
	CP_2	0.698			
	CP_3	0.865			
	CP_4	0.811			
	CP_5	0.789			

Note: CR = (sum of standardized loadings) 2/[(sum of standardized loadings) 2 + sum of indicator measurement error]; AVE = [sum of (standardized loadings) 2]/[sum of (standardized loadings) 2 + sum of indicator measurement error]

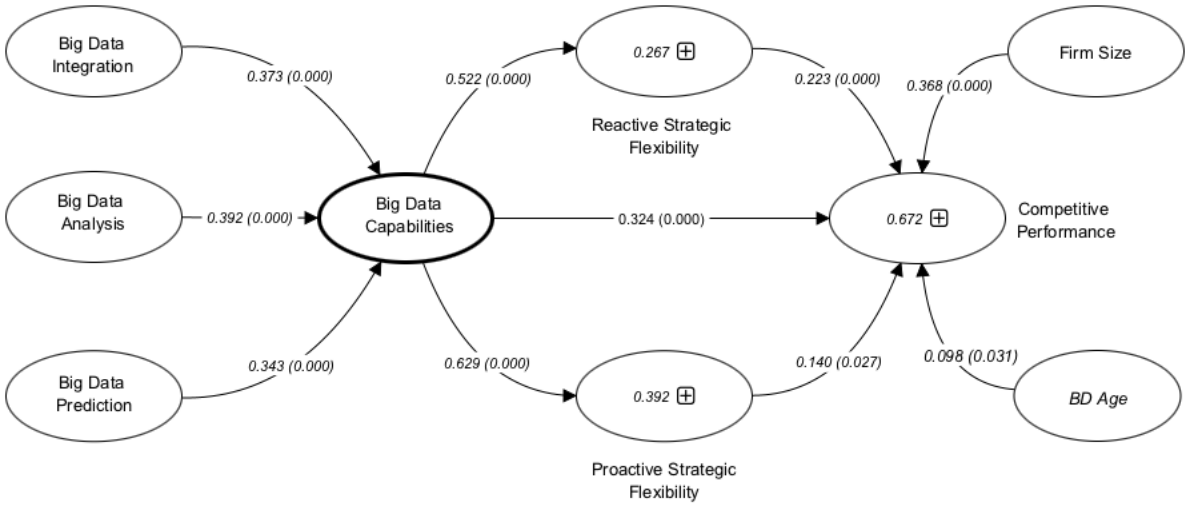
Discriminant validity is tested using the heterotrait-monotrait ratio (HTMT) (Henseler et al., 2015). The results in Table 3 allow us to verify the discriminant validity, as the maximum HTMT value of 0.872 is lower than the threshold level of 0.9. This indicates that the constructs meet the requirement for discriminant validity (Henseler et al., 2015). Possible multicollinearity problems between variables were assessed using the VIF. The VIF values range from 1.377 to 3.707, which are smaller than 5, indicating the absence of collinearity between constructs (Hair et al., 2019).

Table 3: Discriminant validity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) BD Age	0.094							
(2) Big Data Analysis	0.055	0.834						
(3) Big Data Prediction	0.087	0.849	0.872					
(4) Big Data Integration	0.123	0.712	0.737	0.749				
(5) Competitive Performance	0.040	0.386	0.404	0.461	0.699			
(6) Firm Size	0.082	0.551	0.632	0.757	0.675	0.472		
(7) Proactive Strategic Flexibility	0.096	0.574	0.609	0.516	0.680	0.372	0.492	
(8) Reactive Strategic Flexibility	0.574	0.609	0.516	0.111	0.372	0.680	0.492	

Hypotheses Testing

Figure 2: Estimated relationships of structural model



Hypothesis H1a, H1b, H2, H3a, H3b proposes the influence of the quadratic variable big data capacity on strategic flexibility and competitive performance, direct impact test results (Figure 2). The test outcomes of hypotheses summarized in Table 4 show that big data capabilities directly and positively influence proactive strategic flexibility (β = 0.629; P-value = 0.000) and reactive strategic flexibility (β = 0.522; P-value = 0.001). Moreover, the findings confirmed that big data capacity positively affects enterprises' competitive performance (β = 0.324; P-value = 0.000). Furthermore, the research results revealed that both proactive and reactive strategic

flexibility are positively associated with competitive performance (β = 0.140; P-value = 0.027) and (β = 0.223; P-value = 0.000). Therefore, findings confirm that H1a, H1b, H2, H3a and H3b are supported.

Table 4: Results of direct effect

Hypothesis	Relationship	Path Coefficient	t-value	p-value	Support
H2	Big Data Capabilities → Competitive Performance	0.324	4.847	0.000	Yes
H1a	Big Data Capabilities → Proactive Strategic Flexibility	0.629	8.172	0.000	Yes
H1b	Big Data Capabilities → Reactive Strategic Flexibility	0.522	6.850	0.000	Yes
H3a	Proactive Strategic Flexibility → Competitive Performance	0.140	2.216	0.027	Yes
H3b	Reactive Strategic Flexibility → Competitive Performance	0.223	3.961	0.000	Yes

Hypotheses 4a, 4b propose that the reactive and proactive flexibility factors play a mediating role in the relationship between big data capabilities and competitive performance. The results of the mediation test (Table 5) show that proactive strategic flexibility (β = 0.088; P-value = 0.044) and reactive strategic flexibility (β = 0.116; P-value = 0.000) significantly mediate the relationship between big data capabilities and competitive performance, lending support to H4a and H4b. In addition, reactive strategic flexibility's mediating effect is stronger than proactive strategic flexibility's mediating effect. On the other hand, the total direct and indirect effect between big data capabilities and competitive performance is statistically significant at a 1% significance level (β = 0.529; P-value = 0.000). Therefore, we accept H4a and H4b.

Table 5. Results of indirect effect

Hypothesis	Relationship	Direct effect	Indirect effect via Proactive Strategic Flexibility	Indirect effect via Reactive Strategic Flexibility	Total effect	Support
H4a, b	Big Data Capabilities → Competitive Performance	0.324**	0.088*	0.116**	0.529	Yes

This study considers the impact of control variables. The results show that big data age positively impacts competitive performance with β = 0.098 and P-value < 0.05. Firm size also positively impacts competitive performance with β = 0.386 and P-value < 0.05.

Discussion

Initially, this study is one of the few to examine the relationship between big data capability and the competitive performance of enterprises with a mediating role of strategic flexibility to uncover how big data capabilities create value for enterprises. Big data analysis has been recognized as an important driver of business value (Olszak and Zurada, 2019) and competitive performance (Dong and Yang, 2020). Research has shown that resources or capabilities are important to realize important implications that affect performance (Wu et al., 2019). The results confirm that big data capabilities play a vital role in forecasting the competitive performance of enterprises. The ability to combine technology capabilities and big data platforms allows businesses to collect and integrate internal and external resources, exploit data in analyses, and capture relationships in the market to understand changes in customer needs better. This also helps businesses detect potential business opportunities, improve customer satisfaction, maintain customer numbers, and create effective competition compared to competitors. The study also highlights the effect of big data capabilities on strategic flexibility.

Next, the current study further validates the significance of big data capabilities in nurturing flexibility in business strategy. This finding establishes a clear and consistent understanding of the vital role of big data capabilities. Investing in developing big data infrastructure and enhancing big data capabilities have proven to be a support for governance activities within the organization, thereby establishing mechanisms that can effectively adapt to the ever-changing and dynamic business environments.

Moreover, the study shows that strategic flexibility, whether in a reactive or proactive direction, has a positive impact on the competitive performance of enterprises. This finding is consistent with some previous studies (Fan et al., 2013; Zhang, 2006), highlighting that flexibility in business strategy is an important source of competitive advantage for enterprises. Strategic flexibility is expressed in how to respond or adapt to changes or fluctuations in the environment and proactively make changes to adapt. Strategic, agile businesses often serve a wide range of products and markets, which gives them a competitive edge. Companies that proactively change their strategies can gather regular, critical, reliable and puzzle-based information to develop new products, and explore and exploit new market segments, thereby enabling superior market creativity and flexibility. In addition to changing strategies to respond flexibly to evolving environment, businesses also implement resource reallocation to adapt to these changes. This approach enables them to improve overall performance and gain a competitive edge.

Furthermore, this study provides evidence supporting the role of strategic flexibility as a mediating factor in the relationship between big data capacity and a firm's competitive performance. While prior research has suggested a direct and positive impact of big data capabilities on business performance, this study emphasizes that the influence of big data capabilities on competitive performance is mediated by the mechanism which enables businesses to adapt to change (Chen et al., 2021). The effective management of big data empowers businesses to the ability to collect, access, and analyze useful data, thereby fostering flexibility in business strategy and facilitating dynamic adaptation to the evolving environment. When the big data

governance capability transforms into a dynamic capacity, it enables the relocation and reconfiguration of an organization's resources to adapt to the demands of the business environment, which, in turn, enhances the competitiveness of the business in comparison to its competitors. Big data is a factor closely relating to the competitive performance of enterprises, as it improves their ability to address environmental challenges in unpredictable and uncertain environment. Additionally, it enables enterprises to proactively innovate, meet customer needs, strengthen their market position, and enhance their competitiveness. Therefore, this paper provides empirical evidence for the function of strategic flexibility as a mediator between big data capability and competitive performance in both proactive and reactive directions. The researchers have previously examined the relationship between the ability to analyze big data, strategic flexibility, and competitive performance (Wamba et al., 2017) and the relationship between dynamics and competitive performance (Schilke, 2014; Wilden and Gudergan, 2015). However, no studies have verified the structure of big data capabilities versus competing dynamic capabilities and performance (Gupta and George, 2016). Therefore, this paper contributes to a clearer picture of how big data analytics capabilities relate to dynamic capabilities and thus provides a better understanding of the value chain of big data analytics (Côrte-Real et al., 2019).

Finally, by evaluating the significance of enterprise size and the age of big data, this study offers crucial insights into the value of big data capabilities, strategic flexibility, and competitive performance. The finding is particularly noteworthy as previous studies have paid limited attention to the impact of big data scale and age on the capacity and effectiveness of businesses in the tourism and hospitality industries (Elbashir et al., 2013). The finding reveals that large-scale tourism and hospitality enterprises with a longer history of using big data tend to outperform small and medium-sized enterprises with less experience in utilizing big data, especially when they utilize market information to adapt to changing environments and drive superior performance. Consequently, the construction and advancement of big data systems and databases play an increasingly vital role in enabling tourism and hospitality businesses to achieve strategic flexibility.

This study contributes to the extant literature in the following ways. First, this study provides novel empirical evidence that supports the positive relationship between big data capability and the competitive performance. Second, our findings provide deeper knowledge regarding how firms can use big data capability to improve competitive performance through the multiple serial mediators of proactive and reactive strategic flexibility. Based on the strategic management perspective, this study demonstrates the serial mediation roles of proactive strategic flexibility and proactive strategic flexibility between big data capability and competitive performance, thus provides complements for the mediation path revealed in prior studies. Finally, this study confirms the positive control effect of firm size and the adoption big data time on the competitive performance.

Three limitations are acknowledged in this study. First, the sample consisted of managers from tourism and hospitality enterprises without considering the variations in big data capacity among these enterprises resulting from differences in firm size, experience of using big data, or whether the enterprise is a domestic or foreign company. Second, as data was collected through an online survey without the researchers, response bias may be unavoidable. Third, the business environment

context would influence firm performance. This study suggests that future research could add the environmental context into the research framework. Big data and business administration remain promising areas for future research, calling for further studies to generate deeper insights into this subject and provide better recommendations for firms to capitalize on the opportunities presented by the revolution of big data.

Practical Implications for Asian Business

The digital transformation of business activities and processes is an unrelenting trend, analytics big data should be increasingly deployed by hospitality, tourism and travel companies to build, improve and innovate their business models, as well as enhance and tailor their services. Therefore, our study provides several important practical implications. First, our findings confirm that the value of big data is not only determined by core competencies alone but also impact largely on improving strategic flexibility. This result help managers reduce ambiguity and inconsistency in the return on their big data investments. In case of the increasing competition among tourism and hospitality businesses is driving the need for analyzing business data to make more effective strategic decisions. Managers should focus on big data system for core competencies such as collect, analyze and forecast demand trends, guest numbers, bookings, and cancellations. This enables them to accurately design booking capacities, formulate response strategies, and proactively prevent customer cancellations, thus ensuring operational performance (Pan and Yang, 2017). Managers should pay attention to coordinate with the business executives making strategic decisions to ensure financial performance and market performance. Second, the digital transformation of operations has emerged as an inevitable trend, providing a rationale for tourism and hospitality businesses to invest and build big data capabilities. Managers should ensure strategic flexibility in their market, as it acts as a driver of organisational positioning in a dynamic business environment and since it exists on a continuum characterized by the degree to which a firm acquires, allocates and reconfigures its resource portfolio. Big data capabilities provide crucial data to aid managers in making proactive strategic decisions, improving and innovating business processes, and adapting services towards value innovation. The need for big data has become even more pronounced after the Covid-19 pandemic, enabling tourism and hospitality businesses to adapt to external shocks and swiftly respond to changing circumstances (Gallego and Font, 2021). Third, the findings of this study provide practical implications for businesses in the tourism and hospitality industry to promote sustainable competitive advantage. Big data capabilities offer valuable insights and opportunities for tourism and hospitality businesses, facilitating them in developing and delivering better services and experiences. When combined with digital technology, big data capabilities can contribute to the formation of a more sustainable, intelligent and efficient ecosystem within the tourism and hospitality industry (Xu et al., 2020). Finally, this implies that organizations (including the national and local level) should support initiatives to provide critical data for managers to act upon. It is essential to allocate adequate resources and solicit the support of establishing a big data industry and enhancing core big data compilation and analysis skills. Establish local platforms that coordinate new data streams for targeted decision-making by tourism authorities, public and private investments, capacity development, and the design and deployment of new finance mechanisms for

the sector. This provides an integrated information base to better inform sustainable tourism development, facilitate dialogue among different sectors, and encourage integrated, locally relevant decision-making (Helble and Fink, 2022).

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Appendix 1

Variables	Items
Big data acquisition integration capability BDI (Chen et al., 2021)	We have infrastructure related to big data, including big data support platform and business application system, etc. We can continuously obtain and update internal and external big data information in time. We can quickly store and process large amounts of data. We can continuously learn and update big data technology (data crawling, storage, analysis, visualisation). We constantly update our IT architecture to process big data.
Big data in-depth analysis capability, BDA (Chen et al., 2021)	We can effectively clean and standardise massive data. We are skilled in using technologies, tools and platforms related to distributed computing of big data. We can analyse unstructured data such as text and voice in real-time. We can mine valuable information from massive customer and market information. We are good at text analytics that deals with unstructured textual format data.
Big data insight and prediction capability BDP (Chen et al., 2021)	We know and predict customer behaviour in real-time based on big data. We predict the behaviour of partners and competitors based on big data. We realise real-time insight and trend prediction on the market based on big data. We identify business operation and development strategies based on big data.
Reactive strategic flexibility (Fan et al., 2013)	Our strategic plans emphasize building in slack so we can manage unforeseen circumstances. We consider an array of contingencies when developing strategies. We are able to take advantage of opportunities that arise from environmental change. We engage in planning that is typically of the 'wait and see' nature.
Proactive strategic flexibility (Fan et al., 2013)	If circumstances change, we can easily change its current plans. If circumstances change, we are prepared to react in a modified and viable manner. If circumstances change, we can control a shift in strategy. If circumstances change, we have the necessary practical knowledge to make shifts in daily routines and practices.

	If circumstances change, we can proactively develop a new project.
Competitive performance (Wang et al., 2012)	We have entered new markets more quickly than our competitors. We have introduced new products or services into the market faster than our competitors. Our success rate of new products or services has been higher than our competitors. Our market share has exceeded that of our competitors. Our customer retention rate is higher than our competitors.