

The mediating role of business analytics in the relationship between business intelligence capabilities and business agility

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Abstract

This study aims to investigate the effect of Business Intelligence Capabilities in Business Agility—moreover, the mediating role of Business Analytics in Cellular Telecommunications Companies in Jordan. The study population consisted of all (3) Cellular Telecommunications Companies in Jordan (Zain; Orange, and Umniah). The study population was considered as a sample for the current study using a Comprehensive survey method. The sampling unit consisted of (257) individuals from three upper, middle, and lower administrative levels in the Cellular Telecommunications Companies in Jordan. The questionnaire was adopted as a tool to measure the variables of the study through data collection and the use of descriptive and inferential statistical methods, most notably the structural equation model through AMOS software. The study reached several results, there is an indirect and partial effect of business analytics in the relationship between business intelligence capabilities and business agility in Cellular Telecommunications Companies in Jordan.

Several recommendations were presented, the most important of which is that the Cellular Telecommunications Companies in Jordan make a balance between their business intelligence capabilities due to the positive effect on business agility and analytics. The Cellular Telecommunications Companies in Jordan follow up all types of business analytics due to their positive role in achieving business agility.

Introduction

The concept of business agility has become one of the components of the organizations continuation or their exit from the labor market, with the technological revolution acceleration, occurrence of environmental disturbances and the opportunities, and challenges it has generated, speed of response to changes, and high flexibility to adapt them has become a necessity for the survival of organizations. Business agility is not related to size, but rather it is primarily related to the ability to move, the speed of movement, and the quality of what results from that ability and speed. Therefore, talking about business agility today has become one of the most important determinants of the level, size, and ability of organizations to respond to developments and changes in their business environment.

Business agility pillars necessitate the establishment of priorities, the identification of paths, and the collaboration of parallel work teams, as well as the rapid adaptation to unconventional platforms and work media. According to Juneja et al. (2018), business agility is crucial for achieving success in a rapidly changing company environment, it indicates the ability to effectively execute changes and capitalize on opportunities in a highly unpredictable and turbulent environment. In a study conducted by Saputraa et al. (2022), it was found that organization's need to be more agile to effectively navigate the constant turbulence in their business environment, agility, in this context, refers to the ability of organization's to swiftly and easily adapt their business processes and strategies, to achieve this, organization's must explore and examine a range of methods that can facilitate and improve their responsiveness.

Several studies, like the research conducted by Kuilboer et al. (2016), have verified that business intelligence capabilities are an effective approach for enhancing organizational agility and improving performance levels. According to Calderon et al. (2017), agile organizations achieve the most favorable business intelligence results.

Business analytics allows organizations to articulate their requirements, and justification for change, and develop and explain solutions that enable them to create value for others (Ghasemaghaei et al. 2017). The research conducted by Božič and Dimovski (2020) validated the direct relationship between business intelligence and business analytics, which in turn leads to the improvement of absorptive capacity and knowledge production. In Zhao (2021) study, it was elucidated that business analytics allows organizations to efficiently analyze the data created by their business intelligence programmers, this analysis leads to improved performance, hence establishing these organizations as competitive entities.

Systematic business analysis allows organizations to enhance their agility to promptly adapt to a dynamic environment and effectively fulfill client requirements. Ashrafi et al. (2019) validated that business analysis has a significant impact on an organization's agility through enhancing information quality and fostering creativity. Khan et al. (2022) elucidated that business analysis enhances the caliber of information and fosters innovative vigor, hence exerting a significant impact on the organization's agility. Li et al. (2022) have provided evidence that business analysis is positively correlated with organizational agility.

The telecommunications sector, particularly the Jordanian mobile telecommunications companies, plays a crucial role in the Jordanian economy. It is highly motivated to keep up with the rapid development in the global knowledge economy and its impact on the business

environment. Therefore, companies in this sector need to prioritize business intelligence and business analytics capabilities. This will enable them to achieve agility in their operations and maintain consistently high levels of performance.

The purpose of this paper is to explore the mediating role of business analytics in the relationship between business intelligence capabilities and business agility in Jordanian mobile telecommunications companies. To accomplish the research goal, a conceptual model is suggested that examines the potential mediating effect of business analytics on the relationship between business intelligence capabilities and business agility. The survey instrument was modified from the original instrument created by multiple researchers to empirically examine the proposed relationships. The results were presented from the perspective of three administrative levels within Jordanian mobile telecommunications firms.

The current research study is arranged as follows: First, an overview of the business intelligence capabilities, business analytics, and business agility literature, which provide theoretical support for the current research study, assuming hypotheses and conceptual model before presenting the methods used and results obtained. Next, conclusions, implications, and directions for future research are also discussed.

Literature Review and Research Hypotheses

Business intelligence capabilities

The development of business intelligence is very similar to any other development in modern times. It is driven by demand and human need for knowledge, where organizations have for decades dealt with data that had to be collected and analyzed manually and with the time needed for analysts and IT specialists to create reports that were not only incomplete, but old (Kuilboer, et al., 2016). Historically, most of the business intelligence functions were handled by IT sections and the focus was always on how to automate the delivery of useful information to users (AL-Hanandeh, 2020). Therefore, business intelligence capabilities is considered to be an important function of business intelligence that helps organization to improve its adaptation to change as well as its performance through appropriate capabilities, as it helps to predict changes in product demand or to discover an increase in the share of the new product market for competitors and respond quickly by offering a competing product. (Chen and Lin, 2020).

Business intelligence capabilities have been defined as the use of business intelligence resources and their interaction with other resources to support the business process, a more specific form of IT capabilities in the context of business intelligence systems (Neirotti and Raguseo, 2017). Therefore, business intelligence capabilities include a range of techniques such as data repositories, information boards, data extraction, perception, reporting, and applications of programmers and other devices (Isik et al., 2013). Alsaad, et al. (2022) assert that the concept of business intelligence capabilities can be defined from an organizational and technological perspective, as business intelligence capabilities are defined from a technological perspective as technical platforms and databases that can be shared and ideally include a well-defined technical structure and data standards. From an organizational perspective, they are assets for the effective application of the information system in the organization, such as common risks

and responsibilities as well as flexibility. Xu (2022) sees the importance of business intelligence capabilities through the benefits they bring, enabling them to analyze data, improve processes, track performance, accelerate and improve decision-making processes, and thus compete strongly and gain a higher profile among competitors.

Neirotti and Raguseo (2017) Classify business intelligence capabilities for internally and externally oriented business intelligence. Internally-oriented business intelligence is focused on processing internal information in a multifunctional, production and quality control area thus improving operational efficiency and production of reliable products, while external-oriented business intelligence is focused on the external environment, such as customer requirements that allow organizations to respond to market changes in a timely. In the current study, the researcher has identified the business intelligence capabilities based on Chen and Lin, (2020); Torres et al. (2018). First, Sensing capability refers to the ability of the organization to detect, interpret, and pursue opportunities in the environment, as business units are supposed to sense the environment to gather information on market needs, competitive movements, and contemporary technology to identify opportunities for new products and services (Conboy et al., 2020). The Sensing capability includes three actions: generation of information linked to the identification of customer needs, response to market trends and identification of market opportunities, disclosure of resource combinations, dissemination of information associated with the dissemination of market information, as it relates to the interpretation of market information, awareness of events and developments, exploration of opportunities, response to information associated with initial plans for access to information, and follow-up of specific market sectors with plans to exploit new opportunities (Kar and Dwivedi, 2020). Second, Transforming capability represents the ability to prepare or guide business firms on time to make effective changes and enhance their competitive advantages (Kar and Dwivedi, 2020). Chen and Lin (2020) assert that business intelligence is a technology-supported data analysis process that collects fragmented data and transforms it into information or knowledge about organizational goals, opportunities, and the operating environment, which enables organizations to significantly enhance their capabilities to survive and grow in highly competitive markets (Conboy et al., 2020). Finally, Driving capability represents the potential to drive data processing and create new knowledge that will help all stakeholders reach cognitive consensus and overcome organizational red tape or resistance against change in decision-making (Božić and Dimovski, 2019). It is also a fundamental organizational ability to leverage knowledge to drive product innovation, process reengineering, and improved decision-making (Chen and Lin, 2020).

Business Analytics

Business analytics represents the process of transforming data into insights to improve decision-making and relies heavily on statistical, quantitative, and operational analysis (Trkman et al. 2010). Data management, data visualization, predictive modeling, data mining, prediction simulation, and optimization enable the optimal delivery of results (Power et al. 2018). According to Li et al. (2022), business analytics includes a combination of identifying new patterns and relationships with data mining, using quantitative and statistical analysis to design

business models, conducting multivariate testing based on the results, forecasting future business needs, performance and industry trends using predictive modeling, and communicate the results in easy-to-understand reports to management and customers.

Khan, et al. (2022) also confirm that business analytics works to increase the efficiency of the organization by using various analytical methods to reduce operational costs and ideally predict market trends. According to O'Neill and Brabazon (2019), the importance of business analytics emerges through transforming primary data into more valuable inputs to benefit from this information in decision-making, obtaining a deeper understanding of the primary and secondary data emerging from the organization's activities, helping organizations improve their procedures, increasing productivity, assisting in decision making and improving efficiency in addition to achieving more profits.

Business agility

The philosophy of agility was born in the 1990s in software development as a way to deliver software (value) to the customer with greater speed and flexibility (Juneja, et al., 2018). Agility represents a movement that began in 2001 as a set of values and principles. Over time, the term agility has become a commonly cited business necessity and has spread to different sectors (Haider et al. 2021).

Ghasemaghaei et al. (2017) confirmed that business agility represents the key to success in a dynamic business environment; that it reflects the level of ability to implement changes and take advantage of opportunities in an environment characterized by high uncertainty. Business agility has been described as the flexibility and speed of a business organization, which gives it the ability to change its activities in order to respond to changes occurring in its markets and confront the risks it faces (Chen and Siau, 2020).

In the current study, the researcher has identified business agility based on Chakravarty et al. (2013); Lu and Ramamurthy (2011). First, entrepreneurial agility which represents the ability to proactively anticipate and seize market opportunities, allowing the organization to adjust its positions and strategies and organize new business methods to gain advantages under changing circumstances (Chakravarty et al. 2013). Lu and Ramamurthy (2011) confirmed that entrepreneurial agility comes from several resources, namely current and past experiences, practices that lead to innovation, and the opportunity for an event to occur that makes the entrepreneur realize a specific need that has not been satisfied. Second, adaptive agility that represent by the organization's ability to detect and respond to market dynamics in a proactive manner (Chakravarty et al. 2013). Lu and Ramamurthy (2011) confirmed that the picture of many organizations' adaptation to changes in the environment (namely the external environment) is framed by absorbing those changes when setting their goals and finding mechanisms to meet them and prepare to confront them. The secret of the success achieved by organizations is their ability to adopt adaptive agility. Adaptation means the organization's ability to predict the internal and external problems it will face in the future and find ways to control them as much as possible (Doeze Jager - van Vliet, et al., 2022).

Business intelligence capabilities and Business agility

Several scholars have agreed to the vital role played by Business intelligence capabilities in Business agility. Kuilboer et al. (2016) explained that business intelligence capabilities enhance organizational agility and thus improve the performance levels of organizations. Calderon et al. (2017) revealed that agile organizations have optimal business intelligence outcomes. AL-Hanandeh (2020) also concluded, through analyzing data for (62) executives, information technology, and the business intelligence team, that business intelligence capabilities have a strong and positive impact on organizational agility. Aly et al. (2021) confirmed that business intelligence has a positive and direct impact on organizational agility. Finally, Mortezaei et al. (2022) explained that organizations that use business intelligence possess high agility, which is reflected in their ability to respond to environmental changes and transform environmental threats into available opportunities. Hence, our conceptual model proposes this direct effect as our first study hypothesis:

H₁. Business intelligence capabilities is positively related to Business agility.

Business intelligence capabilities and Business Analytics

Based on an empirical study of the relationship between Business intelligence capabilities and Business analytics, Božič and Dimovski's (2020) confirmed that the relationship between business intelligence and business analytics is positively related to enhancing absorptive capacity, thus enhancing knowledge generation. Zhao's (2021) also explained that business analytics enables organizations to effectively analyze the data generated from business intelligence programs, which is reflected in improving their performance and thus makes them distinct competitive organizations. Bany Mohammad et al. (2022) confirmed that the positive correlation between business intelligence and business analytics enhances the ability of banks to complete their work and achieve their goals linked to certain performance levels. Based on these ideas, the second study hypothesis is derived:

H₂. Business intelligence capabilities is positively related to Business analytics.

Business analytics and Business agility

By reviewing the literature related to the relationship between Business Analytics and Business agility, it was found that business analysis strongly affects the agility of the organization by increasing the quality of information and creativity (Afsharia et al. 2019). Khan et al. (2022) explained that business analysis improves the quality of information and creative energy, whose role is reflected in influencing the agility of the organization. This confirms that business analysis has a positive relationship with organization agility (Li et al. 2022). The expected relationship between Business Analytics and Business agility in the following hypothesis

H₃. Business analytics is positively related to Business agility.

The Mediating Role of Business Analytics

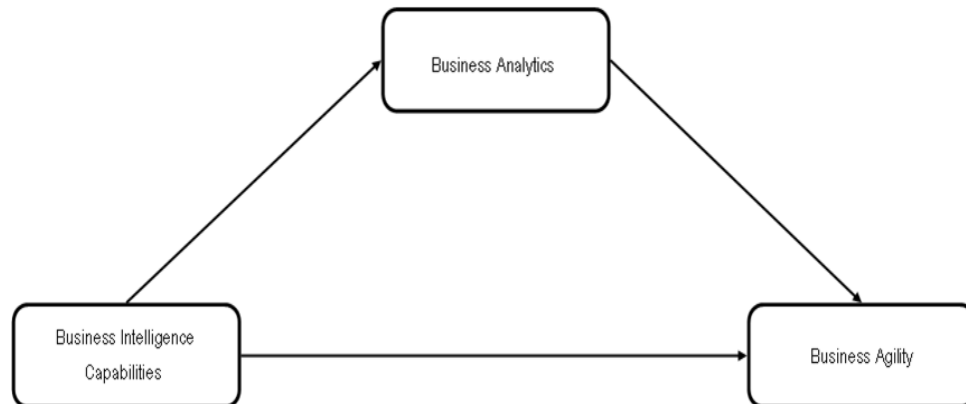
It can be speculated that in the transmission mechanism of Business intelligence capabilities → Business analytics → Business agility. Therefore, increasing awareness of the benefits of both business intelligence and business analytics capabilities will reflect positively on business agility, and following business analytics plays a positive role in achieving business

agility. The proposed relationship between Business intelligence capabilities, Business analytics, and Business agility is captured in the following hypothesis:

H4. Business analytics mediates the relationship between Business intelligence capabilities and Business agility.

The proposed conceptual model is presented in Figure 1.

Figure 1 Conceptual model



Methods

Instrument Development

After conducting a thorough assessment of the existing research, a survey instrument was created to investigate the specific variables that are of interest. The survey had 36 measures to gather data on the three primary research variables. The measurement items in our model consist of perception measures of opinions from three administrative levels. These measures have been demonstrated to meet the criteria for reliability and validity (Ketokivi & Schroeder, 2004). The survey items were rated on a five-point Likert scale, with 1 representing strong disagreement, 3 representing neutrality, and 5 representing strong agreement. The operationalization of business intelligence capabilities was achieved by utilizing a set of 15 items derived from the works of Chen and Lin (2020) and Torres et al. (2018). The initial five items employed to assess the sensing capabilities. The five additional items are employed to assess the transformation capabilities. The third set of five tasks is utilized to assess driving capabilities. The text refers to a list of 10 business analytics items, which are based on the works of Li et al. (2022) and Power et al. (2018). The measurement of Business agility was implemented using eight questions that were modified from the scales developed by Chakravarty et al. (2013) and Lu and Ramamurthy (2011). The initial four items pertain to entrepreneurial agility. The next four items pertain to adaptable agility.

Content and Face Validity

To guarantee the accuracy and credibility of the survey questions, a group of four specialists in the field assessed the measurement instrument for its content and face validity. The group assessed the questionnaire to ensure it was easily understandable, clear, and

comprehensive (Dillman, 2000). The feedback obtained from the panel was utilized to modify the questionnaire and enhance the tool's readability and its ability to gather relevant data.

Data Collection

Surveys were conducted by email among the three hierarchical levels of administration (upper, middle, and lower) in Jordanian mobile telecommunications companies. A total of 278 questionnaires were distributed, out of which 263 were returned. The investigators had to eliminate 9 surveys because they included inadequate information. Out of the 257 questionnaires received, 92.44% were considered effective and usable.

Data Analysis

A basic descriptive analysis of the 257 usable responses was performed. The means and standard deviations for the different scales and survey items used in this study are presented in Table II.

Table II Survey items descriptive statistics

Measurement item	Mean	SD
<i>Business Intelligence Capabilities (Cronbach's alpha = 0.915)</i>		
BIC1	4.144	0.926
BIC2	4.160	0.880
BIC3	4.195	0.898
BIC4	4.051	0.871
BIC5	4.121	0.887
BIC6	4.004	0.929
BIC7	4.074	0.814
BIC8	3.716	1.020
BIC9	3.868	0.975
BIC10	4.125	0.824
BIC11	3.988	1.006
BIC12	3.984	0.960
BIC13	4.074	0.909
BIC14	4.086	0.910
BIC15	4.023	0.892
<i>Business Analytics (Cronbach's alpha = 0.862)</i>		
BA1	4.043	0.932
BA2	3.844	1.011
BA3	4.202	0.823
BA4	4.195	0.880
BA5	4.265	0.800
BA6	3.798	0.979
BA7	3.739	0.918
BA8	3.965	0.928
BA9	3.977	0.897
BA10	3.922	0.876
<i>Business Agility (Cronbach's alpha = 0.877)</i>		
BAG1	4.105	0.910
BAG2	4.132	0.874
BAG3	4.109	0.921
BAG4	4.132	0.930
BAG5	4.121	0.908
BAG6	4.093	0.897
BAG7	4.008	0.879
BAG8	4.000	1.012

Scale Reliability and Convergent Validity

Internal consistency was evaluated by computing Cronbach's alpha coefficients. The Cronbach's alpha coefficient for the Business Intelligence Capabilities scale was 0.915, whereas it was 0.862 for the Business Analytics scale and 0.877 for the Business Agility scale. The estimations above the recommended benchmark of 0.70 proposed by Hair et al. (2017), demonstrate a high level of internal consistency among the items in the scale. Convergent validity was assessed by calculating the Average Variance Extracted (AVE), whereas stability was assessed by calculating the Composite Reliabilities (CR).

Table III. Cronbach's alpha, EFA, composite reliabilities and average variance extracted

Construct	Loadings	Composite Reliability	Average Variance Extracted
Sensing capabilities ($\alpha = 0.784$)	0.895	0.760	0.553
Transformation capabilities ($\alpha = 0.802$)	0.893	0.807	0.662
Driving capabilities ($\alpha = 0.860$)	0.872	0.860	0.772
Business analytics ($\alpha = 0.862$)	0.890	0.864	0.772
Entrepreneurial agility ($\alpha = 0.830$)	0.901	0.837	0.751
Adaptable agility ($\alpha = 0.811$)	0.893	0.810	0.691

* Average Variance Extracted (AVE) = $\frac{\sum (\text{Squared Multiple Correlations})}{\sum (\text{Squared Multiple Correlations})^2 + \sum (1 - \text{Squared Multiple Correlations})}$

** Composite Reliability (CR) = $\frac{\sum (\text{Factor Loading})^2}{\sum (\text{Factor Loading})^2 + \sum (1 - \text{Squared Multiple Correlations})}$

Table III shows that the AVE values for the dimensions of business intelligence capabilities, business analytics, and Business Agility were found to be greater than 0.50. This aligns with the recommendation by Malhotra and Stanton (2004) that AVE values should exceed 0.50 to ensure accurate scale construction. The table also demonstrates that the CR values for the dimensions of business intelligence capabilities, business analytics, and Business Agility are all above 0.70. This aligns with the recommendation by Hair et al. (2017) that CR values should exceed 0.70 to indicate strong internal consistency.

Evaluation of Model Assumptions

To check that there are no collinearity assumptions. The study analyzed Variance Inflation Factors (VIFs) and Tolerance to assess the presence of collinearity. Practitioners consider VIF values exceeding 10 to indicate serious multicollinearity (Stevens, 2012). Tolerance levels above 0.05. The VIF scores for Sensing capabilities, Transformation capabilities, and Driving capabilities were 2.293, 2.264, and 2.406, respectively. These results indicate that there was no issue of collinearity with the survey data. All the tolerance values exceed 0.05. Table V presents the findings from the assessment of model assumptions.

Table V Results of the evaluation of Model Assumptions.

Independents Variables	Tolerance	VIF
Sensing capabilities	2.174	.4600
Transformation capabilities	2.199	.4550
Driving capabilities	2.479	.4030

Results

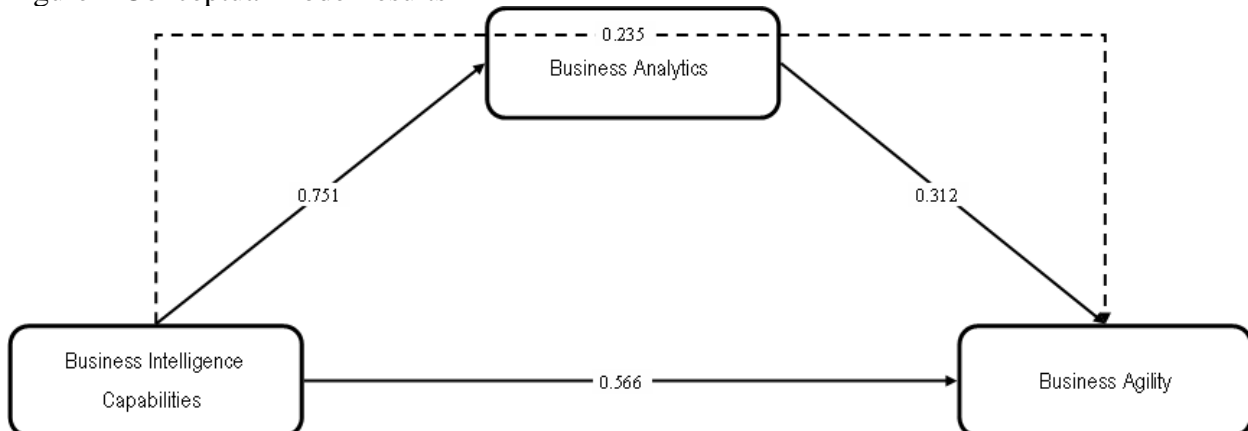
Various statistical analyses were employed to test the hypotheses and assess each component of the proposed mediation model. Table VI presents the findings of the direct and indirect effect (Path Analysis) between Business intelligence capabilities, Business analytics, and Business agility.

Table VI Results of the direct and indirect effect

Hypotheses	Effect Paths	Effect type	Direct Effect Values		Indirect Effect Values		Total Effect	VAF	
			Effect value	P	Effect value	P		Effect Ratio	Direction of effect
H1	BIC → BAG	Direct	0.566	***	-	-	0.801	29.33	Partial
H2	BIC → BAN	Direct	0.751	***	-	-			
H3	BAN → BAG	Direct	0.312	***	-	-			
H4	BIC → BAN → BAG	Indirect	-	-	0.235	***			

The findings of the study show that there is a direct effect between business intelligence capabilities and business agility. The estimate value is 0.566 and the p-value is statistically significant. H1 is compatible. The results of the test of (business intelligence capabilities positively related to business analytics) show a statistically significant positive effect. The estimate is 0.751 and the p-value is ***. H2 is compatible. Subsequently, by doing the H3 test, it was found that there is a statistically significant effect of business analytics on business agility (Estimate = 0.312 and P-value = ***). H3 is compatible. The mediational hypothesis (H4) is validated by the results, indicating that business analytics is positively mediated in the relationship between business intelligence capabilities and business agility. The findings suggest that business analytics plays a partial mediating role in the relationship between business intelligence capabilities and business agility, as shown by Hair et al. (2017). Figure 2 provides a concise overview of the findings from the study.

Figure 2 Conceptual model results



Discussion and implications for research and practice

The results reported in this research have significant implications from both a scholarly and managerial perspective. From a managerial perspective, there has been less focus on the relationship between business intelligence capabilities and business analytics, even though business analytics plays a crucial role in decision-making and future planning (Ashrafi et al., 2019). The present study regards business intelligence capabilities as an antecedent to business analytics and illustrates that a company's business intelligence capabilities, which encompass a range of technologies, contribute to enhancing business agility through business analytics. The survey done in this study reveals that business analytics has a significant effect on business agility. Organizations are compelled to utilize various types of business analytics due to their positive contribution in achieving business agility. The results of this study suggest that having business intelligence capabilities is a factor that comes before the processes involved in business analytics, which in turn, allows for the achievement of business agility.

The results of this study also have significant consequences for managers. Firstly, companies that possess business analytics are structured in a manner that guarantees the preservation of prudence, the capability to effectively arrange, and the procedures necessary to execute appropriate actions. To enhance business agility, it is important to meet the requirements of effectively contributing to long-term flexibility. This can be achieved by transferring strategic assets to adjust market position, adapting business systems to handle unexpected events, and understanding and assimilating successive environmental changes.

Conclusion, study limitations, and research agenda

This study aimed to experimentally investigate the mediating role of business analytics in the relationship between business intelligence capabilities and business agility. To accomplish the designated study objective, a survey instrument was created, information was gathered from over 257 questionnaires, and a theoretical framework was constructed to examine the research hypotheses. The empirical findings indicate that business analytics has a partial effect on the relationship between business intelligence capabilities and business agility.

Several possible limitations of this study warrant investigation. The first limitation is that all participants were exclusively from Jordan. This issue may restrict the applicability of the study findings to other countries. An investigation into the impact of business intelligence capabilities and business analytics on corporate agility across various countries through empirical study. All measures utilized in the study pertain to management's assessment of business intelligence capabilities, business analytics, and business agility concerning the survey. Perception measurements of managers' opinions have demonstrated their adherence to the standards of reliability and validity.

Further investigation is warranted to analyze how technical expertise acts as a mediating in the relationship between business intelligence capabilities and business agility. Despite these limitations, this study makes valuable contributions to both management and academic domains,

has significant research consequences, and serves as a relevant foundation for future empirical research on a current study issue.

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