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Artificial Intelligence Applications as a Modern Trend to Achieve Organizational Innovation in Jordanian Commercial Banks

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Abstract

The objective of this study was to see how artificial intelligence applications affected organizational innovation in Jordanian commercial banks. Both independent and dependent variables were measured in three dimensions: expert systems, neural network systems, and fuzzy logic systems for artificial intelligence applications variable. Product innovation, process innovation, and management innovation for the organizational innovation variable. To achieve study objectives, a questionnaire was developed and distributed to a sample of one hundred fifty-three managers in Jordanian commercial banks, who were selected according to the simple random sampling method. Except for the neural network systems dimension, which comes in at an average level, the study indicated that there is a high level of organizational innovation and artificial intelligence applications. Furthermore, the findings revealed that artificial intelligence applications have a significant impact on organizational innovation in Jordanian commercial banks, with the most important artificial intelligence application being a fuzzy logic system. The study suggested keeping track of technological advancements in the field of artificial intelligence applications and incorporating them into banking operations by benchmarking with the best commercial bank practices and allocating a portion of the budget to technological applications and infrastructure development, as well as balancing between technology use and information security risks to ensure client privacy is protected.

Keywords: Artificial Intelligence Applications, Organizational Innovation, Commercial Banks

JEL Classification Code: G41, G2, C13, C87

1. Introduction

Organizations strive to adapt rapidly to the changing environment, where rapid technological progress increases competitive pressures (Lohapan, 2021), at the same time creates a rich set of opportunities that encourage organizations' behavior towards promoting organizational innovation which is reflected in their competitiveness (Sung & Kim, 2021) and it focuses on customers to earn profits and stay in the future. On the other hand, artificial intelligence

has revolutionized information technology due to its advantages in performing tasks faster, better, and less costly (Al-Otaibi et al., 2021; Lee, 2021) as well as the ability to gather the necessary knowledge quickly to solve complex problems and speed up decision-making process (Zraqat, 2020). wherefore, the applications of artificial intelligence have greatly affected various areas, and the promotion of organizational innovation has become at the main goals that organizations seek to achieve, by activating technological applications, including artificial intelligence applications, which are considered as urgent necessities in a competitive environment with due to the main role of artificial intelligence applications in improving organizational performance, decision-making processes and solving administrative problems, as the success of these organizations depends on the ability to use these applications efficiently, in a way that contributes to adapting to the competitive environment (Meske et al., 2021).

Organizational innovation is one of the most important organizational practices that organizations need to deal with the fierce competition so, that they can achieve

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competitive advantages by focusing on how to take advantage of artificial intelligence applications in directing their operations and making decisions (Trocin et al., 2021). Whereas artificial intelligence applications are considered as a part of an organization's competitive intelligence of organizations (Ranjan & Foropon, 2021), according to the general three-dimensional model of artificial intelligence in influencing business, the first dimension indicated that artificial intelligence explores the success of search and innovation algorithms and then disseminates them through commercially available smart devices and services, and the second dimension is the impact of automation research and artificial intelligence to explore existing best practices and their reflection on the organization's ability to launch services based on artificial intelligence, while the third dimension relates to shaping the business context using artificial intelligence. This indicates that artificial intelligence can contribute to raising the ability of organizations to provide organizational innovations.

The global changes and competitive challenges led to the increasing intensity of global competition have come causing the globalization of banking activity, liberalization of financial and banking services, and increasing challenges to banking management (Königstorfer & Thalmann, 2020; Zraqat et al., 2021). Therefore the development of banking services, keeping pace with the successive technological developments in the banking industry, and paying attention to the quality of services and fulfilling the desires of customers has become one of the main entrances to increasing and developing the competitiveness of banks (Butenko, 2018; Zraqat, 2019). On the other hand, the use of artificial intelligence applications in banking work becomes a must to respond to change and development, after the signs of technological development began to be reflected in a major part of the banking service (Hussien et al., 2021). On the contrary, the use of artificial intelligence applications in banking work became a must to respond to change and development, after the signs of technological development began to be reflected in a major part of the banking service (Hussien et al., 2021), as good human relations alone are not enough to make the customer feel fully satisfied (Ukpong, 2019).

As a result, the goal of this study was to determine the extent to which artificial intelligence applications can help Jordanian commercial banks achieve organizational innovation and to clarify the role that artificial intelligence applications play in transforming the financial industry beyond traditional banking services, as artificial intelligence applications have proven to be an effective tool in achieving innovations in banking services. As a result, banks can benefit from the study's findings, particularly in terms of picking the proper sort of AI application based on the environment,

as well as proposals and recommendations that encourage regulatory innovation.

2. Literature Review and Hypothesis Development

Hafner et al. (2021) investigated the variables of artificial intelligence and innovation management, with the findings indicating that artificial intelligence reshapes organizations and regulates innovation management in them, as well as forcing management in the surveyed organizations to rethink the innovation process at the organizational level. Tekic et al. (2019) examined the same topic and conclude that artificial intelligence applications speed up the pace of product and service innovation, with significant implications for governments, communities, and industries, as well as putting data at the center of modern business organizations as artificial intelligence's main engine of the digital revolution.

In southern Taiwan, Wang (2020) looked at the effects of market orientation, organizational innovation, and regulatory assistance. Market orientation is observed to have a positive effect on organizational creativity, organizational support, and job performance, which is reflected in the efficiency with which companies achieve their objectives. In the same vein, Al-Arabi et al. (2019) discussed the impact of knowledge management processes on organizational innovations, taking into account the trend of adapting to organizational change and how this aids organizations in adapting to their environments and adapting to organizational change processes. According to the findings, knowledge management has an impact on an organization's ability to adapt to environmental change and introduce planned organizational innovations. Wang and Zatzick (2019) clarified the importance of new human capital in encouraging organizational innovation, as well as how employment patterns affect human capital acquisition and development. The study concludes that an increase in the rate of employment boosts organizational creativity and that year-over-year increases in employment rates are positively related to organizational innovation.

2.1. Artificial Intelligence

Artificial intelligence is superior to natural intelligence in that it is more consistent, durable, faster in processing and publishing, every step it takes can be documented, and it can perform certain tasks much faster and better than humans (Alrashidi et al., 2022). AI is used to simplify the management of IT processes and accelerate, automate problem-solving in modern and complex IT operating environments. Taguimdje et al. (2020) define artificial intelligence as a set of techniques and models that are used to build machines capable of simulating human intelligence with the help of

technological devices to reproduce advanced knowledge that facilitates and accelerates the achievement of goals. Artificial intelligence is also based on the development of smart programs capable of learning, thinking, collecting, and perceiving knowledge (Kamble & Shah, 2018), and these complex programs perform tasks through environmental sensing and response processes (Cockburn et al., 2018), and can simulate the behaviors of individuals, thinking and acting smart decisions.

There are many artificial intelligence applications used in various types of contemporary business organizations, each according to its type and field, and because the study community is made up of Jordanian commercial banks, the two researchers looked into the applications used in these banks, which are three applications that pertain to the following studies.

A) Expert Systems:

They're characterized as a collection of systems that use human knowledge stored in computers to tackle problems that typically require human skill to simulate expert thought processes but cannot learn from experience. An expert system uses artificial intelligence (AI) technology based on one or more expert knowledge to assess and solve problems in specific areas of knowledge, experience, and methods, synthesize and construct rules, and then store them using implemented programs. These systems are based on computer software that derives their answers from knowledge bases using the inference engine that interacts with users and processes the results (Bui et al., 2020), and they are knowledge-based systems that have other names such as smart agent systems and consist of four components, namely the user interface, Knowledge acquisition system, knowledge base, and search system (Khalil et al., 2020).

B) Neural Network Systems:

It refers to data processing methods based on simulations of natural neural networks in the human brain, which are made up of artificial nodes or neurons that learn and then work to record and store that knowledge in synaptic neurons (Arunkumar et al., 2020). It also learns from experience and distinguishes between shapes and patterns, which sets it apart from typical programs that follow a set of instructions. It's also compatible with non-linear models, which vary over time and have data related to non-linear relationships, and it represents a base for deep learning starting from the input data, then it trains to recognize data patterns, and then predicts new outputs from the data (Rahman & Muniyandi, 2020). On-linear systems, which can identify shortcuts to attain computationally expensive answers, are one of the

Artificial Neural Network Benefits. Instead of waiting for entries in a data source to be explicitly connected, these systems can infer links between data points.

C) Fuzzy Logic Systems:

Fuzzy logic systems express a mechanism for processing multiple values based on the same variable, thus solving problems using a range of data, arriving at accurate conclusions, and making the best possible decisions based on the available inputs (Kamble & Shah, 2018). This technique resembles human decision-making procedures and displays all options between yes and no, especially in times of uncertainty, based on the knowledge stored in the inference system's knowledge base (Ferdaus et al., 2020). These systems are used with expert systems and neural networks with fuzzy logic, especially in banking fields such as forecasting the expected return of securities, investment portfolio management, and cash flow planning (Mohammadian, 2020).

2.2. Organizational Innovation

Organizational innovation is defined as the use of new organizational methods in an organization's practices to increase operational efficiency by reducing costs and improving workplace satisfaction (Annika & Sverker, 2015). It is the adoption of new methods in managing the organization's business and the mechanisms and procedures followed within it and its relations with its external environment to achieve organizational excellence (Al-Arabi et al., 2019). In the same setting, four factors influence organizational innovation: the environmental context, the organizational context, external, and internal change factors (Annika & Sverker, 2015). Regardless of the type of organizational innovation on products, processes, or administrative processes, Najm (2003) pointed out that it will either be an incremental innovation through modifications and improvements to the currently used innovation type or a radical innovation by introducing something completely new that differs from the existing one.

By looking at previous studies, the researchers found that several scholars (Al-Arabi et al., 2019; Annika & Sverker, 2015) used three dimensions to measure organizational innovation dimensions namely product innovation, process innovation, and managerial innovation. Therefore, the researchers adopted these three dimensions for the current study.

A) Product Innovation:

It refers to the introduction of new products (goods and services) or making modifications and improvements to existing products, including their specifications,

components, and ways of providing them (Al-Arabi et al., 2019). Product innovation is defined as the development of new products, changes in the design of established products, or the use of new materials or components in the manufacture of established products (Al-Arabi et al., 2019). There are two types of innovation of goods and services - Incremental innovation is a series of small improvements or upgrades made to a company’s existing products, services, processes, or methods. The changes implemented through incremental innovation are usually focused on improving an existing product’s development efficiency, productivity, and competitive differentiation (Annika & Sverker, 2015) and radical innovation by introducing entirely new products (Al-Arabi et al., 2019).

B) Process Innovation:

It is related to the changes or developments that organizations implement in the current production methods and the methods and equipment used in that. Alternatively, firms may introduce innovative ways, methods, and technology for manufacturing to cut costs and boost productivity, which is reflected in overall performance and competitiveness (Deep & Bahlul, 2019).

C) Management Innovation:

This refers to all changes to the organizational structure, methods of designing tasks, as well as methods of decision-making, and all administrative processes that take place within the organization (Annika & Sverker, 2015). It also includes the strategies that the organization chooses to adapt to its environment, as well as the organization’s procedures and behaviors that improve the organizational climate and contribute to motivating and empowering human resources (Deep & Bahlul, 2019).

Through a literature review, the following hypotheses were developed:

H1: Artificial intelligence applications positively affect organizational innovation in Jordanian commercial banks.

H2: Artificial intelligence applications positively affect product innovation in Jordanian commercial banks.

H3: Artificial intelligence applications positively affect process innovation in Jordanian commercial banks.

H4: Artificial intelligence applications positively affect management innovation in Jordanian commercial banks.

3. Methodology

The researchers used a three-dimensional scale to measure the applications of artificial intelligence (the independent variable): expert systems, neural network systems, and fuzzy logic systems. For this part of the questionnaire, the researchers used 14 items for the scale measurement, taken from previous studies (Bui et al., 2020; Kamble & Shah, 2018; Mohammadian, 2020). Additionally, to measure organizational innovation (the dependent variable), a scale consisting of three dimensions: product innovation, process innovation, and managerial innovation with 17 items were used taken from previous studies (Al-Arabi et al., 2019; Kamble & Shah, 2018). Then the stability of the scales was tested, and it exceeded (0.70), which indicates its stability.

To achieve the purpose of the current study, the researchers distributed an electronic version of the study questionnaire to 413 managers in 13 Jordanian commercial banks. The sample is selected randomly, as 153 questionnaires were retrieved from the overall population.

4. Results

Table 1 presents descriptive analysis, the stability of the questionnaire, and the relative importance of the dimensions of the study variables.

Table 1 demonstrates the artificial intelligence application dimensions, with expert systems having the highest mean (3.733), followed by fuzzy logic systems, while neural networks have the lowest mean. Furthermore,

Table 1: Descriptive Analysis, Stability, and the Relative Importance

The Dimension	Paragraphs	Cronbach Alpha	SMA	Standard Deviation	Relative Importance
Expert systems	5	0.817	3.733	0.705	High
Neural network systems	5	0.793	3.494	0.869	Medium
Fuzzy logic systems	4	0.783	3.670	0.791	High
Product innovation	6	0.798	3.701	0.730	High
Process innovation	6	0.806	3.800	0.614	High
Management innovation	5	0.905	3.934	0.726	High

all dimensions of organizational innovation scored well, with management innovation having the highest mean of 4.15, followed by process innovation.

Table 2 shows the results of the multiple regression analysis of the impact of artificial intelligence applications' dimensions on organizational innovation. It shows that fuzzy logic systems have a significant impact on organizational innovation, as this impact amounted to (0.332), while there is no impact of expert systems and neural network systems on organizational innovation. Moreover, the impact of the combined dimensions of artificial intelligence applications is significant with a level of significance (0.000), with an interpretation rate of R^2 (0.447). Accordingly, the first hypothesis can be accepted.

Table 3 indicates the results of the multiple regression of the impact of artificial intelligence applications' dimensions on product innovation as one of the dimensions of organizational innovation. It shows that fuzzy logic systems have a significant impact on product innovation, as this impact amounted to (0.555), while expert systems and neural network systems did not have a significant impact. However, the impact of the combined dimensions of artificial intelligence applications is significant with a level of significance (0.000), with an interpretation rate of R^2 (0.545). Accordingly, the second hypothesis is accepted.

Table 4 shows the results of the multiple regression for the impact of artificial intelligence applications on process innovation as one of the dimensions of organizational innovation. It shows that fuzzy logic systems have a significant impact on process innovation, as this impact

Table 2: The Impact of Artificial Intelligence Applications on Organizational Innovation

The Dimension	B	Beta	T	Sig.
Expert systems	0.013	0.018	0.203	0.839
Neural network systems	0.110	0.183	1.765	0.080
Fuzzy logic systems	0.332	0.503	4.928	0.000

$R = 0.669$; $R^2 = 0.447$; $F = 40.158$; Sig. = 0.000.

Table 3: The Impact of Artificial Intelligence Applications on Product Innovation

The Dimension	B	Beta	T	Sig.
Expert systems	0.053	0.052	0.651	0.516
Neural network systems	0.103	0.122	1.301	0.195
Fuzzy logic systems	0.555	0.602	6.495	0.000

$R = 0.738$; $R^2 = 0.545$; $F = 59.429$; Sig. = 0.000.

Table 4: The Impact of Artificial Intelligence Applications on Process Innovation

The Dimension	B	Beta	T	Sig.
Expert systems	0.084	0.097	1.150	0.252
Neural network systems	0.059	0.083	0.835	0.405
Fuzzy logic systems	0.435	0.561	5.703	0.000

$R = 0.698$; $R^2 = 0.487$; $F = 47.182$; Sig. = 0.000.

Table 5: The Impact of Artificial Intelligence Applications on Managerial Innovation

The Dimension	B	Beta	T	Sig.
Expert systems	0.277	0.159	1.440	0.155
Neural network systems	0.019	0.018	0.158	0.875
Fuzzy logic systems	0.610	0.575	5.221	0.000

$R = 0.567$; $R^2 = 0.322$; $F = 35.147$; Sig. = 0.000.

amounted to (0.435). As for expert systems and neural network systems, their impact is not significant. However, the impact of the combined dimensions of artificial intelligence applications is significant with a significance level (0.00), with an interpretation ratio of R^2 (0.487). Therefore, the third hypothesis is accepted.

Table 5 presents the results of the multiple regression of the impact of artificial intelligence applications' dimensions on management innovation as one of the dimensions of organizational innovation. It shows that fuzzy logic systems have a significant impact on management innovation, as this impact amounted to (0.610), while expert systems and neural network systems do not have a significant impact. Moreover, the impact of the combined dimensions of artificial intelligence applications is significant with a significance level of (0.000), with an interpretation rate of R^2 (0.322). So, the fourth hypothesis is accepted.

5. Conclusion and Recommendations

The levels of artificial intelligence applications are high for expert systems and fuzzy logic systems, and medium for neural network systems so, this indicates the interest of Jordanian commercial banks and their focus on providing advanced technological requirements in pursuit of growth and development and achieving a prestigious market position.

Jordanian commercial banks have high levels of organizational innovation features. This is owing to the Jordanian banking sector's intense local and worldwide competitiveness, which raises the obstacles it is attempting

to overcome through innovations at all administrative levels, processes, and products.

There is an impact of artificial intelligence applications on organizational innovation, and the most influential dimension was fuzzy logic systems, while there is no effect on the dimensions of expert systems and neural network systems, and this may be because fuzzy logic systems are considered more developed and expert systems and neural network systems have been updated to become fuzzy to be able to present accurate conclusions and make the best decisions that simulate human thinking.

There is an impact of artificial intelligence applications on product innovation, process innovation, and managerial innovation, with fuzzy logic systems having the most influence, while expert systems and neural network systems have no significant impact. This could be because expert systems lack learning capabilities from experience, making them insufficient to face technological changes on their own. In the case of neural network systems, despite their potential to learn, their levels are average in the study sample, indicating that they are not trusted in most Jordanian commercial banks.

Based on the results, the study recommends that the Jordanian commercial banks' departments should follow up on technological developments in the field of artificial intelligence and include them in banking operations, especially in the field of neural network systems; due to its superior ability to learn and process data very quickly, and this further improves the understanding of customers and their better service, and this can be applied by making a benchmarking with the best commercial banks, and trying to apply the best practices to their operations, products, and management style. This, of course, requires these departments to allocate a portion of the budget related to technological applications and infrastructure development, and at the same time requires them to seek to balance the use of technology and information security risks to ensure the protection of all customers data and money.

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