

Factors Affecting the Adoption of Big Data Analytics in Hotels

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Abstract

Constant changes in the technological environment and the growth of digital transformation are forcing hotels to develop technological capabilities and invest more in information and communication technologies to keep pace with the competition. Therefore, Big Data Analytics (BDA) adoption is required to better predict the future, make accurate and efficient decisions, maximize the efficacy and success of the organization, gain a competitive advantage, improve market performance, improve the quality of decisions, etc. As BDA adoption brings wide-ranging benefits to hotels, it is crucial to investigate the factors that influence it. Therefore, this research examines the impact of three different types of capabilities (i.e., infrastructure, human resources, and management capabilities) and data-driven culture on BDA adoption. Besides, it investigates the effect of BDA adoption on the operational and economic performance of hotels. To achieve these objectives, 168 questionnaire forms were distributed to IT department staff (IT managers, assistant IT managers, and IT engineers) in the 28 five-star hotels in Greater Cairo representing the entire population in the study. A total of 135 usable questionnaire forms were received, with a response rate of 80.3 percent. To analyze these forms, descriptive, correlation, and multiple regression analyses were used. The findings revealed that the three types of BDA capabilities as well as the data-driven culture were found to positively influence BDA adoption. In addition, the results showed that BDA adoption has a positive impact on the two hotel performance dimensions (operational and economic). Therefore, hotel practitioners are recommended to improve IT infrastructure through its maintenance and update. Also, they should provide various types of training (e.g., lectures, role play, and workshops) to their IT staff to enhance their capabilities to use BDA applications.

Keywords: Big data analytics; BDA capabilities; BDA adoption; organizational performance.

Introduction

Big data is extremely large, complex, obscure data sets produced from various sources at a high speed. It cannot be processed using traditional processing techniques (Shamim *et al.*, 2021). Organizations are progressively analyzing big data using BDA to gain new knowledge and expectations, thus enabling them to make correct decisions depending on the analysis (Al-Khatib, 2022). BDA refers to methods (e.g., analytic methods), technologies (such as database and data mining tools), and application software used to analyze large and complicated data sets to increase organizational performance (Zhu *et al.*, 2021). BDA enhances organizational innovation and helps the organization address and reduce uncertainty arising from financial and economic changes in the work environment (Yu *et al.*, 2021). Besides, BDA enables hotels to monitor services in the market and recognize their business environment (Olabode *et al.*, 2022). Therefore, it is important to apply BDA in hospitality organizations and identify the factors that affect it, e.g., the three types of BDA capabilities as well as data-driven culture (Bahrami *et al.*, 2022).

First, infrastructure capabilities include information, technology, investments, and time which are necessary to maintain, allocate, and analyze data (Yasmin *et al.*, 2020). Second, human resources capabilities include technical skills that are very important to create and add value to benefit from the exploitation and investment of BDA (Öhman *et al.*, 2021). Third, management capabilities include BDA planning, investment, coordination, and control. These capabilities are essential for preparing analytical reports and actionable proposals that are managed and processed by mathematical and statistical methods (Zhu *et al.*, 2021).

Concerning data-driven culture, it is an intangible resource like organizational learning, governance, etc. (Dubey *et al.*, 2019). It is credited with making better use of data by BDA capability. Data-driven culture refers to the extent to which an organization relies on beliefs, marbles, attitudes, and opinions extracted from data in making decisions (Yu *et al.*, 2021). An organization with data-driven culture encourages the use of BDA capabilities for making decisions and extracting very useful data-driven insights that lead to raising operating efficiency and giving a competitive advantage (Dubey *et al.*, 2022).

However, although BDA and its potential are critically important for organizations, they face various limitations and constraints that may lead to not adopting it. First, IT infrastructure challenges are related to hardware, software, storage facilities, etc. (Adrian *et al.*, 2018). Second, organizational challenges include the complex organizational hierarchy, insufficient senior management support for BDA usage, and privacy and confidentiality regulations (Sun *et al.*, 2018; Alalawneh and Al-Khatib, 2021). Third, the external environment challenges encompass inappropriate governmental and legal procedures and a lack of public infrastructure availability and quality (Al-Khatib, 2022).

Despite the importance of BDA for organizations to succeed, gain a competitive edge, and improve their sustainable performance, there is still a lack of research on this topic (Hao *et al.*, 2019; Al-Khatib, 2022). The tourism and hospitality literature still has limited coverage of the topic of BDA adoption and the factors affecting it (Horng *et al.*, 2022; Lv *et al.*, 2022). Besides, there is very little research on knowledge resources (e.g., BDA) and their impact on hotel performance (Al-Qaralleh and Atan, 2022).

So far, many studies have focused on the advantages of BDA concerning the company's performance. What is critically important and not addressed by BDA research is the technical or non-technical capabilities that must be gained to drive the big data effort forward (Yasmin *et al.*, 2020). In addition, there have been insufficient studies on how BDA tools can be used for big data analysis (Lee *et al.*, 2020). Moreover, while existing BDA research has mainly been conducted in Western and developed countries, there appears to be a lack of studies in other country contexts, particularly in developing countries and the Middle East (Wang *et al.*, 2018; Yasmin, *et al.*, 2020; Al-Khatib, 2022).

Therefore, the research aims to identify the factors that affect BDA adoption. To achieve this overall goal, the study focuses on five specific objectives: (1) to assess the three types of BDA capabilities (i.e., infrastructure, human resources, and management capabilities); (2) to examine data-driven culture in hotels; (3) to investigate the operational and economic performance of hotels; (4) to identify how

BDA adoption is affected by the three types of BDA capabilities and data-driven culture; and (5) to examine the effect of BDA adoption on the operational and economic performance of hotels.

Literature review

Big data analytics (BDA)

Big data is a vital strategic resource produced from different sources, for example, customers, users, devices, and processes (Shamim *et al.*, 2020). Big data has its own set of characteristics, i.e., volume, variety, and velocity (Mikalef *et al.*, 2020; ZareRavasan, 2021). First, volume refers to large and varied data that is bigger than traditional data sets and can be analyzed by the organization to obtain important knowledge (Ferraris *et al.*, 2019). Second, variety is the data an organization has about its customers, including primary, secondary, unstructured, semi-structured, and structured data, such as customers' needs and desires as well as knowledge of their loyalty (Mohapatra and Mohanty, 2020). Third, velocity expresses the speed in creating, analyzing, and using the data. This speed assists the organization in making the right decision and facing market changes and competitors (Chams and García-Blandón, 2019; Olabode *et al.*, 2022).

BDA applies mathematical and statistical techniques dealing with the three dimensions of big data (i.e., volume, variety, and velocity) to extract important practical insights that facilitate better decision-making (Waqas *et al.*, 2021; ZareRavasan, 2021; Youssef *et al.*, 2022). In addition, BDA can be used to gather, combine, and analyze a large set of various data at the same time, resulting in better effectiveness and improved performance (Al-Khatib, 2022).

BDA is a systematic process that achieves many other benefits for the organization. It creates business value by improving organizational performance by increasing the speed of procedures and processes associated with the completion of tasks (Maroufkhani *et al.*, 2020). In addition, BDA enables hotels to identify underlying customer preferences, determine the factors that influence their loyalty and satisfy their needs, and examine new customer types, leading to advanced and original opportunities and new markets, which in turn bring competitive advantages (Al-Khatib and Al-Ghanem, 2021; Youssef *et al.*, 2022).

Big data analytics adoption

BDA is broadly applied in a variety of fields, e.g., hospitality, medicine, engineering, and business (Santoro *et al.*, 2019). BDA adoption refers to a procedure that includes techniques and technologies for managing the hidden values of data. The adoption process consists of three steps: acceptance, assimilation, and routinization (Yasmin *et al.*, 2020). Big data adoption has many advantages for the organization, the most important of which are enhancing productivity, predicting risk, managing the hidden values of data to help in the decision-making process in a better way, and satisfying customers more effectively, which leads to retaining customers (Behl, 2020; Liyanaarachchi, 2021). In addition, adopting BDA generates more value, achieves competitive advantage, manages resources, and motivates fact-based business decisions and actions (Shamim *et al.*, 2021). It plays an important role in improving

the organization's dynamic capability, as well as developing the path to succeed in the long run (Abdelmoety *et al.*, 2022).

BDA adoption depends on several factors, for example, technological, organizational, managerial, and environmental factors (Yadegaridehkordi *et al.*, 2020). Also, it is associated with other factors, such as government policy, IT infrastructure, usefulness, IT complexity, business leadership, cost, security, risk issues, and culture (Liyanaarachchi, 2021; Abdelmoety *et al.*, 2022).

Big data analytics capabilities and BDA adoption

Three capabilities of BDA were identified in the literature, comprising infrastructure, human resources, and management capabilities (Zhu *et al.*, 2021).

Infrastructure capabilities and BDA adoption

Hotels must first establish a coherent IT infrastructure if their purpose is to benefit from BDA (Maroufkhani *et al.*, 2020). The capabilities of IT infrastructure are very important prerequisites for implementing BDA which has emerged due to technological advances (Maroufkhani *et al.*, 2022). With the lack of innovative technologies in the organization (such as front-of-the-house and back-of-the-house applications) for data collection, storage, and communication, the organization's resistance to adopting BDA increases, and it becomes difficult to use (Min, 2021).

For the successful implementation of an innovation, the organization must prepare appropriate technological infrastructure, databases, and platforms (Verma *et al.*, 2017). These technological resources help hotel managers to better access data intelligence, thus making the best use of it (Talón-Ballesteros *et al.*, 2019). In effect, IT infrastructure capabilities are one of the most important factors affecting the application of BDA in the organization (Yadegaridehkordi *et al.*, 2020; Park and Kim, 2021). Based on the existing literature, BDA adoption is expected to be significantly influenced by infrastructure capabilities.

Management capabilities and BDA adoption

Organizations must have sufficient management and human resource capabilities to deeply understand BDA and realize its benefits (Akter *et al.*, 2016). For an organization to easily analyze big data, its managers must have IT capabilities (Shamim *et al.*, 2021). Organizational readiness refers to a company's willingness and ability to apply new technology including managerial ability and employee expertise. When organizational readiness for change is high, members of the organization are expected to change, put in more effort, show greater persistence, and exhibit more cooperative behavior (Min, 2021; Maroufkhani *et al.*, 2022).

Human resources capabilities and BDA adoption

The application of artificial intelligence and robotic technology results in big data that cannot be used in this form. Therefore, organizations should invest in developing the skills of their IT employees in big data analysis to be able to translate the statistics resulting from big data analysis into a language that is easy for managers to understand and benefit from (Shamim *et al.*, 2021).

The availability of sufficiently skilled human resources in IT is a very important factor in the process of adopting BDA (Sun *et al.*, 2018). In addition, educated, experienced, responsible, and knowledgeable employees can use the new technological innovation easily and effectively (Kandil *et al.*, 2018). In effect, the lack of in-house IT experts with appropriate skills leads to serious problems and additional costs because hotels in this case need to outsource IT specialists or companies (Maduku *et al.*, 2016). Organizations cannot implement BDA without adequate management and human resource capabilities (Ramanathan *et al.*, 2017; Gangwar, 2018; Yadegaridehkordi *et al.*, 2020; Gupta *et al.*, 2020).

In recent years hotel managers have largely succeeded in recruiting a strong scientific pool of well-equipped statisticians and database experts to create and analyze the contents of their data warehouses (Ramos *et al.*, 2017; Talón-Ballesterro *et al.*, 2019). In addition, employees' IS capabilities were reported to be important determinants of the adoption and use of new technologies and innovations (Jebarajakirthy and Shankar, 2021).

Data-driven culture and BDA adoption

To be able to successfully achieve digital transformation, organizations must develop their own data-driven culture (Zollo *et al.*, 2018). The organizational cultural shift from negative to positive toward technological innovation is a required precondition for adopting BDA. This means that BDA adoption imposes cultural change management (Min *et al.*, 2021).

Organizations with data-driven culture consider data as an intangible element that adds value to the business and influences the relationships between tangible assets, human abilities, and big data analytics (Zhang *et al.*, 2020). Therefore, hotels must first initiate an explicit data-based culture if their purpose is to maximize the benefits they can secure from BDA. Such a culture will only be possible if these hotels change the mentality of their employees to one that is primarily data-driven and thus will make use of BDA in their work (Maroufkhani *et al.*, 2022).

A data-driven culture is one of the most important factors related to the level of BDA practice (Al-Dmour *et al.*, 2021). A data-driven culture leads to the use of data in decision-making at different levels in the organization. It also encourages managers to use BDA in the daily operations of the organization (Shamim *et al.*, 2021). Therefore, without top management commitment and a data-driven culture that supports BDA, organizations cannot exploit its benefits, such as enhancing innovation performance and gaining a competitive edge (Chatterjee *et al.*, 2022; Al-Khatib, 2022).

Depending on the existing literature, BDA adoption is expected to be positively influenced by the three types of BDA capabilities (infrastructure, management, and human resources) as well as data-driven culture. Accordingly, the following hypotheses are proposed:

Hypothesis 1: Infrastructure capabilities have a significant effect on BDA adoption.

Hypothesis 2: Human resource capabilities have a significant effect on BDA adoption.

Hypothesis 3: Management capabilities have a significant effect on BDA adoption.

Hypothesis 4: Data-driven culture has a significant effect on BDA adoption.

Organizational performance

Organizational performance means that the organization achieves the highest success by increasing the rate of financial and non-financial performance of the organization that includes sales revenue, cash flow, environmental audit performance, customer satisfaction, and product and service quality (Yildiz and Aykanat, 2021; Manurung and Kurniawan, 2021). Also, organizational performance is defined as achieving the objectives of the organization that are related to various elements, the most important of which is increasing the organization's profitability and growth rate. In addition, organizational performance refers to achieving the organization's strategic objectives by increasing the organization's market share and sales (Shan *et al.*, 2016; Kafetzopoulos *et al.*, 2020).

Dimensions of organizational performance

Organizational performance includes two dimensions: economic performance and operational performance. The first dimension is the organization's ability to achieve financial results and outcomes. It represents financial performance and broader operational criteria, such as sales growth and returns on investment (Shan *et al.*, 2016; Kafetzopoulos *et al.*, 2020). On the contrary, operational performance expresses nonfinancial performance, such as service quality, resource consumption, promoting efficiency, innovation, flexibility, and customer satisfaction (Manurung and Kurniawan, 2021).

The effect of BDA adoption on organizational performance

The ability of companies to analyze big data maintains their competitiveness by reducing costs, for instance reducing the amount of waste and fraud (Ramaswamy, 2013). Moreover, BDA leads to improving companies' performance by increasing their productivity, either in a tangible way, for example reducing paper reports, or increasing productivity in an intangible way, such as the company's reputation (Raut *et al.*, 2019; Maroufkhani *et al.*, 2020; Maroufkhani *et al.*, 2022). In addition, BDA boosts organizational performance in different financial dimensions, e.g., profitability, sales maximization, financial productivity, return on investment, and cost reduction (Soon *et al.*, 2016; Brock and Khan, 2017) as well as non-financial dimensions, such as market share and fast delivery time (Ramanathan *et al.*, 2017; Mikalef *et al.*, 2019). Thus, organizations will be able to get the most out of their performance if they have excellent BDA capabilities (Rialti *et al.*, 2019). Better organizational performance will be generated from the perfect integration of all the resources of the organization, for instance, physical (e.g., IT infrastructure), organizational (e.g., BDA management), and human (e.g., analytical knowledge) resources (Srinivasan and Arunasalam, 2013). Therefore, the huge investment in BDA makes the organization able to improve its performance (Maroufkhani *et al.*, 2020). Depending on the existing literature, BDA adoption is expected to positively affect the economic and operational performance of hotels. Thus, the following two hypotheses are proposed:

Hypothesis 5: BDA adoption has a significant effect on economic performance.

Hypothesis 6: BDA adoption has a significant effect on operational performance.

Based on the literature review and the abovementioned hypotheses proposed, a model has been developed as illustrated in figure 1.

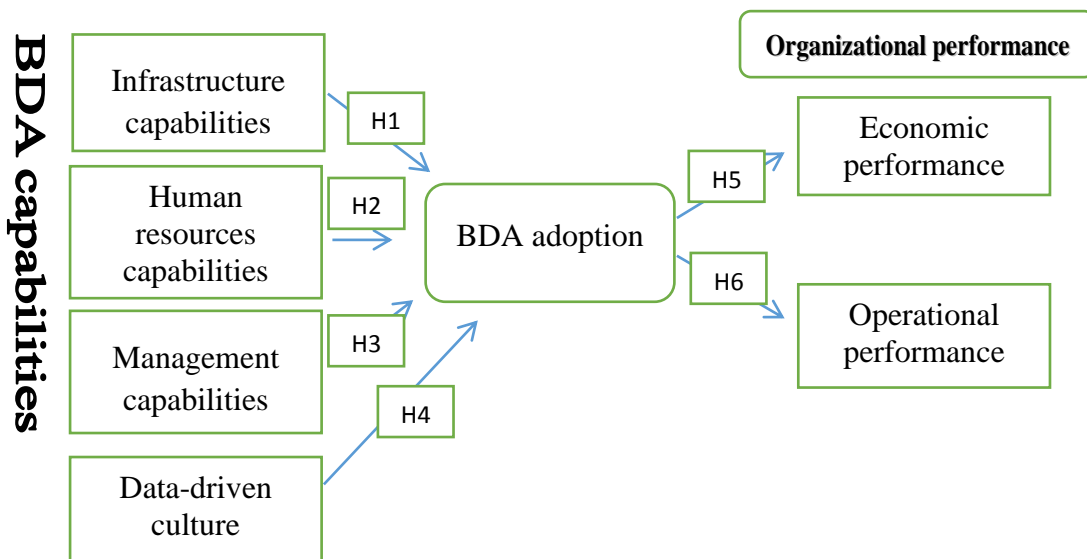


Figure (1): Hypothesized model

Research Methodology

The current study adopted the quantitative approach to investigate the impact of BDA capabilities and data-driven culture on BDA adoption and to assess the influence of BDA adoption on organizational performance. Therefore, this research includes two dependent variables, i.e., BDA adoption and organizational performance as well as two independent variables (i.e., BDA capabilities and data-driven culture).

Sampling

According to the Egyptian Hotel Guide (2021), the number of five-star hotels in Greater Cairo is 28 hotels. Accordingly, the complete enumeration survey method was adapted to the research population because of its manageable size. All 28 five-star hotels accepted the distribution of questionnaire forms among their employees. The choice of five-star hotels in this study is due to the application of the BDA concept and thus it can be measured. In addition, this category of hotels is operated by international hotel companies, therefore three or four-star hotels can benefit from the research results because of their clarity. For the attainment of research objectives, 168 questionnaire forms were distributed to IT department staff (IT managers, assistant IT managers, and IT engineers) in all 28 five-star hotels in Greater Cairo. The forms were distributed during the period from 5-2022 to 7-2022. A total of 135 usable forms were retrieved, representing a response rate of 80.3.

Measurement and instrument development

The questionnaire comprised five main parts. The first part (respondents' characteristics) consisted of four components (i.e., gender, age, educational level, and work experience). The second part (BDA capabilities) comprised three components: infrastructure capabilities (5 items); human resource capabilities (5 items) adapted from Aydiner *et al.* (2019); and management capabilities (5 items) adapted from Yasmin *et al.* (2020). The third part included one component (data-driven culture: 7

items) adapted from Mikalef *et al.* (2019). The fourth part was composed of one component (BDA adoption: 14 items). The fifth part (organizational performance) consisted of two components: economic performance (6 items) and operational performance (6 items) adapted from Gupta *et al.* (2020). A five-point Likert scale ranging from “strongly disagree = 1” to “strongly agree = 5” was used in the last four sections of the survey.

Reliability and validity of the questionnaire

To achieve content validity of the study’s instrument, it was reviewed by 3 professors and 2 associate professors majoring in hotel studies and 5 IT managers in five-star hotels in Cairo in terms of scales, wording, layout, and content. The questionnaire was then changed based on suggestions and comments received. Moreover, all the scales in the questionnaire were used and tested by previous researchers, which confirms the validity of the instrument used. To test the reliability of the questionnaire, the coefficient of Cronbach’s alpha was used. Cronbach’s alpha values for all variables (i.e., infrastructure capabilities, human resources capabilities, management capabilities, data-driven culture, BDA adoption, and organizational performance) in this study were above 0.70, indicating the high internal consistency of each variable which is considered acceptable in social science research (Hair *et al.*, 2006).

Data analysis techniques

All analyses in this study were performed using the statistical package for social sciences (SPSS) for Windows version 25. Mean scores and standard deviations are calculated for all variables in the study. Pearson correlation coefficient was used at a significance level of 5% to examine the relationships between the three types of BDA capabilities, data-driven culture, and BDA adoption as well as to find out the relationship between BDA adoption and organizational performance. In addition, the hierarchical multiple regression was used to investigate the influence of BDA capabilities and data-driven culture on BDA adoption and identify the effect of BDA adoption on organizational performance.

Results and discussions

The questionnaire included four items regarding the respondents’ characteristics: gender, age, educational level, and work experience. Concerning age, 126 out of the 135 respondents (93.3%) were male and 9 of them (6.7%) were female. Regarding age, about 65.2% of IT department staff were aged between 18 to 35 years, while approximately 24.8% of them were aged between 36 to 55 years, and 10% of them were aged more than 55 years. Concerning educational level, the majority of respondents (92%) graduated from university, whereas about 8% of them were post-graduates. Regarding tenure, respondents represent different experiences: about 58% (1-5 years); approximately 32% (5-10 years); and about 10% (more than 10 years).

A descriptive analysis of BDA capabilities, BDA adoption, and organizational performance

Table (2) shows the descriptive analysis of the variables of BDA capabilities, data-driven culture, BDA adoption, and organizational performance. First, the results clearly stated that the total mean score of BDA capabilities was 2.68. Besides, all

three categories of BDA capabilities (i.e., infrastructure, human resources, and management capabilities), as well as data-driven culture, had low average scores ranging from 2.2-3.0, revealing that the level of BDA capabilities and data-driven culture in hotels was deficient. Regarding BDA capabilities, the findings coincide with previous research (Akter *et al.*, 2016; Shamim *et al.*, 2021). In addition, the results related to data-driven culture concur with those of Zhang *et al.* (2020). On the contrary, the results related to BDA capabilities contradict those of prior researchers (e.g., Wang, *et al.*, 2020; Al-Dmour *et al.*, 2021) who found that there is a high level of BDA capabilities in the organization.

Second, as shown in table (1), the total mean score of BDA adoption was low (2.72). In addition, all BDA adoption items had low average scores ranging from 2.2-3.1, indicating that BDA systems are poorly or incompletely applied in hotels. This finding is inconsistent with those of Sun *et al.* (2020) and Al-Dmour *et al.* (2021) who found that BDA applications are well implemented.

Table 1: A descriptive analysis of the items of BDA capabilities, BDA adoption, and hotel performance

| Section 1- Big data analytics capabilities | Mean | Std. Deviation |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------|
| A- Infrastructure capabilities (IC) | 2.68 | |
| IC ₁ : The hotel has a strong enough IT infrastructure among different departments. | 2.9 | .65 |
| IC ₂ : The hotel has an IT infrastructure enabling it to devise customized software applications when needed. | 3 | .77 |
| IC ₃ : The hotel has an IT infrastructure that allows it to respond quickly to customer requests from inside or outside the hotel. | 2.2 | .75 |
| IC ₄ : The hotel has an IT infrastructure capable of dealing with multiple applications. | 2.7 | .68 |
| IC ₅ : The hotel IT infrastructure provides efficient operations suitable for internet-based applications. | 2.6 | .73 |
| B- Human resources capabilities | 2.5 | |
| HC ₁ : Hotel IS personnel have sufficient knowledge of the IT systems. | 2.8 | .75 |
| HC ₂ : Hotel IS personnel have extensive technical expertise in IT systems. | 2.9 | .78 |
| HC ₃ : Hotel IS personnel can use the appropriate software promptly. | 2.2 | .73 |
| HC ₄ : Hotel IS personnel have the ability to quickly identify potential problems related to the IT system. | 2.4 | .78 |
| HC ₅ : Hotel IS personnel have the ability to rapidly maintain the IT system in the event of any failure. | 2.2 | .83 |
| C- Management capabilities (MC) | 2.86 | |
| MC ₁ : Hotel IS strategy is compatible with the hotel strategy | 2.6 | .68 |
| MC ₂ : The hotel gives executive authority to IT managers | 3 | .73 |
| MC ₃ : The hotel has well-defined and documented IS procedures. | 2.9 | .68 |
| MC ₄ : The hotel IS department has clear instructions for prioritizing service requests from IT users | 2.8 | .78 |
| MC ₅ : The hotel IS department has clear instructions on the use of IT resources | 3 | .83 |
| D- Data-driven culture (DR) | 2.51 | |
| DR ₁ : The hotel views data as a tangible asset | 2.1 | .75 |
| DR ₂ : The hotel strongly discourages relying on intuition in decision-making | 2.9 | .68 |
| DR ₃ : The hotel management uses a lot of data to justify decisions they have already made through traditional methods | 2.8 | .73 |
| DR ₄ : The hotel constantly assesses and improves the business rules in the light of insights extracted from data | 3 | .75 |
| DR ₅ : The hotel constantly trains staff to make decisions based on data | 2.2 | .68 |
| DR ₆ : The hotel relies on data as part of its organizational routine | 2.4 | .78 |
| DR ₇ : The hotel has a culture of data-driven work | 2.2 | .83 |

| | | |
|----------------------------------------------------------------------------------------------------|-------------|-----|
| Section 2- BDA adoption (BA) | 2.72 | |
| BA ₁ : The hotel applies BDA to respond quickly to changes | 3.1 | .68 |
| BA ₂ : The hotel applies BDA to gain a competitive edge | 2.4 | .78 |
| BA ₃ : The hotel applies BDA to strengthen consumer relations | 2.9 | .83 |
| BA ₄ : The hotel applies BDA to reduce costs related to managing the food supply chain | 3 | .68 |
| BA ₅ : The hotel applies BDA to cut down operational costs | 2.2 | .65 |
| BA ₆ : The hotel applies BDA to decrease communication costs | 2.7 | .77 |
| BA ₇ : The hotel applies BDA to improve staff productivity | 2.6 | .75 |
| BA ₈ : The hotel applies BDA to enhance staff aptitudes | 2.9 | .68 |
| BA ₉ : The hotel applies BDA to create new business chances | 3 | .73 |
| BA ₁₀ : The hotel applies BDA to increase capabilities | 2.2 | .65 |
| BA ₁₁ : The hotel applies BDA to strengthen organizational structure and operations | 2.7 | .77 |
| BA ₁₂ : The hotel applies BDA to enable IT staff to quickly gain access to data | 2.6 | .75 |
| BA ₁₃ : The hotel applies BDA to improve the quality of management data | 2.9 | .68 |
| BA ₁₄ : The hotel applies BDA to get more accurate data | 3 | .73 |
| Section 3- Hotel performance | 4.34 | |
| Economic performance (EP) | 4.15 | |
| EP ₁ : The hotel increases its productivity. | 3.9 | .65 |
| EP ₂ : The hotel increases revenue sales. | 4.5 | .77 |
| EP ₃ : The hotel opens up new markets. | 4.2 | .75 |
| EP ₄ : The hotel launches new services and products in the market. | 4.3 | .68 |
| EP ₅ : The hotel has a faster rate of success for its services. | 4.1 | .73 |
| EP ₆ : The hotel enjoys a large market share. | 3.9 | .65 |
| Operational performance (OP) | 4.52 | |
| OP ₁ : The hotel increases the number of hotel products and services delivered on time. | 4.2 | .68 |
| OP ₂ : The hotel reduces inventory levels. | 4.7 | .73 |
| OP ₃ : The hotel lowers its scrap rate. | 4.6 | .75 |
| OP ₄ : The hotel improves product and service quality. | 4.9 | .68 |
| OP ₅ : The hotel increases the production rate. | 4 | .68 |
| OP ₆ : The hotel optimizes capacity utilization. | 4.7 | .73 |

IS: information systems; IT: information technology.

Third, the results in a table (1) showed that the total mean score of organizational performance was 4.34. This finding agrees with previous research (Akter *et al.*, 2016). On the other hand, it is inconsistent with prior studies (e.g., Yadegaridehkordi *et al.*, 2020). The results also indicate that the hotel's operational performance (mean = 4.52) is higher than the economic performance (mean = 4.15). In addition, all the items of operational performance had high average scores ranging from 4 to 4.9. As regards economic performance, findings correspond with those of Maroufkhani *et al.* (2020) and Wang *et al.* (2020). Concerning operational performance, findings are not consistent with previous studies (e.g., Agarwal *et al.*, 2020).

Relationship between BDA capabilities and BDA adoption

The results in table (2) showed that all three types of BDA capabilities (i.e., infrastructure capabilities; human resources capabilities; management capabilities) are positively related to BDA adoption. As regards infrastructure capabilities, the results indicated that it is positively associated with BDA adoption ($r= 0.35$, Sig. <0.000). This means that if infrastructure capabilities increase, BDA adoption will increase. These results are supported by previous studies (e.g., Mothobi and Grzybowski, 2017; Yadegaridehkordi *et al.*, 2020) which found that IT infrastructure capabilities are significantly associated with IT usage.

Table 2: Correlations between BDA capabilities, data-driven culture, and BDA adoption

| | | Infrastructure capabilities |
|---------------------|---------------------|-------------------------------------|
| BDA adoption | Pearson correlation | .35 |
| | Sig. (2-tailed) | .000 |
| | N | 135 |
| | | Human resources capabilities |
| BDA adoption | Pearson correlation | .33 |
| | Sig. (2-tailed) | .000 |
| | N | 135 |
| | | Management capabilities |
| BDA adoption | Pearson correlation | .33 |
| | Sig. (2-tailed) | .000 |
| | N | 135 |
| | | Data-driven culture |
| BDA adoption | Pearson correlation | .29 |
| | Sig. (2-tailed) | .000 |
| | N | 135 |

**Correlation is significant at the 0.01 level (2-tailed).

Concerning human resource capabilities, table (2) indicates that it is positively related to BDA adoption ($r= 0.33$, Sig. <0.000). This means that if human resource capabilities increase, BDA adoption will increase. Concerning management capabilities, the results indicated that it is positively associated with BDA adoption ($r= 0.33$, Sig. <0.000). This means that if management capabilities increase, BDA adoption will increase. These results are consistent with previously-published results (e.g., Gangwar, 2018; Kandil *et al.*, 2018; Lai *et al.*, 2018; Gupta *et al.*, 2020) which showed that management and human resources capabilities are positively related to BDA adoption. Besides, Asiaei and Rahim (2019) and Maroufkhani *et al.* (2020) found that organizational readiness is positively associated with new technology usage. Besides, several researchers (e.g., Nguyen *et al.*, 2015; Maduku *et al.*, 2016; Min, 2021) found that companies with employees possessing greater IT knowledge were more likely to implement IT than those without. Moreover, Youssef *et al.* (2022) found that IS staff aptitudes are positively associated with BDA adoption. Furthermore, table (2) illustrates that there is a low positive relationship between data-driven culture and BDA adoption ($r= .29$, Sig. < 0.000). This means that if data-driven culture increases, BDA adoption will increase. This result agrees with previous studies which found that BDA adoption is positively related to data-driven culture (Min, 2021; Maroufkhani *et al.*, 2022). Also, these results correspond with those of Youssef *et al.* (2022) who found that data-driven culture is associated with BDA adoption.

Relationship between BDA adoption and organizational performance dimensions

To indicate the relationships between BDA adoption and the two dimensions of organizational performance (i.e., economic performance and operational performance), correlations were measured. Table (3) shows that BDA adoption is positively related to these two dimensions: economic performance ($r= 0.35$, Sig. <0.000); and operational performance ($r= 0.8$, Sig. <0.000). This means that if BDA adoption increases, organizational performance will increase.

Table 3: Correlation between BDA adoption and organizational performance

| | | Economic performance |
|---------------------|---------------------|-----------------------------|
| BDA adoption | Pearson correlation | .35 |
| | Sig. (2-tailed) | .000 |

| | | |
|---------------------|---------------------|--------------------------------|
| | N | 135 |
| | | Operational performance |
| BDA adoption | Pearson correlation | .80 |
| | Sig. (2-tailed) | .000 |
| | N | 135 |

**Correlation is significant at the 0.01 level (2-tailed).

The results in table (3) are in agreement with prior studies which found that BDA adoption is positively related to organizational performance (Ramanathan *et al.*, 2017; Akhtar *et al.*, 2019; Aydiner *et al.*, 2019; Al-Dmour *et al.*, 2021). In addition, the results correspond with those of Dubey *et al.* (2019) and Gupta *et al.* (2020), who found that big data and predictive analytics are positively correlated with economic and operational performance. In this regard, Yasmin *et al.* (2020) and Zhu *et al.* (2021) found that BDA capabilities are associated with operational performance.

Regression results of BDA capabilities and data-driven culture with BDA adoption

As shown in table (4), all three BDA capabilities (infrastructure, human resources, management) and data-driven culture were found to positively affect BDA adoption. First, results showed that infrastructure capabilities positively affect BDA adoption (R-square=.36, P-value=.000). In this regard, several researchers (e.g., Mothobi and Grzybowski, 2017; Yadegaridehkordi *et al.*, 2020; Min, 2021) found that infrastructure capabilities were found to positively affect BDA adoption. In addition, infrastructure capabilities were found to be more important than the other two types of BDA capabilities in influencing BDA adoption. This finding concurs with those of Akter *et al.* (2016), Dubey *et al.* (2019), Mikalef *et al.* (2019), and Yasmin *et al.* (2020).

Table 4: BDA capabilities and data-driven culture influencing BDA adoption

| Infrastructure capabilities | Un-standardized coefficients | | | Sig. | Model statistics |
|-----------------------------|------------------------------|------------|----------|------|------------------|
| | B | Std. Error | R-square | .000 | F: 11.3020 |
| Constant | .329* | .001 | .36 | .000 | |
| BDA adoption | .125* | .002 | | .000 | |
| Human resource capabilities | Un-standardized coefficients | | | Sig. | Model statistics |
| | B | Std. Error | R-square | .000 | F: 10.3269 |
| Constant | .115** | .021 | .32 | .000 | |
| BDA adoption | .104** | .013 | | .000 | |
| Management capabilities | Un-standardized coefficients | | | Sig. | Model statistics |
| | B | Std. Error | R-square | .000 | F: 9.3578 |
| Constant | .301*** | .0001 | .35 | .000 | |
| BDA adoption | .435*** | .0004 | | .000 | |
| Data-driven culture | Un-standardized coefficients | | | Sig. | Model statistics |
| | B | Std. Error | R-square | .000 | F: 11.3000 |
| Constant | .113**** | .004 | .30 | .000 | |
| BDA adoption | .311**** | .002 | | .000 | |

*Regression equation can be formed as **infrastructure capabilities** = .329 + .125 **BDA adoption**

Regression equation can be formed as **human resource capabilities = .115 + .104 **BDA adoption**

*** Regression equation can be formed as **management capabilities** = .301 + .435 **BDA adoption**

**** Regression equation can be formed as **data-driven culture** = .113+ .311 **BDA adoption**

Second, human resource capabilities were found to positively influence BDA adoption (R-square=.32, P-value=.000). Third, management capabilities were also found to positively influence BDA adoption (R-square=.35, P-value=.000). These findings concur with several researchers (e.g., Park *et al.*, 2015; Sun *et al.*, 2018) who reported that BDA adoption can be significantly affected by organizational resources. Additionally, the findings are consistent with previously-published results (e.g., Kandil *et al.*, 2018; Lai *et al.*, 2018; Asiaei and Rahim, 2019; Park and Kim, 2021; Maroufkhani *et al.*, 2022) which showed that organizational readiness positively affects BDA adoption.

Besides, the findings agree with previous researchers (e.g., Taxman *et al.*, 2014; Maroufkhani *et al.*, 2020) who found that lack of technical knowledge is one of the main factors hindering the use of information systems in organizations. In addition, the findings correspond with those of Youssef *et al.* (2022) who found that employees' IS capabilities positively affect the adoption and use of BDA.

Fourth, data-driven culture was found to positively affect BDA adoption (R-square=.30, P-value=.000). This result coincides with the results of Maroufkhani *et al.* (2020). In addition, the result is consistent with those of Min (2021) who found that if the organizational culture is negative toward digital transformation, this reduces the possibility of BDA adoption. Moreover, the result agrees with those of Youssef *et al.* (2022) who found that data-driven culture positively influences BDA adoption.

Based on the previous regression results, hypotheses 1, 2, 3, and 4 which predicted that the four resources of BDA (infrastructure, human resources, management capabilities, and data-driven culture) would have a significant influence on BDA adoption are supported.

Regression results of BDA adoption with organizational performance

As illustrated in table (5), the two dimensions of organizational performance were found to be positively affected by BDA adoption: economic performance (R-square = .36, P-value=.000) and operational performance (R-square = .81, P-value=.000). These findings are consistent with those of Garrison *et al.* (2015) who stated that innovation adoption positively influences organizational performance. Similarly, Sun *et al.* (2018) confirmed that big data analysis is one of the most important driving forces for the organization's competitive advantage. Furthermore, these findings are in agreement with those of Müller *et al.* (2018) which showed that organizational performance was found to be positively influenced by the business value of BDA. Moreover, the findings coincide with those of Maroufkhani *et al.* (2022) who found that BDA improves the financial welfare of the organization.

Table 5: BDA adoption influencing organizational performance

| BDA adoption | Un-standardized coefficients | | | Sig. | Model statistics | |
|-------------------------|------------------------------|------------|----------|------|------------------|------|
| | B | Std. Error | R-square | | | |
| Constant | .711* | .001 | .36 | .000 | F: 9.003 | |
| Economic performance | .631* | .003 | | .000 | | |
| Operational performance | .440* | .001 | | .81 | | .000 |

*Regression equation can be formed as **BDA adoption = .711 + .631 economic performance+ .440 operational performance**

In addition, the results indicated that practicing BDA applications has a positive impact on organizational performance. This finding is consistent with previous research (Raguseo and Vitari, 2018; Akhtar *et al.*, 2019; Aydiner *et al.*, 2019; Wang *et al.*, 2019; Al-Dmour *et al.*, 2021) which found that organizational performance is significantly affected by BDA adoption. Besides, BDA adoption was found to positively influence economic performance (Dubey *et al.*, 2019; Gupta *et al.*, 2020) as well as operational performance (Gupta *et al.*, 2020; Yasmin *et al.*, 2020; Zhu *et al.*, 2021). It was expected that BDA adoption would have a significant impact on economic performance (hypothesis 5), and operational performance (hypothesis 6). These two hypotheses are supported based on the previous regression results.

Conclusions and implications

This study highlighted the relationships between the four resources of BDA (infrastructure, human resources, management capabilities, and data-driven culture), BDA adoption, and organizational performance in hotels. Six conclusions were drawn from the results. First, the level of BDA capabilities and data-driven culture in hotels was deficient. Second, the level of hotel's operational performance is lower than the economic performance. Third, the four BDA resources were found to positively affect BDA adoption. Fourth, infrastructure capabilities were found to be more important than the other two types of BDA capabilities (human resources and management capabilities) in influencing BDA adoption. Fifth, there are positive effects of BDA adoption on economic performance and operational performance in hotels. Sixth, BDA adoption had a greater impact on operational performance than economic performance. Based on the related literature review and the results obtained, several recommendations are addressed below.

1- As regards infrastructure capabilities, hotel practitioners should increase these capabilities by strengthening IS infrastructure between inter-organizational units and improving the quality of BDA systems by maintaining and updating them. Despite the importance of all the BDA capabilities, hotel practitioners should prioritize the most important set of BDA capabilities (i.e., infrastructure capabilities) to achieve the best hotel performance objectives. Additionally, to build strong information system infrastructure, hotel companies should invest more financially by innovating an integrated ICT system.

2- Regarding human resources capabilities, hotel management is recommended to provide different methods of training (such as lecture, role play, videoconference, and workshops) to existing IT staff on BDA applications in order to: (1) improve their knowledge of the BDA systems, (2) enhance their abilities to employ the correct BDA application and methods at the right time, (3) find out possible problems quickly in the system, and (4) maintain the system whenever a failure happens. Furthermore, hotels need to hire IS personnel with expertise to be able to efficiently perform big data analysis tasks due to their insufficient numbers.

3- Concerning management capabilities, the head office should enhance the information system strategy to align with the company's strategy, and give the information system managers higher authority at the executive level. Besides,

information system management should standardize and document information system operations. In addition, a practical guide and toolkit should be developed to assist information system managers in evaluating and combining their viewpoints concerning developing better BDA capabilities.

4- In terms of data-driven culture, top management should prevent managers in all hotel departments from relying on intuition in decision-making. It should also support them to make use of a lot of data to explain decisions taken by means of conventional ways. Additionally, managers are recommended to continuously train employees to make decisions depending on data.

5- All big data analytics capabilities (infrastructure, human resources, and management) as well as a data-driven culture should be effectively integrated to successfully adopt BDA and achieve a high level of financial and operational hotel performance, with priority given to improving the ICT infrastructure. Finally, about hotel performance, the results of this research showed top management that enhancing BDA adoption contributes to raising the hotel's operational and financial performance.

Limitations and avenues for future research

Despite the theoretical contribution and practical implications of this research, it has several limitations that need to be investigated by future hospitality research. First, this research investigated the effect of one type of intangible resources (i.e., data-driven culture) on BDA adoption. It may be beneficial to examine other intangible resources, such as organizational learning, governance, etc. Second, since this research relied on the responses of IT staff and their managers, there is a need for further research that considers the views of managers and supervisors across all hotel departments regarding study variables. Third, the study findings cannot be generalized to all hospitality segments as the sample was selected from employees working in the hotel sector in Greater Cairo. Thus, it may be beneficial to conduct future studies on other hospitality sectors, e.g., restaurants, and on other cities (e.g., Sharm El Sheikh and Hurghada). Fourth, further research should pay attention to the existence of other dependent variables that could be influenced by BDA adoption and related to organizational outcomes, e.g., competitive advantage, organizational agility, decision-making, value creation, and innovation performance. Fifth, the questionnaire was used as a data collection tool in this research, but the interviews were not conducted as a qualitative method. Therefore, future research can apply the qualitative approach (for example, interviews) or the mixed method where both quantitative and qualitative methods are used to gain more depth and rich data on the topic of study.

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العوامل المؤثرة في اعتماد تحليلات البيانات الضخمة في الفنادق

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تدفع التغييرات المستمرة في البيئة التكنولوجية ونمو التحول الرقمي الفنادق الي تطوير القدرات التكنولوجية لديها والاستثمار بشكل أكبر في مجال تقنيات المعلومات والاتصالات لمواكبة المنافسة. لذلك، يلزم اعتماد نظم تحليل البيانات الضخمة (BDA) للتنبؤ بشكل أفضل بالمستقبل، واتخاذ قرارات دقيقة وفعالة، وتعظيم فعالية ونجاح المنظمة، واكتساب ميزة تنافسية، وتحسين أداء السوق، وتحسين جودة القرارات، وما إلى ذلك. يحقق تطبيق مثل هذه النظم فوائد واسعة النطاق للفنادق، فمن الأهمية بمكان دراسة العوامل التي تؤثر عليه. لذلك، يقيس هذا البحث تأثير ثلاثة أنواع مختلفة من القدرات (البنية التحتية والموارد البشرية والقدرات الإدارية) والثقافة التي تعتمد على البيانات على استخدام نظم تحليل البيانات الضخمة في الفنادق. إلى جانب ذلك، تقيم الدراسة تأثير تطبيق تحليل البيانات الضخمة على الأداء التشغيلي والاقتصادي للفنادق. ولتحقيق هذه الأهداف، تم توزيع 168 استمارة الإستقصاء على موظفي قسم تكنولوجيا المعلومات (مديرو القسم، ومساعدهم، ومهندسو نظم المعلومات) في 28 فندقاً من فئة الخمس نجوم في القاهرة تمثل جميع أفراد مجتمع الدراسة. ومع ذلك، تم استلام 135 استمارة فقط صالحة للتحليل الاحصائي، بمعدل استجابة 80.3 في المائة. ولتحليل هذه الإستمارات إحصائياً عن طريق برنامج الحزمة الإحصائية للعلوم الإجتماعية (SPSS)، تم استخدام التحليلات الوصفية والارتباط والانحدار المتعدد. وفيما يتعلق بنتائج البحث، وضحت النتائج أن الأنواع الثلاثة من قدرات تحليل البيانات الضخمة وكذلك الثقافة القائمة على البيانات تؤثر بشكل إيجابي على اعتماد واستخدام تحليل البيانات الضخمة. بالإضافة إلى ذلك، أظهرت النتائج أن اعتماد استخدام تحليل البيانات الضخمة له تأثير إيجابي على بعدي الأداء الفندقي (التشغيلي والاقتصادي). وطبقاً لهذه النتائج، أوصت الدراسة الفنادق بتحسين البنية التحتية لتكنولوجيا المعلومات من خلال صيانتها وتحديثها. علاوة على ذلك، يجب عليهم تقديم أنواع مختلفة من التدريب (مثل المحاضرات ولعب الأدوار وورش العمل) لموظفي تكنولوجيا المعلومات لديهم لتعزيز قدراتهم على استخدام تطبيقات تحليل البيانات الضخمة.

الكلمات الدالة: تحليل البيانات الضخمة، قدرات تحليل البيانات الضخمة، اعتماد تحليل البيانات الضخمة، الأداء التنظيمي.