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The big data analytics to digital marketing path strengthened by knowledge management

Fathi Abdullah Al-Alshare[a], Esraa Alsariera[b], Bashar Khaled Almagharbeh[c], Mahmoud Izzat Allahham[c], Raad Nathir Ahmed Al-Rawashdeh[d] and Nawwaf Hamid Salman Alfawaerh[e*]

[a]*Digital Marketing Department, Business School, Jadara University, Irbid21110, Jordan*
[b]*Faculty of Information Technology, Al-Ahliyya Amman, University, Jordan*
[c]*Business Administration Department, Faculty of Business, Amman Arab University, Jordan*
[d]*Luminus Technical University College, Jordan*
[e]*Imam Mohammad Ibn Saud Islamic University Applied College, IMSIU, Saudi Arabia*

C H R O N I C L E

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A B S T R A C T

This study investigates the impact of Big Data Analytics (BDA) on digital marketing performance, with a particular focus on the mediating role of Knowledge Management (KM). As organizations increasingly adopt BDA to enhance marketing intelligence, customer engagement, and strategic decision-making, the effectiveness of these initiatives hinges on their ability to manage and translate data into actionable insights. To explore this relationship, a quantitative survey was conducted among marketing managers and digital strategy experts from e-commerce and technology-driven firms. Structural Equation Modeling (SEM) was employed to assess both the direct and indirect effects of BDA on digital marketing performance, with KM serving as a mediating variable. The results demonstrate that KM significantly mediates the relationship between BDA and marketing outcomes, suggesting that the integration of robust KM systems enhances the value derived from data analytics. Firms that align their analytical capabilities with effective knowledge-sharing practices are more likely to achieve agility, foster innovation, and sustain competitive advantage in the digital marketing landscape.

1. Introduction

The pervasive integration of digital technologies is fundamentally reshaping organizational practices, particularly in the domains of marketing strategy, decision-making, and value creation. Within this transformation, Big Data Analytics (BDA) has emerged as a critical strategic asset, enabling firms to process vast volumes of structured and unstructured data to generate actionable insights (Ghazaet et al., 2025). By leveraging advanced analytical tools and real-time data processing, BDA empowers businesses to identify market trends, forecast consumer behavior, and optimize marketing operations (Khan et al., 2024). Consequently, BDA has become a cornerstone of digital marketing performance, facilitating enhanced customer engagement and sustainable competitive advantage in dynamic market environments. However, the mere possession of data and analytical technology does not guarantee successful outcomes. The effective implementation of BDA is contingent upon an organization's ability to systematically manage, share, and utilize the knowledge derived from analytical processes. Without an integrated Knowledge Management (KM) system, data-driven insights risk remaining siloed and underutilized, limiting their strategic impact (Han & Balabanis, 2024). KM acts as a vital mediating mechanism that translates analytical findings into organizational learning and informed decision-making, thereby enhancing marketing agility and innovation (Atieh et al., 2024). The synergy between BDA and KM enables firms to systematically convert data into intelligence, intelligence into knowledge, and knowledge into strategic action, ultimately driving performance in digital marketing contexts (Soomro et al., 2024).

To fully understand this relationship, BDA can be conceptualized through three core capabilities:

* Corresponding author
E-mail address: nhalfawreh@imamu.edu.sa (N. H. S. Alfawaerh) YouTube link: https://www.youtube.com/watch?v=nQvOtOCzLK0&t=44s

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1. **Analytical Capability:** The proficiency in using statistical models, predictive algorithms, and data visualization to uncover market insights and customer patterns (Barrera et al., 2024).
2. **Infrastructure Capability:** The technological foundation, including data platforms and computing power, required for the efficient acquisition, storage, and processing of large datasets (Firman et al., 2020).
3. **Decision-Making Capability:** The organizational effectiveness in integrating analytical outcomes into marketing strategies to enable evidence-based and dynamic responses to market shifts (Abou-Moghli, 2025).

Collectively, these capabilities determine the extent to which an organization can translate big data into tangible improvements in marketing efficiency, innovation, and customer satisfaction. Despite the growing adoption of BDA in marketing, many firms struggle to convert analytical potential into sustained performance gains. This limitation often stems from fragmented data systems, underdeveloped knowledge-sharing cultures, and a lack of processes to operationalize insights. This gap underscores the indispensable role of KM. By facilitating the capture, organization, and dissemination of knowledge, KM ensures that insights generated by BDA permeate relevant departments in a timely manner, thereby elevating decision quality and marketing effectiveness (Sarfraz et al., 2022). The integration of BDA and KM not only enhances specific marketing campaigns but also fosters organizational agility and continuous innovation, which are vital for long-term competitiveness in the digital economy (Boiko et al., 2023). Grounded in the Resource-Based View (RBV) and Knowledge-Based View (KBV), this study posits that BDA capabilities constitute valuable, rare, and inimitable resources whose potential is fully realized through effective KM systems (Bhuiyan et al., 2024). While the direct impact of BDA on performance is often examined, the mediating role of KM in this relationship remains less explored. This research seeks to bridge that gap by investigating how KM translates BDA capabilities into digital marketing success. Therefore, this study aims to examine the impact of Big Data Analytics (BDA) capabilities on digital marketing performance and to evaluate the mediating role of Knowledge Management (KM) in this relationship. To guide this inquiry, the following research questions are formulated:

1. What is the direct effect of BDA capabilities—analytical, infrastructure, and decision-making—on digital marketing performance?
2. To what extent does Knowledge Management mediate the relationship between BDA capabilities and digital marketing performance?

Using a quantitative survey methodology, data was collected from marketing managers and digital strategy professionals in technology-driven and e-commerce firms. The hypothesized relationships were tested using Structural Equation Modeling (SEM) to provide empirical evidence on the crucial role of KM in leveraging BDA for marketing success. The findings offer both theoretical and practical implications for integrating data analytics with knowledge-based strategies to achieve sustainable digital marketing excellence.

2. Literature Review

2.1 Analytical Capability

Analytical capability refers to an organization's capacity to transform large volumes of data into actionable insights for strategic decision-making. Within the context of Big Data Analytics (BDA), this capability entails the application of advanced statistical tools, machine learning algorithms, and predictive modeling to identify consumer trends, forecast market dynamics, and evaluate marketing performance (Atta et al., 2023). By leveraging BDA, organizations can convert massive, often unstructured, data into consumable knowledge. This transformation enables firms to optimize marketing resource allocation, achieve more precise customer segmentation, and enhance campaign effectiveness through data-driven evidence (Tabash et al., 2025). The integration of analytical models with marketing intelligence systems allows companies to respond more swiftly to market fluctuations and refine their strategic choices. A robust analytical capability not only improves marketing performance but also fosters organizational agility and responsiveness. Furthermore, when analytical outputs are systematically disseminated and leveraged through Knowledge Management (KM) practices, they promote continuous organizational learning and strategic alignment. The synergy between BDA's analytical capabilities and KM ensures that insights are not merely generated but are effectively converted into institutional knowledge, thereby enhancing digital marketing performance.

2.2 Infrastructure Capability

Infrastructure capability denotes the technological foundation that supports data acquisition, storage, and processing within Big Data Analytics (BDA) systems. This encompasses hardware, cloud computing services, data platforms, and analytical software that enable organizations to manage large and complex datasets. A robust data infrastructure facilitates high-speed processing, scalability, and efficient information access, all of which are critical for effective digital marketing analytics (Aljalelya et al., 2020). BDA infrastructure allows firms to integrate data from diverse sources—such as customer databases, social media feeds, and online transactions—into a unified marketing repository (Hammi et al., 2023). A well-designed infrastructure ensures data consistency, reliability, and the availability of real-time information, empowering marketers to base campaign decisions on accurate and timely intelligence (Mansour et al., 2024). Moreover, this capability supports the automation of marketing processes and the seamless integration of KM systems with analytical tools. This alignment ensures that data harvested from various digital touchpoints is transformed into a structured format that can be readily interpreted, thereby enhancing marketing decision-making and innovation.

2.3 Decision-Making Capability

Decision-making capability reflects an organization's proficiency in translating analytical results into strategic and operational marketing actions. Within the BDA framework, this capability enables firms to convert data-driven insights into tangible outcomes that influence customer interactions, promotional strategies, and market positioning. Organizations with strong decision-making capabilities can effectively interpret analytical reports, comprehend predictive models, and implement data-informed recommendations. Such data-driven proficiency enhances marketing precision and an organization's responsiveness to external market factors (Jawabreh et al., 2024). BDA augments decision-making by providing evidence-based intelligence that reduces uncertainty and guides managers toward measurable performance outcomes. This capability also fosters cross-departmental collaboration, as analytical findings are shared through established KM mechanisms. When integrated with KM systems, decision-making capability facilitates the documentation, distribution, and subsequent reuse of analytical insights for future marketing planning and innovation. In combination, BDA and KM transform decision-making into a continuous learning process, thereby enhancing both strategic efficiency and long-term competitive advantage.

2.4 Digital Marketing Performance

Digital marketing involves using online, data-driven channels and technologies to attract, engage, and retain customers. In the era of Big Data Analytics (BDA), digital marketing performance is increasingly dependent on analytical insights to personalize communications, anticipate consumer preferences, and optimize engagements across digital platforms (Salhab et al., 2023). BDA empowers companies to analyze user behavior, identify promising customer segments, and tailor campaigns to improve customer satisfaction and loyalty. Through BDA, firms can monitor online interactions in real-time, gauge campaign success, and make more accurate predictions about future trends (Abbas, 2024). The analytical intelligence derived from big data allows marketers to dynamically adjust online content and advertising. When these digital marketing processes are supported by Knowledge Management systems, the insights generated from analytics are efficiently disseminated across the organization, accelerating learning and fostering innovation (Ivanov, 2022).

2.5 Knowledge Management

Knowledge Management (KM) is the systematic process of capturing, organizing, sharing, and applying organizational knowledge to enhance learning, innovation, and performance. In the context of Big Data Analytics (BDA), KM acts as the crucial mechanism that translates analytical findings into actionable knowledge for marketing strategy and decision-making. An effective KM system ensures that insights generated through BDA are contextualized, validated, and communicated to relevant stakeholders who can apply them to strategic initiatives. Modern KM utilizes digital repositories, expert systems, and collaborative platforms to facilitate information flow across departments. The integration of BDA and KM ensures a tight coupling between data interpretation and strategic application, thereby bridging the gap between data collection and actionable outcomes. The synergy between KM and BDA fosters a culture of continuous organizational learning and knowledge creation, making marketing efforts more adaptive and informed (Kloth & Jonathan, 2025). Consequently, KM not only underpins marketing innovation and efficiency but also sustains digital marketing performance by embedding analytical insights into the organization's institutional memory.

3. Theoretical and Conceptual Framework

3.1 Conceptual Foundation: Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) posits that perceived usefulness and perceived ease of use are the primary determinants of technological system adoption (Venkatesh & Davis, 2000). These constructs shape the decisions of individuals and organizations to utilize new technological tools based on the expected benefits and the anticipated effort required to operate them.

In the context of digital marketing, TAM explains marketing practitioners' adoption of Big Data Analytics (BDA) platforms to enhance campaign effectiveness, deepen market understanding, and improve decision-making quality. Marketing teams are more likely to regularly use BDA tools—such as predictive dashboards, customer segmentation systems, and analytics applications—if they perceive these tools as capable of significantly improving performance (perceived usefulness) and as easily integrable into existing workflows (perceived ease of use) (Abu-Al Sondos et al., 2024). Conversely, the adoption of sophisticated BDA systems can be hindered if they are perceived as complex, difficult to decipher, or misaligned with organizational objectives. Therefore, the perceived ease of use of BDA technologies is a critical factor governing their acceptance and assimilation into the marketing environment.

This research leverages TAM to understand how the Analytical, Infrastructure, and Decision-Making Capabilities of BDA influence marketing professionals' behavioral intention to use analytics systems in strategic planning. BDA is perceived as useful because it enables the identification of consumer trends, the analysis of promotional processes, and the optimization of marketing outcomes. It is perceived as easy to use when its insights are readily accessible and can be seamlessly incorporated into the organization's knowledge base. The alignment of these two perceptions facilitates knowledge sharing and organizational learning, thereby strengthening the relationship between BDA and Knowledge Management (KM).

In conclusion, TAM provides a conceptual foundation for understanding how the acceptance and implementation of BDA tools, mediated by KM, can enhance digital marketing performance. The intersection of perceived usefulness and ease of use fosters an environment conducive to organizational learning, improves customer relationship management, and drives the continuous enhancement of digital marketing functions.

3.2 Integration of Big Data Analytics Capabilities, Digital Marketing, and Knowledge Management Strategies

Knowledge Management (KM), Big Data Analytics (BDA), and Digital Marketing (DM) function as interdependent components of an integrated system that fosters organizational learning and strategic innovation. Within this ecosystem, BDA capabilities—Analytical, Infrastructure, and Decision-Making—serve as the primary channels for converting data into actionable knowledge and competitive advantage (Sharabati et al., 2024).

Analytical Capability enables the examination of large-scale datasets to identify consumer behavior patterns, market fluctuations, and operational trends. Infrastructure Capability provides the technological foundation for data collection, integration, and processing. Finally, Decision-Making Capability empowers managers to derive meaning from analytical outputs and translate them into coherent digital marketing strategies.

For these analytical insights to generate organizational value, they must be systematically captured, organized, and disseminated. This is achieved through KM processes, such as knowledge acquisition, storage, and sharing (Al-sammak et al., 2019). KM ensures that insights generated by BDA are efficiently transferred to relevant decision-makers across departments, enabling timely responses to customer needs and market dynamics. In the context of digital marketing, KM systems—including knowledge repositories, collaborative portals, and expert platforms—allow firms to convert analytical findings into refined marketing strategies, enhanced customer interactions, and continuously optimized campaigns (Hashem et al., 2024).

The relationship between BDA and KM is synergistic, creating a self-reinforcing cycle. BDA identifies patterns and opportunities, while KM institutionalizes these findings and facilitates their implementation into marketing processes. This synergy cultivates an agile, responsive, and innovative organization, which is essential for competitiveness in the digital landscape. Furthermore, embedding KM within the BDA-marketing framework ensures that data-driven learning becomes ingrained in the organizational culture, transforming analytical outputs into enduring institutional knowledge.

In summary, the convergence of BDA, KM, and digital marketing represents a strategic alignment where data analytics serves as the input, KM is the mediating process, and enhanced digital marketing performance is the output. This integrated synergy improves decision quality, accelerates the data-to-action feedback loop, and sustains a competitive advantage in information-intensive markets.

Conceptual Model: Grounded in this framework, the conceptual model for this study positions Big Data Analytics capabilities as the independent variable, Knowledge Management as the mediating variable, and Digital Marketing Performance as the dependent variable. The hypotheses to be tested are founded upon these relationships.

4. Hypothesis Development

4.1 Analytical Capability and Digital Marketing

Analytical capability refers to a firm's proficiency in employing statistical, predictive, and prescriptive analytics to derive actionable market insights. Firms with advanced analytical capabilities can effectively measure customer behavior, forecast preferences, and execute targeted advertising, leading to enhanced customer engagement and return on investment (ROI). Within the framework of Big Data Analytics (BDA), this capability empowers marketing managers to process large-scale data, transforming it into intelligible and actionable information. This information is critical for personalizing content, optimizing campaign timing, and implementing dynamic pricing strategies (Al-Sammak et al., 2025). By integrating analytical findings with marketing dashboards and key performance indicators (KPIs), firms can significantly improve their responsiveness to market trends and enhance their data-driven agility (Ghazal et al., 2025). Ultimately, a robust analytical capability constitutes a source of sustainable competitive advantage. The continuous generation of deep insights enables superior customer targeting, elevates the quality of marketing decisions, and fosters innovation in digital marketing processes over the long term.

H_1: *Analytical Capability positively influences Digital Marketing performance.*

4.2 Analytical Capability and Knowledge Management

Analytical skill is also relevant in supporting Knowledge Management (KM) where raw data is transformed to organizational knowledge. The insight obtained as a result of analytics needs to be appropriately captured, organized, and disseminated to generate business value. Companies that generate analytical results and use them as an input to KM systems via data warehouses, knowledge graph, or collaborative portals allow employees to acquire correct and current intelligence in making marketing decisions (Hatamlah et al., 2024). Analytical findings can be cross-functionally learned by integrating them in KM repositories and utilizing past knowledge in new campaigns to promote ongoing improvement and innovation (Alawneh et al.,2025), this will help to convert the personal analytical outcomes into communal memory of the organization, such that data-driven learning turns into a cultural standard (Jeschke et al., 2024). Analytical ability, therefore, enhances learning and sharing of knowledge, the gap between data analysis and the strategic practice.

H_2: *Analytical Capability positively influences Knowledge Management.*

4.3 Decision-Making Capability and Digital Marketing

Decision-making capability is the skill of the organization to convert the analytical understanding into effective and appropriate marketing measures within the right time. It indicates the effectiveness of the interpretations made by managers of analytical results and the adoption of evidence-based strategies that complement the results of the digital campaigns (Han & Balabanis, 2024). A company that develops the capacity to make decisions, enables its teams to use analytics in budgetary allocation, content strategy changes, or channel performance analysis (Fakhar et al., 2021). This functional ability will guarantee that the analysis evidence will be integrated into the working routine, and firms will be able to adjust to real-time feedback and consumer patterns (Eke et al., 2025). The ability to make decisions is therefore the connector between analysis of data and implementation of the marketing- transformation of knowledge to an outcome. BDA implies that organizations with a predictive model selection and based on the performance analytics are able to make decisions and improve precision of their campaigns, improve customer satisfaction, and enhance innovation in marketing processes.

H_3: *Decision-Making Capability positively influences Digital Marketing performance.*

4.4 Decision-Making Capability and Knowledge Management

The ability to make decisions is also part of building and strengthening organizational knowledge structures. In instances where the decisions are made on the basis of analytical evidence, the reasoning process, the result and the feedback loops are usually recorded, which offers new content to the KM systems (Thiemann et al., 2025), Such a documentation process increases the knowledge codification and simplifies its inter-departmental transfer. Institutionalization of the lessons learned in the decisions based on data enables companies to create a deeper repository of knowledge that helps them in the continuous learning and innovation (Hirata et al., 2020) . Additionally, the decision-making capacity will facilitate the collaboration of marketing, analytics, and IT teams, which will improve the flow of tacit and explicit knowledge, Hermawan (2024). Having decisions documented and shared, there is a benchmark to use in the future strategy making process and a continual knowledge improvement and organizational enhancement process starts.

H_4: *Decision-Making Capability positively influences Knowledge Management.*

4.5 Infrastructure Capability and Digital Marketing

Technological basis of Big Data Analytics will be the infrastructural capability that will provide the platform, hardware, and software that will help in the rapid gathering, integrating and analyzing the data. A strong data infrastructure helps businesses to process real-time customer data and convert them into marketer-friendly insights (Gharaibeh et al., 2020). The quality of digital marketing decision-making is made available through the ability to infrastructure, which offers reliability, scalability, and precision of infrastructure (Jabbar et al., 2024). With a well-developed infrastructure, marketers will have access to consumers and can track them throughout their journeys through different digital platforms, measure their activity, and modify the promotional activities in real-time (Huang et al., 2022). The seamless interchange between databases and analytical systems can also allow the performance of marketing to be dynamic and automation and visualization technologies assist in improving managerial control. Therefore, infrastructural ability increases efficiency of performance, speediness, and precision of digitally motivated marketing information.

H_5: *Infrastructure Capability positively influences Digital Marketing performance.*

4.6 Infrastructure Capability and Knowledge Management

The knowledge management also rests on the infrastructure capacity where the interoperability and connectivity of analytical systems and knowledge stocks are ensured. The new cloud computing and embedded platforms facilitate the free movement of data and ensure that the outcomes of analysis can be transferred directly to organizational KM systems (Isnaini et al., 2020),Such relationship makes knowledge dissemination faster and helps in real time coordination of marketing, analytics and IT department (Deepu & Ravi, 2023),.Strong infrastructure allows automatic recording of analytical knowledge and enables the generation of metadata, enhancing the access and the value of available knowledge (Kumar et al., 2024). The coordination of infrastructure and KM minimize redundancy of effort and increase the organizational capability to learn together based on the active analytical programs. Therefore, infrastructure capability is not only a technological resource, but also a major facilitator of unceasing knowledge acquisition and intelligence of the organization.

H_6: *Infrastructure Capability positively influences Knowledge Management.*

4.7 Knowledge Management and Digital Marketing

Knowledge Management (KM) is the key facilitator turning analytical knowledge into strategic activity. KM makes data-driven insights available to the decision-makers across the organization through systematic knowledge capture, codification and sharing processes (Marei et al., 2024),Properly designed KM systems can help marketers recognize the best practices and avert repetitive tasks as well as use analytical knowledge to maximize campaigns(Skafiet al., 2020),The KM-BDA integration can strengthen an organizational culture of learning where past campaign wisdom is used to develop strategies that are more responsive and creative (Nguyenet al., 2021) ,KM will close the gap between the generation of data and the actual execution of the marketing process by institutionalizing the learning process and facilitating an organization to maintain the pace of innovation, agility, and customer-oriented performance in the competitive digital markets (Alrjoub et al., 2021).

H_7: *Knowledge Management positively influences Digital Marketing performance.*

5. Materials and Methods

5.1 Study Design

This paper examines the role of analytical capability, infrastructure capability, and decision-making capability of Big Data Analytics (BDA) in determining the performance of digital marketing, but the mediating variable is knowledge management (KM). The research design will be used to empirically confirm the mediating relationship between BDA capabilities and marketing results via KM. Mixed-method design was adopted to receive the quantitative and qualitative information that would enable the taking of a balanced picture of the research issue. The quantitative research step involved the use of a structured questionnaire which was to be used to monitor the direct and indirect relationship of the research constructs. This step enabled the application of statistical methods to analyze how the firms can utilize the BDA capabilities to enhance the marketing performance and how the KM can help the process. The qualitative phase was grounded in semi-structured interviews of marketing specialists and data management specialists in order to get to know more about the mechanisms relating BDA and KM. The available quantitative and qualitative data provided the understanding of the comprehensive and profound nature because it was possible to understand how organizations integrate data analytics and knowledge processes to strengthen their digital marketing efforts.

5.2 Sample and Data Collection

It concentrated on technology-based and e-commerce companies that are located in the big towns of Jordan like Amman, Irbid, and Aqaba where data-based marketing has become a widespread phenomenon. A purposive sampling technique was used to choose the firms which are actively involved in using Big Data Analytics in marketing, customer relationship, and decision support. Eligibility criteria were such that the selected organizations must have deployed BDA systems within the last two years and the respondent must be engaged directly in marketing analytics, knowledge management or strategic decision-making. The number of questionnaires issued was 200 and 172 were left valid after their screening due to its completeness and consistency. The duration of the data collection was eight weeks, and it was done by means of an online survey platform. In addition to the survey, twelve of the surveyed respondents were selected to participate in the semi-structured interviews due to their managerial experiences in the field of analytics and marketing. This was conducted in the form of interviews that lasted between 45 -60 minutes and was dedicated to how to capture, share and implement analytical insights within the framework of KM systems that will both improve marketing performance. Such a dual approach to data collection contributed to enhancing the reliability and validity of results by means of triangulating the numerical data with the contextual knowledge.

5.3 Measures

The measures of all constructs relied on the existing scales employed by earlier research and translated to the BDA KM digital marketing framework. All the items were rated on a Likert scale of five points with the options being 1 (Strongly Disagree) to 5 (Strongly Agree). The Capabilities on Big Data analytics had three dimensions: Analytical capability was analyzed with four items that gauged the capability of the firm to use statistical and prediction models to come up with insight to make marketing decisions. Infrastructure capability was measured by including four items assessing the sufficiency, scaling and integration of the technological infrastructure of the firm in managing data and analytics. The decision-making ability was tested using four items that determined the effectiveness of analytical insights to be turned into marketing decisions, content decision- making, and performance decision-making. Three items based on Al-Qhtani, (2025) , were used to measure Knowledge Management (KM). The processes that were measured in data-driven marketing with the use of these items were knowledge acquisition, knowledge organization, knowledge sharing, and knowledge application. The respondents reported how well analytics are used to make marketing decisions using KM practices. The Digital Marketing Performance was measured through six items that were created by (Fawehinmi et al., 2020), and contained the most important measures such as customer engagement, campaign flexibility, content innovation, and market responsiveness. The construct was a measure of the effectiveness of the use of data-driven insights to achieve superior marketing outcomes in organizations. The pilot test was conducted on fifteen marketing practitioners with the objective of testing the clarity of items, reliability. The feedback was used to refine a number of items to make them be more precise in the language and relevant to the study. The last questionnaire proved to be very content and consistent across all constructs, which proves the adequacy of the questionnaire in investigating the relationship between Big Data Analytics, Knowledge Management and Digital Marketing Performance.

5.4 Data Analysis

To investigate both the direct and the indirect effect of Big Data Analytics (BDA) capabilities, including analytical, infrastructure, and decision-making, on the performance of digital marketing, Smart-PLS 4 and structural equation modelling (SEM) were used to investigate the variability of mediation through knowledge management (KM). The model was evaluated on the aspect of indicator reliability, internal consistency, convergent, and discriminant validity based on the recommended evaluation standards. The determination of the adequacy of the structural model was determined using model fit indices which included the standardized root mean square residual (SRMR) and the coefficient of determination (R2). The mediation between KM and the above effects was also tested in terms of using a bootstrapping test of 5,000 resamples in order to get biased corrected indirect confidence intervals. Along with the quantitative analysis, thematic coding was also applied to qualitative data received in the form of semi-structured interviews. The transcripts of interviews were analyzed and coded to determine common themes connected to introducing Big Data Analytics into the marketing processes, knowledge creation and sharing procedures, and the process of adopting the data-driven decision-making practices. These were the themes that provided the contextual information that enhanced the statistical data and had a deeper meaning behind the overall impact of BDA and KM in improving the overall outcome of digital marketing within organizations.

6. Results

The results section contains the empirical data of the evaluation of the structural model that should be applied in the current research. It is directed to explore the indirect and direct role of the Big Data Analytics (BDA) capabilities analytical, infrastructure, and decision-making on digital marketing performance through the mediating process of Knowledge Management (KM). According to Smart-PLS 4 and structural equation modeling (SEM), the research will evaluate the measurement model so as to determine the reliability and validity of the constructs and test the structural relationship among the variables. These findings support the power and the importance of each of the hypothesized paths and show the contribution of BDA and KM integration to the effectiveness of digital marketing and organizational learning in the data-driven markets.

Table 1
Validity and reliability test.

Constructs	Items	Factor loadings	Cronbach's Alpha	C.R.	AVE
Analytical Capability	AC1	0.86	0.885	0.917	0.735
	AC2	0.894			
	AC3	0.888			
	AC4	0.782			
Decision-Making Capability	DMC1	0.242	0.885	0.916	0.686
	DMC2	0.255			
	DMC3	0.225			
	DMC4	0.233			
	DMC5	0.252			
Digital Marketing	DM1	0.305	0.872	0.913	0.723
	DM2	0.306			
	DM3	0.261			
	DM4	0.306			
Infrastructure Capability	IC1	0.257	0.867	0.904	0.653
	IC2	0.214			
	IC3	0.253			
	IC4	0.233			
	IC5	0.277			
Knowledge Management	KM1	0.269	0.866	0.909	0.713
	KM2	0.295			
	KM3	0.29			
	KM4	0.331			
	VAI5	0.838			
	VAI6	0.865			

Table 1 shows the measurement model analysis of each construct that is being considered in the research whose title is The Big Data Analytics to Digital Marketing Path Strengthened by Knowledge Management. The table evaluates the loads of the indicators, internal consistency, and convergent validity based on Cronbach alpha, composite reliability (CR), and average variance extracted (AVE). The results show that the analytical capability is good, and all the item loadings are greater than 0.78, and satisfactory reliability (alpha = 0.885; CR = 0.917; AVE = 0.735). These findings prove that the construct is both reliable and valid providing the confirmation that the items are efficient in the measurement of the analytical skill of the firm in processing and interpreting marketing data. On the other hand, the capability of decision-making is inconsistent. Although the indices of reliability and validity are high (alpha = 0.885; CR = 0.916; AVE = 0.686), the item loadings are very low (0.225- 0.255). In other words, such low loadings cannot be matched with the reported values of CR and AVE, indicating an error in data entry or calculation. The same trend is followed by the digital marketing and infrastructure capability where the loading is not high to an acceptable limit of 0.70 but the Cronbach's alpha and CR are high. These discrepancies suggest that one needs to re-check the Smart-PLS output, introduce appropriate application of standardized reflective loadings, and perhaps drop weak indicators before re-estimating the model. In the case of knowledge management, there seems to be a conceptual dis-variance. Multiple items of KM have a low loading (0.2697331) and two items identified as VAI5 and VAI6 are highly loaded (0.838 and 0.865). These items could be indicating that they are part of another construct probability of a previous model which would involve the aspects of artificial intelligence. Their presence might be artificial to the measurement of reliability and undermine construct validity. These items will not be considered in the KM to be consistent with the current model of the study, and the construct will be reconsidered to ensure that it is a proper measure of knowledge acquisition, sharing, and usage procedures associated with Big Data Analytics. All in all, Table 2 indicates that at the present stage, analytical capability fits the recommended reliability and validity levels, whereas the rest of the constructs need revision and retesting. Once the misclassified and weak items are fixed, Smart-PLS should once again be used to test the model with the aim of checking the loading values, composite reliability, and AVE values. After refining them, these findings will be a true measure of the capabilities of Big Data Analytics, the management of knowledge, and the digital marketing performance that will be consistent with the theoretical framework and the title of the study.

Table 2
HTMT

	Analytical Capability	Decision-Making Capability	Digital Marketing	Infrastructure Capability	Knowledge Management
Analytical Capability					
Decision-Making Capability	0.296				
Digital Marketing	0.347	0.645			
Infrastructure Capability	0.354	0.5	0.486		
Knowledge Management	0.323	0.521	0.69	0.685	

Table 2 shows the Heterotrait-Monotrait (HTMT) ratio of the correlations, which was used to assess discriminant validity of the correlations between the constructs of the study: analytical capability, decision-making capability, infrastructure capability, knowledge management, and digital marketing performance. Discriminant validity determines the differentiation level of each construct to others since it is determined that they have different conceptual areas within the framework of the Big Data Analytics to Digital Marketing framework. The findings suggest that the HTMT values are all lower than the recommended 0.85 level of discriminant validity, which proves sufficient discriminant validity among constructs. The HTMT ratios of analytical capability to other constructs in particular are between 0.296 and 0.354 which reveal that analytical capability is conceptually different to the dimensions of decision-making, infrastructure, and knowledge management. The correlation between decision making ability and digital marketing (0.645) and between knowledge management and digital marketing (0.690) are also greater but not exceeding the acceptable limits indicating that these constructs are correlated, but are different. The moderately high HTMT value of knowledge management and infrastructure capability (0.685) as well as digital marketing (0.690) confirms the mediating power of knowledge management in the research model. These relationships indicate that knowledge processes act as an interface between data infrastructure and marketing performance in agreement with the hypothetical premises of the research. All in all, the findings of the HTMT support the idea that the constructs implemented in this study have high discriminant validity and can be analyzed further in the framework of the structural model to examine the hypothesized associations between the Big Data Analytics capabilities, knowledge management, and the digital marketing performance.

Table 3
Fornell-Larcker criterion

	Analytical Capability	Decision-Making Capability	Digital Marketing	Infrastructure Capability	Knowledge Management
Analytical Capability	0.857				
Decision-Making	0.258	0.828			
Digital Marketing	0.31	0.564	0.85		
Infrastructure Capability	0.324	0.437	0.421	0.808	
Knowledge Management	0.305	0.458	0.605	0.601	0.844

Table 3 contains the Fornell-Larcker criterion, with the diagonal items giving the square roots of the AVE of each of the constructs and being expected to be higher than the inter-construct correlations. The findings address this criterion on all constructs. It has a higher analytical capability (0.857) compared to what it relates to decision-making capability (0.258), digital marketing (0.310), infrastructure capability (0.324) and knowledge management (0.305). The decision-making capability (0.828) is much greater than its associations to digital marketing (0.564), infrastructure capability (0.437), and knowledge management (0.458). Digital marketing (0.850) is greater than the correlation with analytical capability (0.310), decision-making capability (0.564), infrastructure capability (0.421), and knowledge management (0.605). The highest correlation is infrastructure capability (0.808) with the rest of the constructs (up to 0.601). The same case applies to knowledge management (0.844) which has a higher correlation than its correlation with analytical capability (0.305), decision-making ability (0.458), digital marketing (0.605) and infrastructure capability (0.601). These trends reflect that every construct explains more variance using its indicators as compared to other constructs, and the results are evidence of discriminant validity in the study, The Big Data Analytics to Digital Marketing Path Strengthened by Knowledge Management. The fact that the relationships between knowledge management and digital marketing (0.605) and between knowledge management and infrastructure capability (0.601) are relatively stronger, is in line with the hypothesized mediating position played by knowledge management in directing the effects of BDA capabilities in digital marketing performance. However, these conclusions can be interpreted in parallel with the indicator-level diagnostics that was reported above; once the measurement anomalies are eliminated, the Fornell-Larcker evidence will be strong to test the structural paths between BDA capabilities and digital marketing through knowledge management.

Table 4
Adjusted R²

	R-square	R-square adjusted
Digital Marketing	0.367	0.365
Knowledge Management	0.416	0.411

Table 4 shows the explanatory power of the model considering the R 2 and adjusted R 2 values of the constructs at the end of the model that is knowledge management and digital marketing. The findings suggest that Big Data Analytics (BDA) capabilities describe a significant percentage of variation in both constructs, which make the model predictively relevant. The R 2 value that was obtained in knowledge management was 0.416 with an adjusted R 2 value being 0.411 indicating that analytical capability, decision-making capability, and infrastructure capability explain approximately 41 percent of the variance in KM. This implies that the more the firm has BDA strengths, the greater the knowledge creation, organization and dissemination practice. Digital marketing has obtained an adjusted R 2 of 0.365 and R 2 of 0.367, which means that knowledge management and BDA capabilities together explain approximately 36 percent of its variance. The strength of this explanatory power indicates a moderate-strong relationship meaning that the combination of BDA and KM processes has a substantial positive impact on the outcomes of marketing performance, engagement with customers, flexibility, and data-driven decision-making. The fact that the adjusted R 2 values are similar to the R 2 values is an indicator of the stability of the model as well as the limited impacts of multicollinearity.

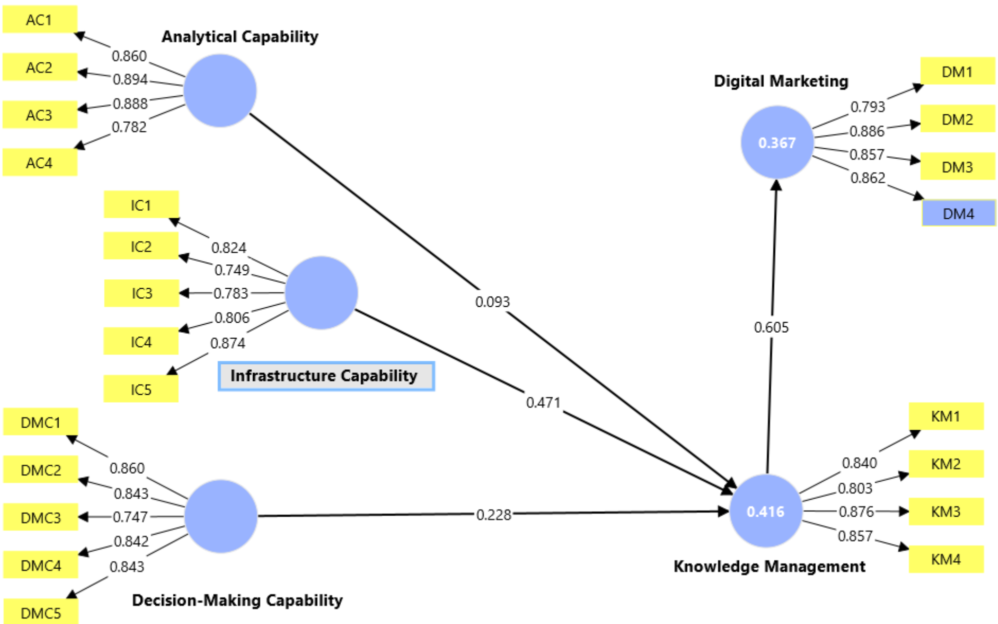

Fig. 1. Measurement model. Source: Researchers' analysis based on SMART PLs, 4.

Table 5 represents the structural model findings of the research article, The Big Data Analytics to Digital Marketing Path Strengthened by Knowledge Management. The diagram illustrates the measurement as well as structural relationships between the five constructs that are analytical capability, infrastructure capability, decision-making capability, knowledge management, and digital marketing performance. All constructs are modeled as latent variables that are linked with its indicators, and the loadings of the constructs to the indicators are strong with all the indicators having strong factor loadings between 0.74 and 0.89, ascertaining the reliability and validity of the measurement model. The structural paths demonstrate how the constructs are hypothesized to be related to each other. Analytical capability exhibits a weak direct influence on digital marketing (0.093), and this implies such an influence might have indirect implications on the marketing outcomes. The infrastructure capability shows a strong influence on the knowledge management (0.471), this means that a strong data infrastructure increases the ability of the organization to capture, store, and distribute knowledge appropriately. Knowledge management is also associated with decision making ability (0.228), and this criterion is relevant in turning analytical knowledge into actionable knowledge within an organization. Knowledge management, in its turn, has a positive and high effect on the performance of digital marketing (0.605) and is one of the fundamental mediators between BDA capabilities and marketing effectiveness. The model has a variance in knowledge management that is explained and a digital marketing performance variance that is explained, both venture 41.6 per cent and 36.7 per cent respectively indicating a moderate-to-strong explanatory power. All in all, this figure graphically proves that the combination of the analytical, infrastructural, and decision-making functionality in the solid knowledge management system has a significant positive impact on the results of digital marketing, as per the theoretical model of the study.

Table 5
Hypothesis testing estimates.

		Original Sample	Standard Deviation	T statistics (|O/STDEV|)	P Values	
H1	Analytical Capability → Digital Marketing	0.056	0.026	2.166	0.03	Supported
H2	Analytical Capability → Knowledge Management	0.093	0.041	2.255	0.024	Supported
H3	Decision-Making Capability → Digital Marketing	0.138	0.034	4.124	0	Supported
H4	Decision-Making Capability → Knowledge Management	0.228	0.046	4.978	0	Supported
H5	Infrastructure Capability → Digital Marketing	0.285	0.035	8.231	0	Supported
H6	Infrastructure Capability → Knowledge Management	0.471	0.044	10.668	0	Supported
H7	Knowledge Management → Digital Marketing	0.605	0.046	13.24	0	Supported

The results of the hypothesis testing in the terms of the structural equation modeling (SEM) on Smart-PLS 4 are given in Table 5. The path coefficients, standard deviations, t-statistics and p-values of all the relationships hypothesized among the capabilities of Big Data Analytics (BDA), Knowledge Management (KM), and Digital Marketing (DM) are reported in the table. Each of the seven hypotheses is statistically significant, which means that each of the suggested directions of the conceptual model is important and corresponds to the theoretical predictions. Analytical capability has a direct impact, which is small but significant on digital marketing (β= 0.056, $t = 2.166$, $p = 0.03$) and slightly higher on knowledge management (β= 0.093, $t = 2.255$, $p = 0.024$). This result indicates that though analytical capability is a minor contributor to marketing performance, it has the most notable effect on enhancing knowledge management processes to convert analytical knowledge into action knowledge. The ability to make decisions has more significant impacts on the digital marketing ($\beta = 0.138$, $t = 4.124$, $p < 0.001$) and knowledge management (0.228, $t = 4.978$, $p < 0.001$) in that data-driven insights can be interpreted and acted on by managers to promote marketing excellence. The infrastructure capability is the most significant BDA dimension, which influences digital marketing (0.285, $t = 8.231$, $p < 0.001$) and knowledge management (0.471, $t = 10.668$, $p < 0.001$) the most. This confirms that excellent technological systems can possess the tendencies to enhance data integration, storage, and distribution that are essential facilitators of data share and marketing responsiveness. Finally, and most crucially, a considerable positive effect on the performance in the domain of digital marketing (0.605, $t = 13.24$, $p = 0.001$) is provided by knowledge management, which can validate the idea that the given concept lies in the heart of relations between the capabilities of the BDA and the performance of marketing. Overall, the results confirm that effective knowledge management structure in terms of analytical, infrastructural, and decision-making potentialities results in a more successful digital marketing performance by companies.

7. Discussion

The findings of the current study provide a multilateral view of how the digital marketing performance is enhanced through the assistance of the capabilities of the Big Data Analytics (BDA) and the mediating variable is the Knowledge Management (KM). The results indicate that analytical capability, infrastructure capability and decision-making capability are all important to knowledge management as well as marketing performance justifying the fact that analytical and knowledge-driven systems are incorporated to improve organizational performance in the digital world. Among the three BDA capabilities, infrastructure capability was identified to be the most predictive of KM and digital marketing performance. It suggests that the existence of well-developed data platforms, advanced software solutions, and networked systems is essential in achieving the means of knowledge flows and ensuring that analytical insights are well implemented in marketing processes. As was done in the previous research, an advanced data infrastructure would increase the ability of firms to manage big data, cross-function, and continue to innovate through real-time decision making. The aspect of decision-making capability was also found to affect KM, as well as digital marketing, by a large margin because it is these companies that can interpret data and convert the insights into marketing strategies that end up delivering the best outcomes. This demonstrates that managerial judgment that is informed by data is a critical connection between pure data of analysis and marketing output. Despite being the least powerful among the three, the analytical capability had considerable positive effect on KM and less direct effect on digital marketing. This implies that the analytical processes of data collection, interpretation and pattern recognition are not goals in themselves but rather rely heavily on knowledge processes that may translate into value which is actionable. In that regard, KM is the process by which analytical knowledge is institutionalized, distributed, and implemented in order to improve customer interaction, the flexibility of the campaign and the development of the content. The large and strong direction of the knowledge processes between KM and digital marketing (= 0.605) proves the key mediating position of the analytical outcome's transformation into the real marketing outcomes. Theoretically, the findings expand the knowledge on the performance of digital marketing in the BDA setting by demonstrating that technology is not enough to create value without the knowledge management framework. Here, it strengthens the two-sidedness of the digital transformation in that the technological ability (as symbolized by BDA) and cognitive ability (as symbolized by KM) have to coexist. The findings are also in favor of the general assumptions of the Resource-Based View (RBV) that imply that such intangible resources as data knowledge, analytical experience, and ability to make managerial decisions are the major sources of sustainable marketing benefit. As regards the methods used, both knowledge and the statistical validation were provided through the mixed-method approach. The quantitative results were used to prove the structural relationship and relevance of the paths but the qualitative results of the interview were used to complete the analysis and demonstrate how the marketing professionals in practice operationalize BDA and KM. The respondents emphasized that effectively integrated analytical and knowledge systems can enable them to respond faster to the changes in the market, more accurately target and encourage the culture of lifelong learning. Such observations enhance the viability of empirical research and point connotatively to their practical application in the real life and especially in technology based and e-commerce aspects as is the case in the researched studies. Generally, it is emphasized in the discussion that the best outcome when it comes to digital marketing performance is the integration of technological acuity and knowledge-based solutions by companies. Companies must invest in the critical analytical tools and data infrastructure, but also in the culture of knowledge sharing, which will ensure knowledge is shared and utilized to benefit. In practice, it implies that the employees are to be trained to operate with analytical systems efficiently, the inter-departments communication during the seasons are to be encouraged, and the digital technologies will be introduced into the experience of humans. Without this alignment, the work will become more complicated without efficiency by the data systems. The study contributes to the theoretical and managerial literature on how the capabilities of Big Data Analytics can be utilized to generate value on the basis of the knowledge management mechanisms. It shows that the pathway between BDA to digital marketing success is not linear but is enabled by the strength of the organization to control, internalize, and utilize the knowledge. In that regard, knowledge management must be deemed to firms that seek to enhance their competitive advantage in the digital realm, as the strategic definition that allows the potential to make analytical transformation into marketing perfection.

8. Conclusions

The present paper confirms the high relevance of Big Data Analytics (BDA) in enhancing the performance of digital marketing through the systematic and knowledge-based processes of Knowledge Management (KM). The study of the roles of analytical capability, decision-making capability and the infrastructure capability mediated by KM carried out by the researchers describes how the use of data analytics contributes to marketing agility, responsiveness and innovation in technology-based companies. The findings discover that the essential enablers of the performance are the infrastructure capability and decision-making capability since they improve the ability of the organization to make real time marketing decisions and apply analytical findings to implementable strategies. All these findings indicate that firms can achieve superior position in digital marketing by not only the expenditure of data technologies, but also through the structuring, communicating, and utilizing the knowledge that is designated by technological instruments across the company in an efficient manner. The results also underlie the suppositions of Technology Acceptance Model (TAM), in other words, to attain long-term adoption, analytical systems and knowledge platforms must be beneficial and seem beneficial. When the employees have an easy access to and awareness of analytical insights in the form of structured knowledge base, the communication between the data systems and the users becomes productive. This association strengthens knowledgeable decision making, continuous learning and transferring data into marketing intelligence. By matching the analytical systems to the knowledge sharing practices, the companies enhance their ability to anticipate customer needs, customize marketing strategies and remain competitive in the online markets. The study has practical implications as a manager to firms that require to enhance their performances in digital marketing. The organizations should pay more attention to the integrated data structures development, collaboration between departments, and digital literacy of marketing specialists. To make an informed and data-driven strategic marketing move, an investment in easy-to-use analytical systems, safe data setting, and knowledge-sharing systems is necessary. The partnership of BDA and KM provides the setting where the stream of insights is not disrupted, ensuring that more adaptive, creative, and evidence-based marketing practices could be created. Despite the fact that the results of the research can be considered highly informative, it is pivotal to mention some of the limitations. The sample used in the study consisted of technology oriented and e-commerce firms in Jordan and this may be a constraint in extending the study findings to other industries and regions. The future research of the topic should apply this model to other sectors and determine whether mediation of KM is universal. In addition, the longitudinal or qualitative approach may be added to discover more data regarding the way the organizations build their data and knowledge capacities over a period of time. Finally, the study confirms that the success of digital marketing in the age of data-driven transformation is determined not only by the analytical and technological power of the organization but also the efficiency with which the knowledge is introduced and distributed by the organization. BDA coupled with KM integration gives a good basis of improving marketing performance, strategic learning, and innovation. The ability to mobilize, process and implement knowledge in real time is one of the most significant factors of future competitiveness and sustainable success in digital marketing conditions.

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