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RESEARCH ARTICLE

Enhancing Performance through Business Intelligence and IT Infrastructure, A Competitive Edge Perspective

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ABSTRACT

This study aims to quantify the moderating influence of competitive advantage between IT infrastructure and business intelligence on bank performance. The results demonstrated how competitive advantage, IT infrastructure, and business intelligence significantly improved banks' performance. Competitive edge considerably affected the performance of banks, business intelligence, and IT infrastructure. According to the study's findings, data from countries with various regulatory systems may be used in subsequent research to further examine the idea. Furthermore, future study may build upon this model by incorporating additional variables that can affect the variables that are now included.

INTRODUCTION

Organizational performance determines organizational strength (Akpa, Asikhia & Nneji, 2021; Alnabhan, Al-Jaafreh, Abadleh, Atoum, Hammouri & Al-dalahmeh,2021), and as such academics and practitioners have extensively focused on the determinants of organizational performance. They have examined how certain variables and their mechanisms positively or negatively influence organizational performance (Maroufkhani et al., 2019; Alnabhan, Al-qatawneh, Alabadleh, Atoum & Alnawyseh, 2020).

Banking organizations are facing challenging scenarios amidst rapid changes in their environment (Kasasbeh, Harada & Noor, 2017; Abadleh, 2019). Rapidly changing demand and preferences of customers, for example, have intensified competition among banking organizations, forcing them to innovate and exploit available opportunities (Ismail & Bakar, 2019; Aljaafreh, Abadleh, Alja'Afreh, Alawasa, Almajali & Faris, 2022). Customers are becoming increasingly informed and knowledgeable, and thus banks have to develop and implement innovative strategies and consider the attitude and behavior of customers to remain competitive (Habanyati, 2022; Abadleh & Qatawneh, 2022). Adding to this factor is the unprecedented progress in information technology (IT), which urges banks to offer various products and services (Zouari & Abdelhedi, 2021; Maayah, Abadleh & Al-Subehat, 2022). Therefore, banks must design products or services based on the needs, feedback, and

expectations of customers to ensure their innovativeness and quality (Ismail & Bakar, 2019; Abadleh, A., Han, Hyun, Lee & Kim, 2014). One way to assist banks in being innovative is the utilization of big data analytics.

Business intelligence (BI) system facilitates advanced data analytics that can assist an organization to make timely business decisions through better understanding of its environment (Awan et al., 2021). It is also useful to cope with the rising pressure from competitors (Srinivas & Ramachandiran, 2023; Abadleh, Al-Mahadeen, AlNaimat & Lasassmeh, 2021). Banks have adopted BI to identify enterprises that have the potential to become business partners or merger, as well as identifying regions where expansion is possible (Owusu, 2019). BI is therefore among the most important transformation initiatives in the banking system.

BI is, of course, dependent on IT. IT is significant because it can improve efficiency in new product development processes by means of automating tasks (Niu et al., 2021). IT is also considered a valuable internal resource of an organization because it is used in BI, which could improve organizational performance (Romero et al., 2021).

This study links BI adoption, IT, and competitive environment with organizational performance. A study that examines these variables in an integrated framework to explain performance, to the researcher's knowledge, is limited. This study is thus expected to provide a framework to understand how BI and IT may influence the performance of banking institutions.

This section has described the gap in the literature. A review of relevant literature is in the following section. It is followed by the formulation of research hypotheses in Section 3, theoretical framework in Section 4, and the methodology in Section 5. The findings are discussed in Section 6 and Section 7 concludes.

LITERATURE REVIEW

Bank Performance

Organizational performance is a measure of organizational success in creating value for and distributing it to internal and external customers (Ramakrishnan et al., 2020). Organizational performance is reflected in the degree to which the actual organizational output is accomplished relative to the planned objectives and output. There are numerous measures of organizational performance (Rasul, Rogger & Williams, 2021), which is surprising given the importance of performance measurement to evaluate an organization's competitiveness and effectiveness of its strategies. Nonetheless, scholars agree that there are three primary components of organizational performance: customer satisfaction or social responsibility; financial or accounting strategies; and market orientation.

Organizational performance, and accordingly competitive advantage, is determined by, among others, the routines or activities conducted within an organization and with external stakeholders (Casalino et al., 2019). The value chain analysis can be used to understand how an organization's activities within itself and with external parties can influence its competitive positioning (Utami et al., 2019). The activities and routines of the organization are found to be correlated with their superior performance (Chen, Wang & Huang, 2021).

Business Intelligence

BI is a broad concept that refers collectively to, among others, various tools, methodologies, architectures, databases, and infrastructures (Moscoso-Zea et al., 2019; Baniata, Othman, Shajrawi, Atta, Ahmad & Alqaraleh, 2024). BI is mainly used to facilitate data management and interactivity and enable analysts and managers to make relevant analyses and make more informed decisions (Appelbaum et al., 2017). Analysis of historical and current data provides decision makers with a

sharper perspective and more informed decision making (Killen, Geraldi, & Kock, 2020). BI converts data into information, which informs decision-making that leads into action.

Organizations are increasingly focusing on BI, and many others are rapidly drawn into it due to its prospects (Alqaraleh & Ahmad, 2018; Gao & Sarwar, 2022). A report by Gartner Group in 2008 shows that a large number of chief information officers are prioritizing BI (Ismail, 2018). BI adds value to an organization as it enables it to collect volumes of data from various sources and then organize and analyze it. Business users can use real-time data and make better decisions to create and maintain competitive advantage (Alqaraleh & Nour, 2020; Awan et al., 2021). Despite these perceived benefits, there is mixed empirical evidence on the overall success of BI.

Information Technology infrastructure

IT infrastructure means the degree to which communication networks within an organization can share applications and data to other internal users (Ahmad, Atta, Alawawdeh, Aljundi, Morshed, Dahbour & Alqaraleh, 2023; Thuneibat et al., 2022). It is a set of shared IT resources that facilitate communication across an organization (Li & Chan, 2019). IT infrastructure comprises two main components: technical and human (Agostinelli et al., 2021). IT infrastructure is the ability of an existing IT system to facilitate system development and information sharing and support IT operations with minimum costs (Felser, Rentschler & Kleineberg, 2019).

Alqareh et al. (2022) define IT infrastructure as the ability of IT to share information and support various hardware and software, applications, communication technologies, commitments, data, and values within the physical and human components of the IT infrastructure. IT infrastructure is a necessity amidst the dynamic business environment (Li et al., 2021; Nour, Noor & Alqaralehc, 2020). IT infrastructure also includes aligning IT plans with IT infrastructure, IT personnel skills, and business objectives (Megawaty & Santia, 2019). IT infrastructure enables IT applications to support organizational objectives and ensure that organizational initiatives are positioned competitively (Li & Chan, 2019).

Competitive Environment

Competitiveness is the ability of an organization, sector, region, or country to assert itself fully in the local and global markets (Vlados, 2019). Organizations survive and thrive through successful competition in a capitalist system (Prasetyo, Setyadharma & Kistanti, 2020). In light of this, it has become essential for an organization to have a competitor-focused strategy to survive. However, focusing only on the competitive environment may impede the firm from developing strategies based on its capacity for creativity and innovation (Rodrigues, 2020). Competitiveness, as a concept, is multidimensional. It generally concerns an organization's ability to create and sustain competitive advantage at the firm, industry, national, and/or global level (Zuñiga-Collazos et al., 2019). At the firm level, competitiveness is defined as an organization's ability to create value through its product and service offerings vis-à-vis its competitors or to respond to the strategies and initiatives of its rivals (Sun & Lee, 2021). The position of an organization in a competitive market relative to its rivals is the key difference between a successful and unsuccessful organization (Shikur, 2023).

Hypothesis Development

Business Intelligence and Banks Performance

Among the determinants of commercial bank performance are product, market, technology, and strategic alliance intelligence practices (Sande & Ragui, 2018). BI, especially technology intelligence, contributes to the higher performance and lower cost of banks (Mugo, Wanjau & Ayodo, 2012). BI and financial performance are positively correlated (Yang et al., 2022). Vugec et al. (2020) likewise reveal that BI in corporate strategy positively influences business performance. A similar conclusion,

that BI and organizational performance are positively correlated, is found by Mohd Asri and Abdul Mohsin (2020).

Despite the abundance of studies focusing on intelligence activities, few have empirically examined the link between BI and business performance (Owusu, 2019). BI can improve revenue, increase customer satisfaction, expediate business processes, and increase reporting accuracy (Ahmad et al., 2020). BI can also lower costs and increase customer satisfaction, revenue, and market share (Alzoubi et al., 2022). It is thus proposed that:

H1: BI influences bank performance.

Information Technology Infrastructure and banks Performance

IT infrastructure is a broad term that covers, among others, software, hardware, operating systems, networks, database, shared services (e.g., email and cloud storage), and teleconferencing service (Mustafa & Goyal, 2020; Al Tarawneh et al., 2023). Most theories related to IT implicitly or explicitly emphasize its implications to business unit or organizational performance.

Chege, Wang, and Suntu (2020) has estimated the effect of IT towards firm performance. IT contributes substantially to productivity and output growth (Bai et al., 2020). IT is also positively correlated with labor productivity (Abramova & Grishchenko, 2020). Several studies have also evinced that IT and organizational performance are positive correlates (Chege et al., 2020). It is thus proposed that:

H2: IT infrastructure influences bank performance.

Moderating Role of Competitive Environment

Moderating variable(s) can strengthen or weaken a predictor–outcome relationship or even change its direction and effect size (Baron & Kenny, 1986; Jam et al., 2011). A moderating variable should therefore be considered to better understand how it influences the predictor-outcome relationship (Hayes & Rockwood, 2017). It is thus proposed that:

H3: Competitive environment positively moderates IT infrastructure and bank performance.

H4: Competitive environment positively moderates BI and bank performance.

Theoretical Framework

Figure 1 shows the theoretical framework developed to estimate how competitive mediates the effect of BI and IT infrastructure on bank performance.

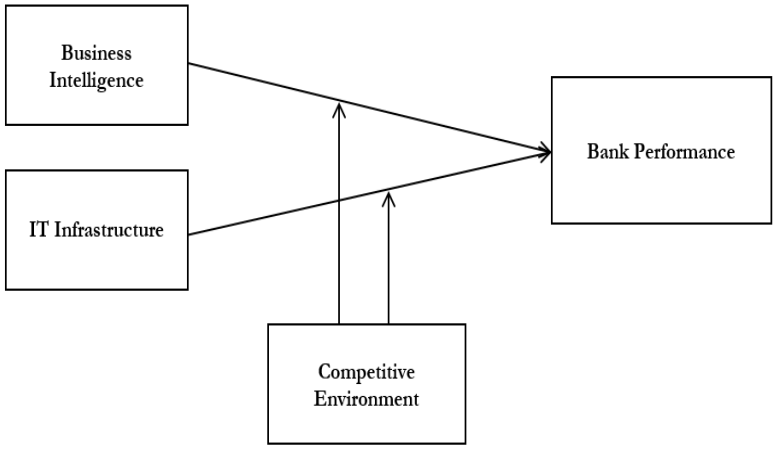


Figure 1: Theoretical Framework

RESEARCH METHODOLOGY

This is a descriptive study that explains a phenomenon and to test theories published on this issue (Alqaraleh, Thuneibat & Nour, 2020; Rahman et al., 2024). A large amount of information is gathered to fully understand the issue at hand. This study examines how competitive mediates the effect of BI and IT infrastructure on bank performance.

The main research instrument was a questionnaire that comprises five sections and 31 items. Section 1 is on sociodemographic characteristics; Section 2 on BI; Section 3 on IT infrastructure; Section 4 on competitive environment; and Section 5 on bank performance. Items in Sections 2–5 are measured on a five-point Likert scale.

The questionnaire's validity and reliability were established using two approaches. The first is feedback from academic experts, after which the items were revised. The second was measurement of internal consistency using Cronbach's alpha. Every construct was reliable: competitive environment (0.72); BI (0.78); IT infrastructure (0.8); and bank performance (0.84). The items were thus valid and reliable.

The questionnaire was distributed to 294 randomly selected managers and assistant managers in the branches of Jordanian commercial banks. They were chosen because they understand the significance of bank performance. There were 214 returned questionnaires, but seven were incomplete. Table 1 shows the research variables, items, and their sources.

Table 1: Scales Used in Research

No	Variable	Code	No of items	Reference
1	Banks Performance	BP	7	(Rahman, 2019; Chen, You & Chang, 2021)
2	Business Intelligence	BI	10	(Huang, Savita & Zhong-jie, 2022; Zoubi, ALfaris, Fraihat, Otoum, Nawasreh & ALfandi, 2023)
3	Information Technology Infrastructure	ITI	6	(Imanaka, 2019; Ali, 2022)
4	Competitive Environment	CE	8	Huang, 2011; Reverdito, Fonseca, Lopes, Aires, Santos Alves, Alves de Lima & Gonçalves, 2023)

The questionnaire was validated by scholarly feedback. Cronbach's alpha was also used to establish construct reliability. The alphas for risk management ($\alpha = 0.81$), expert systems ($\alpha = 0.78$), neural networks ($\alpha = 0.76$), internal control system ($\alpha = 0.88$), and IA efficacy ($\alpha = 0.90$) were all more than 0.7. These demonstrated the instrument's validity and dependability.

According to Gefen, Rigdon, and Straub (2011), who recommended a minimum sample size of 98 to achieve a medium impact in a model with two variables, 350 internal auditors from conventional and Islamic banks in Jordan were given the questionnaire. This was also consistent with the >100 respondent recommendation made by Hair et al. (2010).

Data Analysis

The data was analyzed using PLS-SEM. The program used to analyze the model was called SmartPLS. Assessments of measurement and structural models were conducted (Alqaraleh, Thuneibat & Nour, 2020). To make sure the items were valid for assessing the research constructs, the measurement model was evaluated. This assessment is associated with a number of ideas and metrics. The first is factor loading, which shows how closely the items on its concept are correlated. The items measure the latent construct, which is the second. Third, measurement errors show that the model does not

account for the variance. The model fit was then evaluated. To make sure that the items accurately measure the constructs and that the results are trustworthy, a measurement model assessment is required. The measuring model can be seen in Figure 2.

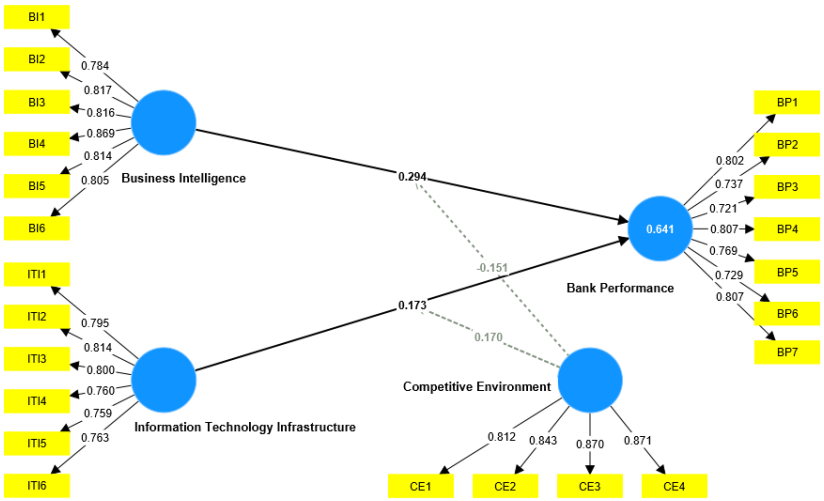


Fig 2 Measuring model

Construct reliability and validity

Table 2 displays the constructs' validity and reliability criteria. These standards ought to fall within the suggested range. Cronbach's alpha was used to measure congruence within a construct's items; it should be more than 0.7 (Hair, 2016). This condition was met by the constructions' alphas, indicating that the items measured the corresponding constructs.

Composite reliability measures the internal consistency and reliability of construct items. This measure should be >0.7 (Hair, 2016). The research constructs had composite reliability because their values were 0.889–0.904. Finally, the average variance extracted (AVE) of the constructs was satisfactory as they were >0.5 (Hair, 2016). AVE signifies the share of variance of a construct that is explained by its items. Here, the constructs had AVEs of 0.590–0.722. The AVE of Bank Performance was lower compared to Competitive Environment. Table 2 thus shows that the constructs were reliable and valid because they satisfied Hair's (2016) established criteria.

Table 2 Construct reliability and validity:

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
Bank Performance	0.884	0.890	0.910	0.590
Business Intelligence	0.901	0.905	0.924	0.669
Competitive Environment	0.873	0.889	0.912	0.722
Information Technology Infrastructure	0.876	0.901	0.904	0.611

Discriminant validity

Indicating that the items assess their underlying concept and not another construct, Table 3 displays the measures of discriminant validity. To make sure the constructs explain a distinct aspect of the study and do not overlap with other constructs, discriminant validity is crucial. The square root of a construct's AVE is represented by the diagonal numbers in Table 3. Conversely, the off-diagonal values indicate where one construct overlaps with another. It is necessary for the diagonal values to

exceed the off-diagonal values. Stated differently, the construct needs to account for a greater proportion of its variance than another construct (Hair, 2016). For instance, Bank Performance's measure was 0.768, meaning that 76.8% of its variance can be explained by it. Discriminant validity was proved because the off-diagonal readings were less than this number.

Table 3 Discriminant validity

	Bank Performance	**Business Intelligence**	**Competitive Environment**	**Information Technology Infrastructure**
Bank Performance	0.768			
Business Intelligence	0.638	0.818		
Competitive Environment	0.621	0.398	0.849	
Information Technology Infrastructure	0.522	0.396	0.763	0.782

Hypotheses Testing

Table 4 presents the results of the hypotheses testing. The significance of the relationships was assessed using t- and p-values. The results indicated that bank performance was positively influenced by business Intelligence, $t = 5.364$, $p < 0.05$, thus hypothesis 1 was supported. Hypothesis 2 was also supported because competitive environment positively influenced bank performance, $t = 8.062$, $p < 0.05$. Information Technology Infrastructure also had a positive direct impact on bank performance, $t = 2.941$, $p < 0.05$, supporting hypothesis 3.

Moderation analysis showed the significant effects of the competitive environment between information technology Infrastructure and bank performance $t = 2.811$, $p < 0.05$. Finally, the competitive environment between Business Intelligence and bank performance, $t = 3.607$, $p < 0.05$. This means that hypotheses 5 and 8 were accepted, while 4–5 were rejected.

Table 4: Testing of Hypotheses:

	Original sample (O)	**Sample mean (M)**	**Standard deviation (STDEV)**	**T statistics (|O/STDEV|)**	**P values**
Business Intelligence -> Bank Performance	0.294	0.292	0.055	5.364	0.000
Competitive Environment -> Bank Performance	0.510	0.513	0.063	8.062	0.000
Information Technology Infrastructure -> Bank Performance	0.173	0.174	0.059	2.941	0.003
Competitive Environment x Information Technology Infrastructure -> Bank Performance	0.170	0.174	0.061	2.811	0.005
Competitive Environment x Business Intelligence -> Bank Performance	-0.151	-0.151	0.061	2.485	0.013

R-square:

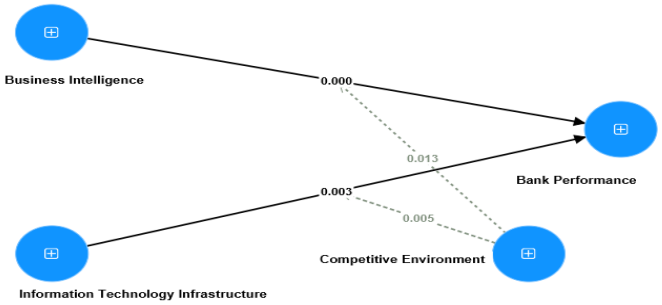
The R-square and adjusted R-square, which gauge how well the model explains the variance in the endogenous variable, are displayed in Table 5. The latter takes into consideration model complexity in terms of the quantity of predictors, which is how it differs from the former. According to Table 5, the independent variables accounted for 64.1% of the variance in Bank Performance, with an R-square of 0.641. With a reasonably similar adjusted R-square (0.634), the model was able to account for 63.4% of the variance in the dependent variable. When taken together, these two metrics indicate that the model was successful in explaining how risk management practices changed.

Table 5: R-square

	R-square	R-square adjusted
Bank Performance	0.641	0.634

Structural model

After that, the structural model was evaluated. Figure 3, which illustrates the connections among the research constructs, presents the findings.



DISCUSSION AND CONCLUSION

The purpose of this study was to determine Enhancing Performance through Business Intelligence and IT Infrastructure, A Competitive Edge Perspective. The results indicate that the hypotheses testing. The significance of the relationships was assessed using t- and p-values. The results indicated that bank performance was positively influenced by business Intelligence, $t = 5.364$, $p < 0.05$, thus hypothesis 1 was supported. Hypothesis 2 was also supported because competitive environment positively influenced bank performance, $t = 8.062$, $p < 0.05$. Information Technology Infrastructure also had a positive direct impact on bank performance, $t = 2.941$, $p < 0.05$, supporting hypothesis 3. Moderation analysis showed the significant effects of the competitive environment between information technology Infrastructure and bank performance $t = 2.811$, $p < 0.05$. Finally, the competitive environment between Business Intelligence and bank performance, $t = 3.607$, $p < 0.05$. This means that hypotheses 5 and 8 were accepted, while 4–5 were rejected. When it comes to bank performance, the results of the current study might be very helpful to banks, IT departments, and chief financial officers. The study's conclusions might also improve the performance of the bank. Notwithstanding its value, the present study has some shortcomings that may indicate areas for further investigation. Future studies may therefore use data from nations with different regulatory frameworks to test the hypothesis even more. Furthermore, by including other variables that can influence the current variables in the model, future research might expand on it.

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