







“Influence of big data on process and product innovation: Case study of the Housing Bank in Jordan”

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INFLUENCE OF BIG DATA ON PROCESS AND PRODUCT INNOVATION: CASE STUDY OF THE HOUSING BANK IN JORDAN

Abstract

This study investigates the relationship between big data and knowledge sharing and how they can be linked to banking innovation, including process and product innovation. In this study, questionnaires are tailored to fit the hypotheses formulated from data collected from 279 participants (including managers from several departments of the bank such as administration, research & development, accounting, operations, marketing, and sales) at the Housing Bank for Trade operating in the city of Irbid, Jordan. To get a correct result, this study used the structural equation model 'SEM' and found a positive relationship between big data and innovation in products and processes, which is confirmed by the data. BID positively affects product innovation ($\beta = 0.302$; $p < 0.001$) and process innovation ($\beta = 0.286$; $p < 0.001$). Also, the study confirms that mediating "knowledge sharing" plays a significant role in innovation and big data in the bank. This study brought evidence that big data is the major dimension that leads to knowledge sharing and innovation performance. The findings also show that companies must employ counterintuitive strategies when developing innovative products or services that differ significantly, quite a bit, from the established expectations of consumers. Ultimately, to reap the benefits of technology such as big data and market-driven investing, organizations must invest in both. To orchestrate dynamic capabilities required by innovation, organizational models, roles, and management methods need to be revised.

Keywords

big data, performance, process innovation, Housing Bank, knowledge sharing, Jordan

JEL Classification

M15, O31, D83, G21

INTRODUCTION

Nowadays, organizations face more difficulties and challenges than ever before due to technological advancements, globalization, and increasing competition (Abusweilem & Abualoush, 2019). Increasingly, firms are using innovation as a buzzword to create value and remain competitive (Mehralian et al., 2021). Innovation is considered to be a dynamic capability and an important organizational tool for companies to adapt to unpredictable external factors (Abualoush et al., 2022) and achieve long-term success (Berraies, 2019). Companies are increasingly embracing innovation and seeing it as an effective way to respond to complex and uncertain market conditions and consumer demands, and to stay ahead of the competition by combining strengths with market opportunities (Alrowwad et al., 2020; Qadri et al., 2021). Due to these trends, researchers and practitioners have begun examining how to improve organizational innovation capabilities. They have also examined its antecedents (Rabaai et al., 2022). Most

recently, the topic of enhancing innovation has been studied extensively, showing the importance of the issue (Ato Sarsah et al., 2020), “since innovation is habitually respected as an output,” there are some inputs needed (Bamber et al., 2017; Alsmadi et al., 2024). To remain innovative and competitive, organizations require resources that are valuable, rare, inimitable, and non-replaceable (Zhao et al., 2021). Numerous factors that drive innovation have been identified in the literature (Rasheed et al., 2021). Yet current literature emphasizes the importance of using an organization’s strategic resources such as human and knowledge capital and IT capability to continually innovate (Irtaimah et al., 2016). Among these factors, the importance of information technology resources and knowledge as determinants of firms’ innovation performance has been highlighted by researchers (Zhao et al., 2021). Information technology resources such as big data (BIG) influence the capabilities of an organization through agility, entrepreneurship, and the enhancement of its knowledge, processes, and innovation capabilities (Rasheed et al., 2021).

However, it is unclear what support tools would be available to help unleash the innovation potential. Researchers have argued that innovation implementation requires a significant amount of capabilities and resources for firms to succeed. Back to a study, organizational resources, such as modern information technology, create the necessary conditions for the deployment of innovation in any business. BIG has the potential to significantly affect competitiveness by altering processes, changing corporate ecosystems, and fostering innovation. Managing BIG is crucial to creating business value. BIG is essential for modern businesses, as, using this tool, managers can get more understanding of how data are used and how processes can be reinforced. Thus, these analytical tools can assist organizations in navigating, maneuvering, competing with, and adapting to an ever-changing business environment. The capabilities of information technology such as BIG are widely recognized and play a key role in facilitating innovation, achieving efficiency, and maintaining the competitive advantage of organizations. Knowledge sharing (KS) activities contribute tremendously to an organization’s innovation capability and key results by enriching its knowledge resources. Moreover, many studies show the significance of BIG analytical in the finding of a suitable environment for KS actions; there is limited research on the mechanisms by which BIG affects employees’ KS activities. This study tries to get important answers to several questions about the impact of BIG analytics on the KS process.

1. LITERATURE REVIEW AND HYPOTHESES

The main objective of the current study is to evaluate the impact of BIG on process and product innovation by focusing on BIG and process and product innovation literature. The study investigates the relationship between modern IT capabilities and exploratory and exploitative innovation by examining the strategic management of organizational knowledge resources. From the learning perspective, it is important to provide an environment that encourages knowledge sharing, especially among key knowledge workers that make up the innovation base. Modern IT capabilities can make this possible. When considering the influence of modern IT capabilities on the search for knowledge resources, this study suggests that a new antecedent should be considered. This study has significant implications for BIG, knowledge

sharing, and process and product innovation; BIG and knowledge sharing can help improve exploratory and exploitative innovation.

The literature defines big data (BIG) as a vast amount of structured and unstructured data available in real time. Data of this type are found throughout nature, although they are complex and cannot be analyzed by traditional methods. Over the past few years, academics and businesses have shown interest in BIG due to its operational and strategic value for generating business value. In the commercial, industrial, and public sectors, BIG significantly increases business opportunities (Affelt, 2017; Ferraris et al., 2019; Bresciani et al., 2021), BIG is the approach to managing, processing, and analyzing five dimensions (5 Vs) of data (Rialti et al., 2019). As technology continues to evolve, the amount of data generated is rapidly increasing, with BIG emerging from a wide

range of sources. Digital devices contribute to this by providing insights into consumer behaviors, preferences, and demands. For instance, BID can be found in messages, social media updates, images, and readings from sensors or smartphones (Abualoush, 2025; Sardi et al., 2020). The velocity of data refers to the speed at which it can be processed, ranging from batch processing to real-time analytics (Elia et al., 2020).

As a result of knowledge-based economies, technological advancement, and fierce global competition, innovation has become increasingly important to competitiveness (Yang et al., 2018). Innovation is primarily aimed at improving a company's performance and competitive advantage (Le, 2020). There are various categories of innovation capability (Le, 2020) among which process innovation and product innovation are regarded as key aspects of innovation, denoting different degrees of innovation originality (Iqbal, 2021). A product innovation is a new tangible output that differentiates a product's market and customer base (Bulut et al., 2022). Process innovations are meant to improve quality, decrease costs, increase customer-driven flexibility, and reduce the amount of time required to complete orders/deliver (Bulut et al., 2022). Pointing out that product and process innovations are mutually reinforcing, product innovation may trigger improvements in organizational processes, and process innovation may stimulate new products (Begum et al., 2021). As a result, this study draws on the recent literature about innovation types in two forms as described above.

Building BID has recently been a daring attempt for businesses to modify their business methods, increase productivity, and acquire market share (Wan & Liu, 2021) BID is called the next "management revolution" (Wan & Liu, 2021). Globally, enterprises are investing more and more in BID because they need a sustainable competitive advantage in uncertain environments (Ghasemaghaei & Calic, 2020). Businesses that use BID to develop new technologies can boost revenue and gain a competitive advantage, and it has been shown to have a major impact on innovation performance (Wan & Liu, 2021). According to some experts, accelerating the innovation process, consumer interactions, and establishing an innovation ecosystem are significant success elements in product innova-

tion processes employing BID. Furthermore, BID analytics can assist businesses in accelerating new product development and lowering costs (Capurro et al., 2021). Shahid and Sheikh (2021) indicated that by using BID insights, businesses can rethink business models, innovate business processes, and develop new strategies. Hasemaghaei and Calic (2020) proposed that understanding customers better by analyzing large volumes of data about their behavior can lead to incremental innovation. In this way, large amounts of data are processed in a way that enables firms to generate insights from data on consumer behavior that allows them to increase their innovation activities (Alzoubi et al., 2022; Norman et al., 2013).

On the other hand, firms can sustain their competitive advantage by identifying and responding rapidly to environmental threats and opportunities. However, for a firm to be proactive about re-inventing existing knowledge and creating new knowledge, it must be able to select and manage multiple sources and various amounts of data. In this vein, a recent study found that BID analytics can capture weak signals from customers and use them to forecast consumer and market trends. Specifically, these studies imply that companies that use fresh insights gleaned from BID to discover unmet consumer needs have improved dynamic capacities. (El-Kassar & Singh, 2019). BID can help companies improve their dynamic capacities by supporting decision-makers to adapt to changing environmental patterns (Nguyen et al., 2022; Ghasemaghaei & Calic, 2020; Oudat et al., 2020). When properly utilized, consumer insights generated from BID contribute to the improvement of a business model capable of increasing firm performance and process and product innovation (Ghasemaghaei & Calic, 2020). Furthermore, researchers have discovered that creating dynamic skills aided by BID analytics may stimulate a company's innovation process.

Knowledge management is based on the knowledge-based view of a firm, which provides an underlying theoretical framework for BID and knowledge management (Khan & Vorley, 2017). Analytics of BID can be used to capture and use different sources of explicit and tacit knowledge to make more effective decisions using new insights (Amayreh, 2021; Khan & Vorley, 2017). To convert

data into knowledge that can be used, BID capabilities are crucial. Information management and BID complement each other by combining business intelligence and human expertise, as a result of which organizations can perform better in a variety of ways. It allows organizations to share data and information with different stakeholders, channel-specific knowledge quickly, and turn customer and external information into actionable intelligence. A large amount of BID can help organizations gain computerized and personalized knowledge, for example, through search engines, search analytics, web analytics, and pay-per-click management (El-Kassar & Singh, 2019). In this manner, the organization's BID capabilities could be increased by making these insights available to the right people and improving its information refinement capabilities.

Based on Social Exchange Theory (Blau, 1964), employees share their expertise and knowledge resources with others with the expectation of reciprocity or receiving anything in return. One such exchange behavior is knowledge sharing (Nguyen & Malik, 2021). Knowledge sharing refers to the spread of individual knowledge within an organization. It entails social contact, knowledge exchange, experiences, insights, and know-how, all of which contribute to collaborative knowledge development (Singh, 2022), Abualoush et al. (2018) argue that if employees have a strong desire to share knowledge, companies can acquire a competitive advantage. Useful and relevant knowledge can assist employees to enhance their job performance and provide better service to clients. The link between innovation and knowledge (Santos et al., 2023) is explained by the fact that the innovation procedure requires a continuous search for new information and its use. There is evidence that knowledge sharing is necessary for the generation of new ideas and the development of new things, as a result of which it is closely related to innovation. As Le and Lei (2019) pointed out, knowledge sharing greatly facilitates product and process innovation since employees share their expertise and skills with their coworkers, thus promoting new ideas and encouraging the organization's capacity for innovation. As a result, individuals become better at defining problems or adverse situations and applying their knowledge to resolve them. In general, organizations with strong technology ca-

pabilities can identify technical opportunities and the value of technological resources, acquire those resources, and leverage them to thrive in product creation (Gupta & George, 2016). Particularly, BID is characterized as outward-looking (finding and using new opportunities and technology resources outside of one's own environment) and inward-looking (utilizing new technology and creating new products using the resources acquired). The purchase and use of external resources is required for innovation, which necessitates an investment in internal competence to identify and absorb these resources, So the process of learning from the outside involves a lot more than just acquiring knowledge from the outside. Companies need to be able to take some of the external information and apply it to their organization's knowledge base and innovation processes (Taghizadeh et al., 2021).

This study aims to evaluate the impact of big data on process and product innovation by focusing on big data and process and product innovation literature. The study investigates the relationship between modern IT capability and exploratory and exploitative innovation by examining the strategic management of organizational knowledge resources. From the perspective of learning, it is important to provide an environment that encourages knowledge sharing, especially among key knowledge workers that make up the innovation base. Modern IT capabilities can make this possible. When considering the influence of modern IT capability on the search for knowledge resources, it is suggested that a new antecedent should be considered in this study. Thus, to achieve the objectives of this study, the following hypotheses are formulated:

- H1: *There is a significant positive relationship between BID and innovation Performance (product and process).*
- H2: *BID has a significant positive impact on knowledge sharing.*
- H3: *Knowledge sharing positively influences innovation capability (product and process).*
- H4: *The positive relationship between big data and innovation capability will be mediated by knowledge sharing.*

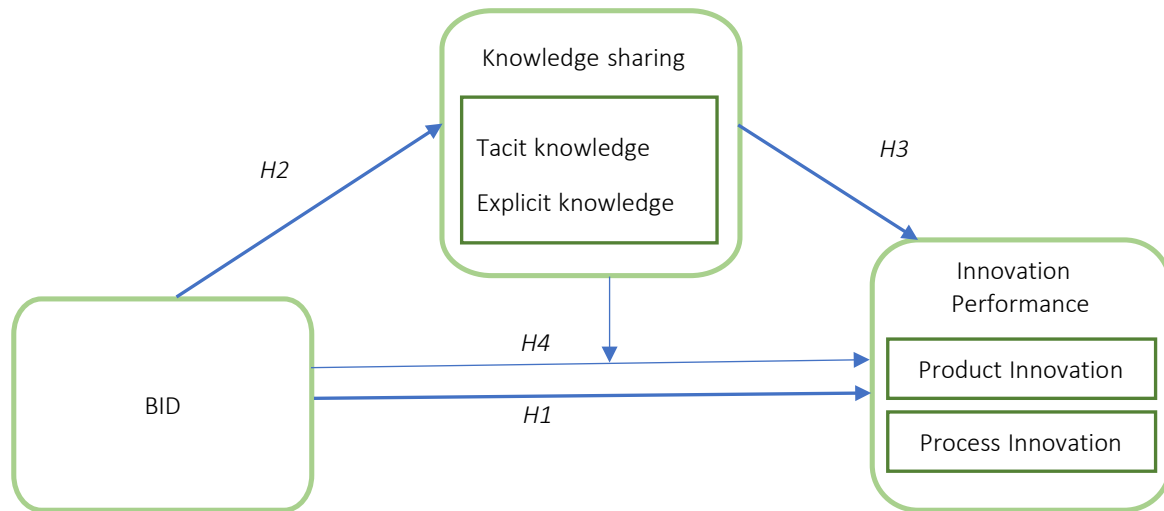


Figure 1. Research model

2. METHOD

The current study utilizes questionnaires and survey methods to collect data. The population for this study comprised 15 branches of the Housing Bank for Trade located in Irbid. Key participants in the study include employees working in administration, research and development (R&D), accounting, operations, marketing, and sales. This will enable them to know their company well and exchange information with each other regularly. To ensure sufficient understanding of their firm and the frequent exchange of strategic information within the organization, the final sample in the survey included managers from several departments of the bank such as administration, research and development, accounting, operations, marketing, and sales.

To build the questionnaires, the authors contacted bank representatives via phone or face-to-face to explain the objectives of the study. Out of this effort, 12 branches agreed to assist. During the formal data collection phase, 411 questionnaires were distributed, and 294 responses were collected. Of these responses, 279 were deemed valid, resulting in a validity rate of 58.6 percent (refer to Table 1 for details).

The study employs Likert-type scales to measure all items, with responses ranging from “1” (strongly disagree) to “5” (strongly agree).

Wamba et al. (2017) developed a 6-item scale to assess BID. Sample items are: “Business analytics are used effectively when the appropriate plans are

Table 1. Survey method for data collection

Items	Category	Freq	%
Gender	Male	168	60.40
	Female	111	39.06
	Total	279	100.00
Level of Education	Bachelor degree	219	78.49
	Master degree	51	18.28
	Ph.D. degree	9	3.22
	Total	279	100.00
Degree of Management	high management	49	17.56
	Middle management	54	19.35
	Low management	176	63.09
	Total	279	100.00
Work of Experience	Below than 5 years	39	14.01
	Between 5-10 years	93	33.33
	Between 10-15 years	120	43.01
	More than 15 years	27	9.71
	The Total	279	100.00

in place,” and “Essentially, we perform systematic processes for planning business analytics.”

Six items from Abualoush et al. (2018) were adapted for this study to assess tacit and explicit knowledge sharing. Of these, three items pertain to tacit knowledge, while the other three focus on explicit knowledge. An example of tacit knowledge sharing includes “We encourage the exchange of information and knowledge among team members and across different departments.” For explicit knowledge sharing, an example is “Employees in our organization regularly share knowledge derived from their personal experiences.”

3. RESULTS

In the initial step of assessing reliability, Cronbach’s Alpha ($C\alpha$) coefficient was calculated for each construct, yielding values ranging from 0.78 to 0.84. These results surpassed the recommended threshold of 0.7. Next, the overall mea-

surement model was evaluated, focusing on convergent and discriminant validity using confirmatory factor analysis (CFA), in line with Hair et al. (2006). The convergent validity test confirmed that the model satisfied the following conditions:

- 1) factor loadings were above 0.6 ($p < 0.001$);
- 2) composite reliability (CR) exceeded 0.78; and
- 3) average variance extracted (AVE) was greater than 0.50.

Discriminant validity ensures that factors representing a construct are not associated with unrelated criteria (Gunasekaran et al., 2017; Bekhet & Al-Smadi, 2015; Fornell & Larcker, 1981). Fornell and Larcker (1981) introduced the Average Variance Extracted (AVE) as a method to assess discriminant validity (see Table 2). By comparing the square root of the AVE with the correlations between latent variables, the discriminant validity of the research instrument was evaluated. When

Table 2. Reliability and validity of the study

Construct	Item No	Loadings	t-value	Cronbach’s Alpha	Composite reliability	AVE
BID	BID1	0.818***	20.675	.841	.924	.78
	BID2	0.829***	21.945			
	BID3	0.814***	18.965			
	BID4	0.811***	17.965			
	BID15	0.821***	23.876			
	BID6	0.834***	20.987			
Tacit knowledge	KST 1	0.810***	21.548	0.789	0.931	0.74
	KST 2	0.732***	21.562			
	KST3	0.818***	20.481			
Explicit knowledge	KSE1	0.825***	19.765	0.814	0.922	0.78
	KSE2	0.819***	20.301			
	KSE3	0.737***	23.981			
Innovation capability	INCAP	0.829***	22.875	0.831	0.921	0.77
	INCAP	0.820***	18.645			
	INCAP	0.891***	19.874			
	INCAP	0.772***	20.567			
	INCAP	0.796***	22.349			
	INCAP	0.851***	23.876			

Note: $C\alpha \geq 0.7$; $CR \geq 0.7$; $AVE \geq 0.5$; *** significant at $p < 0.001$.

Table 3. Mean, SD, and discriminant validity

Construct	Mean	SD	BID	KST	INCAP	INCAP
BID	3.61	.77	0.82	–	–	–
Knowledge sharing	3.72	.72	0.71***	0.84	–	–
Product innovation	3.81	.74	0.74***	0.73***	0.87	–
Process innovation	3.76	.73	0.77***	0.78***	0.743**	0.85

Note: *** $p < 0.001$.

the square root of the AVE exceeds the correlations between constructs, this indicates stronger correlations within constructs, confirming that neither the construct validity, concurrent validity, nor discriminant validity of the scales is in doubt.

The research proposal was evaluated through Structural Equation Modeling (SEM) by utilizing the 22.0 software version of AMOS. The maximum likelihood estimation method was employed to determine the validity of the hypotheses.

Table 4 shows that various innovation dimensions are significantly affected by BID and knowledge-sharing processes, thus supporting *H1* and *H2*. Hypothesis 1 proposed a positive relationship between BID and innovation in products and processes, which is confirmed by the data: BID positively affects product innovation ($\beta = 0.302$; $p < 0.001$) and process innovation ($\beta = 0.286$; $p < 0.001$). Similarly, Hypothesis 2 (*H2*) is validated, showing that BID positively influences both tacit and explicit knowledge sharing. Notably, BID has a greater effect on tacit KS ($\beta = 0.278$; $p < 0.001$) than on explicit KS ($\beta = 0.311$; $p < 0.001$).

Further analysis of the relationship between KST and innovation capabilities reveals that knowledge sharing enhances both product innovation ($\beta = 0.412$; $p < 0.001$) and process innovation ($\beta = 0.403$; $p < 0.001$), thereby supporting Hypotheses 3 and 4. To explore the mediating role of KST in the link between BID and innovation, particularly for product and process innovations, additional statistical tests were conducted. The significance of the indirect effects was determined using 5,000 bootstrap iterations, as shown in Table 4. These results confirm the mediating role of KST in the relationship between BID and innovation capacities.

Table 4. Study result summary

Hypotheses	Path	β	T-value	Result
H.1a	BID → INCAP	.302***	7.133	Confirmed
H.1b	BID → INCAP	.271***	5.138	Confirmed
H.2a	BID → KST	.311***	7.222	Confirmed
H.2b	BID → KSE	.278***	7.083	Confirmed
H.3a	KST → INCAP	.412***	4.434	Confirmed
H.3b	KST → INCAP	.403***	9.171	Confirmed
H.4a	BID → KST → INCAP	.213***indirect effect	3.121	Confirmed
H.4b	BID → KST → INCAP	.213***indirect effect	6.631	Confirmed

Note: *** $p < 0.001$.

4. DISCUSSION

This study investigated the impact of big data (BID) on knowledge sharing and innovation capability. Some studies argue that different types of resources can lead to significant differences in firm performance. However, in this study, BID can contribute to knowledge sharing and innovation capability (Usman Shehzad et al., 2022; Obeidat et al., 2021). Moreover, the significance of reinforcing innovation abilities is one of companies' strategies to get a long-run competitive advantage (Ghasemaghahi & Calic, 2020). Some other studies confirmed that innovation ability is the first requirement for companies to create competitive advantage and there are most valuable goods to consumers and other parties in the sectors (Usman Shehzad et al., 2022). However, this study attempts to explore a clear vision of the theoretical and practical aspects of BID and knowledge sharing, as well as innovation potential, in several ways.

In literature reviews, BID, its characteristics, and implications for organizations have been described generally (Khan & Vorle, 2017). Literature reviews have primarily dealt with the conceptual side of BID in these studies. These studies focus on the potential of BID for knowledge creation and the utilization of that knowledge to boost business growth. The focus is shifting, however. More recently, BID research has focused on its nature and management, as well as its value-added applications (Sumbal et al., 2019). This trend indicates that knowledge management communities demonstrate interest in BID as a resource for knowledge creation. In addition, these studies revealed little or no focus on soft aspects of BID, such as organizational learning, value creation, top management support, and organizational culture.

Currently, most research examines knowledge creation mechanisms, ignoring implementation, particularly the factors that enable and hinder value creation. Several studies have explored these aspects conceptually and anecdotally, but empirical studies are needed to examine them more thoroughly. Therefore, this study attempts to go along with this transformation to fill one of the research gaps in the impact of BID on organizational outcomes, including innovation capabilities and knowledge sharing.

Furthermore, this study shows the significance of knowledge sharing in relating BID to various aspects of innovation found throughout the literature, and these results are similar to the results of Affelt (2017), Ferraris et al. (2019), and Bresciani et al. (2021), which confirmed that it is significantly affected by BID and knowledge sharing processes. Unfortunately, studies have largely overlooked the role of knowledge sharing as a mediator of BID and the various aspects of innovation, particularly in de-

veloping countries like Jordan. Therefore, this study has contributed to advancing innovation research by explaining the role that knowledge sharing plays in mediating innovation theory. This study shows how BID may be used with other resources and talents, such as knowledge sharing, to increase innovation and gain a competitive advantage (Shahid & Sheikh, 2021). Returning to the obtained results, it can be said that BID is likely to have a significant impact on various aspects of innovation potential (products and processes), directly or indirectly, through the promotion of knowledge sources. In general, there is evidence that big data (BID) significantly affects various aspects of innovation via direct or indirect influence on knowledge sharing. Also, the results of this study confirmed that knowledge sharing enhances both product and process innovation, and this result is similar to the result of Amayreh (2021) and Khan and Vorley (2017), which confirms that there is a significant relationship between knowledge sharing and both product and process innovation.

CONCLUSION

The purpose of this study is to evaluate the impact of big data on process and product innovation by focusing on big data and process and product innovation. However, the study shows how BID can influence innovation by validating the emerging relevance of these IT-related capabilities to the profitability and competitive strength of modern and more “digital” firms. Additionally, the results of previous studies that suggest that IT capabilities correlate positively with firm outcomes can be complemented by examining the link between processes, enabling a greater understanding of the factors that contribute to IT-driven competitiveness. However, an organization should work on building its IT resources for innovation by focusing on its employees’ IT expertise and collaborating with the business units. Various aspects of innovation are affected directly and indirectly by IT resources.

Since BID has the potential to significantly affect knowledge sharing and innovation in various ways, organizations can utilize a variety of BID resources to develop the capability to manage knowledge effectively and replace the output of innovation. The findings of this study emphasize how recent technological developments, such as those related to BID, are transforming various aspects of firms’ operations and especially how they innovate. This study shows that companies must employ counterintuitive strategies when developing innovative products or services that differ significantly, quite a bit, from the established expectations of consumers. Ultimately, to reap the benefits of technology such as BID and market-driven investing, organizations must invest in both. To create the dynamic capabilities needed for innovation, organizational models, roles, and management practices must be rethought.

AUTHOR CONTRIBUTIONS

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Writing – reviewing & editing: Manal Ali Almarashdah, Mahmoud Barakat Alnawaiseh, Mahmoud Ali Al-Rousan, Zaid Saidat.

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