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<https://doi.org/10.1057/s41599-024-03198-9>

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Technology factors and ERP system efficiency in the Jordanian industrial firms: does company size matter?

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The study was structured to investigate the impact of technological factors on the effectiveness of enterprise resource planning (ERP) in Jordanian industrial firms, using a descriptive-analytical approach. This study also examines company size as a moderator variable, which has been measured using the logarithm of total assets extracted from each firm's annual report. The study's target population consisted of all Jordanian industrial firms listed on the Amman Stock Exchange, totaling 55 firms. Managers participated as respondents, with 220 questionnaires distributed electronically, averaging four questionnaires per company. After data collection, 92 valid questionnaires were used for statistical analysis. The findings indicate a significant and positive relationship between technological factors (such as ease of use, perceived usefulness, and digital proficiency) and ERP system effectiveness in Jordanian industrial firms. However, the study revealed that trust, as one of the technological factors, did not significantly impact ERP system efficiency. Additionally, it was found that the moderating role of company size moderates positively the relationship between two technological factors (i.e., perceived usefulness and digital proficiency), and ERP system efficiency. The research suggests that industrial firms in Jordan should take into account technological factors, including factors like ease of use, perceived usefulness, and digital proficiency, to remain current with advancements that can improve the efficiency of ERP systems. This is important due to the positive influence it can have on the operational effectiveness of Jordanian industrial companies, aiding them in their planning and decision-making processes.

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Introduction

The present century is marked by significant challenges that organizations face, both in terms of quantity and quality (Almaiah et al., 2022a; Alshirah et al., 2020; Daviy, 2023). These challenges encompass the rapid evolution of information systems and information and communications technology (Lutfi et al., 2022a), the globalization of markets, the expanding influence of the knowledge-based economy, heightened competition, the surge in mergers, and collaborative ventures among organizations (Saad et al., 2022). In response to these challenges, organizations must adopt a clear vision to navigate and thrive in this dynamic landscape (Almaiah et al., 2022b; Alsharif et al., 2024). The future demands the ability to identify opportunities, seize them, and discern and mitigate potential threats and risks (AlQudah et al., 2022; Alshirah et al., 2021a; Lutfi et al., 2023). Consequently, many firms have been prompted to explore swift and effective solutions that foster success and sustainability, foster business development, enhance adaptability to their surroundings and equip them to compete effectively against other firms, whether within their respective industries or in supportive roles (Almaiah et al., 2022c; Almajali et al., 2022). These solutions aim to create new advantages through speed, precision, and the harmonious integration of the company's systems (AlQudah, 2015; Lutfi, 2021). In light of these challenges, the concept of an enterprise resource planning (ERP) system has emerged (Zamzeer et al., 2020; Abu Afifa, Saleh & Vo Van, 2023).

The ERP system can be described as a collection of interconnected subsystems that encompass accounting information systems and management information systems (Lutfi, 2021). Essentially, it represents an integrated framework that combines both financial and non-financial processes to attain specific objectives for businesses (Daviy, 2023). Its primary aims are cost reduction and the facilitation of streamlined communication with the various branches of the company (Zamzeer et al., 2020; AlQudah et al., 2024; Jaradat, Shbail & Baker, 2022). The integrated ERP system relies on information technology and is characterized by the seamless integration of four core dimensions: accounting and finance, sales and marketing, manufacturing and production, and human resources (Saad et al., 2022). As a result, the ERP system is recognized as an information system that encompasses all aspects of an organization's operations, spanning from raw material procurement to post-sales activities (Almajali et al., 2022).

Therefore, using ERP systems effectively and efficiently has resulted in significant benefits such as reduced inventory levels, speed in exchanging transactions, better financial management, improved supply chain, reduced transportation and logistics costs, improved level of responsiveness to customers, increased flexibility, increased productivity, and making tacit knowledge explicit (Lutfi, 2021). Nevertheless, for organizations to achieve the intended advantages of the resource planning system, it is imperative that they meticulously strategize the system's implementation. Numerous projects have faced delays as a result of requiring extra funding due to inadequate budget allocation for the implementation process. Hence, it is essential to comprehend the factors that could potentially give rise to issues that hinder the efficient application of the ERP system. As a new technology, the ERP systems are affected by several technological factors, that may enhance or decrease the efficiency of ERP systems.

The technological factors include ease of use, dependability, perceived value, and digital expertise, which have a pivotal role in the efficiency of technology. Ease of use refers to how individuals perceive the simplicity of employing a specific technology. When technology is perceived as user-friendly, it fosters a higher level of enthusiasm for adoption. The perceived usefulness of software significantly influences its adoption (AlQudah, 2024; Lutfi et al.,

2022c). Trust in the utilization of technology is contingent on users feeling secure with the technology and their capacity to validate the actions of other active Internet participants (Almaiah et al., 2022d). Lastly, the digital proficiency of employees in employing such technology is a vital consideration, and it falls within the purview of senior management (Daviy, 2023). It is the responsibility of top management to provide employees with the necessary education and training on the proper utilization of information systems and the associated methods (Almajali et al., 2022). Besides, the efficiency of an ERP system is linked to the size of the company; not all firms can afford the cost of implementing an ERP system. Larger firms typically have the financial resources to provide training to their employees for new technologies (Egdair, Rajemi & Nadarajan, 2015; Lutfi, 2020).

In the context of the Jordanian industrial sector, implementing an (ERP) system in Jordanian companies is considered an important part of the business management strategy. The ERP system aims to integrate and unify the company's various operations into one system to improve efficiency and make better decisions (Noureddine, 2021). However, implementing the ERP system in Jordanian industrial companies has faced several challenges. The high Cost of Implementing an ERP system is one of the main obstacles that face ERP system adoption in Jordanian industrial companies. Also, adopting an ERP system requires good planning and effective direction to avoid problems and ensure project success (Almahirat, 2016). Changing a company's operations can also present a challenge in adapting the organization's culture to the new ERP system (Siam, 2015). At the same time, rapid technological developments may make some ERP systems outdated quickly, requiring periodic updating in Jordanian industrial companies (Noureddine, 2021). On the other hand, the success of an ERP system requires good training and qualification of employees to understand and use the system effectively. However, implementing an ERP system in Jordanian industrial companies can have a significant positive impact on management and business.

They have established strong security measures to protect company data and customer information, training employees on security practices and emphasizing the importance of maintaining the confidentiality of information (AlQudah, 2023; Almahirat, 2016). They provided extensive training programs for employees to ensure they have a good understanding of the ERP system and can use it effectively. Furthermore, they defined a plan to implement the ERP system gradually rather than as an immediate shift to minimize the impact on daily operations. They ensure that the implementation of the ERP system takes into account Jordanian regulations and legislation, especially regarding data protection and taxes (Siam, 2015). Additionally, they defined policies to regularly evaluate the ERP system's performance and take actions to improve it based on technology updates or company needs (Almahirat, 2016; Noureddine, 2021). Despite these policies, the efficiency of the ERP system in Jordanian industrial companies is still vulnerable. Therefore, through reviewing the literature and the context of Jordan, this study has addressed the technological factors to investigate the efficiency of the ERP system (Almahirat, 2016; Siam, 2015). Furthermore, this study uses the size of the industrial company as a moderator factor because not all Jordanian industrial companies can afford the cost of implementing an ERP system. Small firms typically do not have the financial resources to provide training to their employees for new technologies compared to large companies (Egdair et al., 2015; Lutfi, 2022).

Furthermore, despite the limited number of studies addressing ERP system efficiency, previous research has mainly focused on the intention to use the ERP system or examined general factors

affecting its effectiveness (Zamzeer et al., 2020; Jaradat et al., 2022). Unfortunately, technological factors have been overlooked, despite their significance in the context of ERP system efficiency, particularly in developing societies like Jordan (Marei et al., 2023). Moreover, Jordanian industrial firms face challenges in comprehending the true impact of technological factors on ERP system efficiency, as well as the influence of company size on the relationship between technological factors and ERP system efficiency within Jordanian industrial firms (Alghadi et al., 2023; Almajali et al., 2022).

The importance of this study is derived from its unique focus on the relationship between technological factors and the efficiency of ERP systems, especially in the context of a company's size. The inspiration for this study stems from the advantages associated with the efficiency of ERP systems in diverse domains. ERP systems integrate a range of business functions and processes, minimizing the need for manual data input and optimizing operations. This ultimately results in heightened efficiency and decreased operational expenses.

Nonetheless, implementing an ERP system can introduce a range of difficulties and obstacles. These challenges encompass the potentially high expenses associated with procuring and deploying ERP systems, which include costs related to software licenses, hardware, training, and consulting services (Almajali et al., 2022). Furthermore, the inherent complexity of ERP systems, arising from their integration of diverse business processes, can pose significant challenges. Resistance to change among employees can result in hurdles related to user acceptance and disruptions in workflow. Consequently, this study has directed its attention to technological factors, such as ease of use, perceived usefulness, trust, and digital proficiency, which are pivotal elements influencing the efficiency of ERP systems within Jordanian industrial enterprises.

However, the lack of studies concerning the Diffusion of Innovations (DOI) theory in accounting innovation has been exacerbated by the limited focus on audits in developed nations, largely ignoring the advanced technology in accounting, particularly in the industrial sector (Lutfi & Alqudah, 2023). Moreover, the drivers or preventers of innovation adoption of ERP systems in the industrial sector vary from one context to the next, which varies from developed to developing nations (Ahmi, Saidin & Abdullah, 2014). Hence, this study examines the effect of technological factors on ERP systems efficiency in Jordanian industrial firms, using the DOI theory as the underpinning theory. This is because DOI theory provides a structured framework for understanding how innovations, including technological solutions like ERP systems, are adopted over time. It helps in identifying the stages through which organizations move in adopting new technologies.

The present study tackles this practical issue by proposing a framework that delves into the efficiency of ERP systems in connection with technological factors, with the inclusion of company size as a moderating variable. This approach is underpinned by the following objectives: (1) to assess how technological factors impact the efficiency of ERP systems in Jordanian industrial firms; (2) to assess how technological factors affect the efficiency of ERP systems in Jordanian industrial firms, taking into account the moderating role of company size. However, this paper found a significant and positive effect of technological factors i.e., ease of use, perceived usefulness, and digital proficiency on the ERP system efficiency in Jordanian industrial firms.

Literature review and hypotheses development

The ERP system efficiency in Jordanian industrial companies.

The industrial sector is one of the important pillars of

development in countries, as it contributes significantly to the process of economic development and possesses forces capable of influencing economic systems. The Jordanian industrial sector is primarily composed of the "manufacturing industries" sector, encompassing leather, textile, therapeutic, medical supplies, chemical, cosmetics, plastic, rubber, engineering, electrical, information technology, wood, furniture, construction, catering, food, packaging, paper, cardboard, and office supplies industries. Additionally, the sector includes the "extractive industries" sector, involving mining, and the "electricity and water" sector. The industrial sector is considered a fundamental pillar of the Jordanian economy, thanks to its multiple and prominent contributions to achieving economic and social development. Consequently, the industrial sector bears a significant responsibility for enhancing the standard of living by facilitating individual integration into the labor market and elevating their skills and experience levels (Ministry of Industry and Trade, 2022).

The number of companies listed in the industrial sector, according to the Amman Stock Exchange website for the year 2022, reached 55 companies. The industry in Jordan is mainly divided into two sectors: manufacturing industries and mining industries. Below is a breakdown of each: (1) The manufacturing sector: The exports of this sector constituted 82.8% of the total Jordanian industrial exports, according to data from the Ministry of Industry, and Trade (2022). It includes various sub-industries such as leather, plastic, chemical, food, information technology industries, and others. (2) Mining industries sector: Considered one of the most important strategic sectors in Jordan, the exports of this sector, in its various branches, constituted 17.2% of the total Jordanian industrial exports, as per data from the Ministry of Industry, and Trade (2022). It encompasses mining and quarrying, potash, cement, phosphate, stone extraction, limestone, and other mining industries.

Furthermore, Jordan is home to a diverse range of industrial firms across various sectors. Jordan's industrial landscape covers a wide range of sectors, including manufacturing, pharmaceuticals, chemicals, food and beverages, textiles, construction materials, and electronics (Alqudah et al., 2023a; Smadi, 2016). Industrial firms in Jordan often engage in export-oriented activities, selling their products to regional and international markets (Shehadeh 2023). Key export items include pharmaceuticals, clothing, and agricultural products. The industrial sector plays a significant role in Jordan's economy, contributing to GDP and providing employment opportunities (Hamza Mohammad, 2020). The sector has experienced growth and diversification in recent years. The Jordanian government has implemented policies and initiatives to support the industrial sector, including tax incentives and investment promotion measures (Zaitoun & Alqudah, 2020). Sustainability and environmental concerns are becoming more significant for industrial firms in Jordan (Abu Afifa et al., 2023). There is a growing emphasis on adopting eco-friendly and energy-efficient practices. The country has a relatively well-educated and skilled workforce, with many technical and vocational training institutions to support the industrial sector.

Despite the challenges that face Jordanian industrial firms such as access to financing, infrastructure development, the need for skilled labor, and regional geopolitical instability that impacts trade and investment (Mansour et al., 2023a), Jordan's industrial firms are an essential component of its economic landscape, contributing to both the local and global economies (Hamza Mohammad, 2020; Shehadeh, 2023). They are influenced by regional and international dynamics and continue to adapt and evolve to meet the challenges and opportunities presented by the global market (Smadi, 2016). Therefore, Jordanian industrial firms began to search for accounting and administrative

information systems that would help them achieve their goals and keep pace with developments occurring in the business environment. In light of the escalation of criticism directed at traditional accounting and administrative information systems due to their weak ability to support the processes of evaluating and improving the performance of firms, the ERP system appeared.

ERP systems is a comprehensive software solution designed to streamline and integrate various business processes and functions within a company (Smadi, 2016). The systems consolidate and centralize data from various departments, including finance, human resources, manufacturing, sales, and more (Daviy, 2023). This integration facilitates better communication and data sharing between different parts of the company (Zamzeer et al., 2020). ERP systems also provide real-time data and insights, allowing organizations to make informed decisions and respond to changes more rapidly. Another benefit of ERP systems it can help industrial firms stay compliant with industry-specific regulations and standards by ensuring accurate and auditable data (Almajali et al., 2022).

Furthermore, by automating processes and reducing manual data entry, ERP systems can significantly improve operational efficiency (Abu Afifa et al., 2023). This leads to time and cost savings. Data entered into an ERP system is typically more accurate because it's entered once and shared across the organization, reducing errors associated with duplicate data entry. ERP systems offer a comprehensive view of an organization's performance, enabling managers to monitor key metrics and make data-driven decisions. ERP systems often come with reporting and analytics tools that allow users to generate custom reports and gain insights into various aspects of the business. ERP systems can be customized to fit the unique needs and processes of an organization. This adaptability is critical for aligning the system with specific business requirements.

On the other hand, ERP systems can entail substantial initial costs, which encompass expenses for software licenses, hardware, and implementation services. Ongoing maintenance and support costs are also critical factors to consider in relation to the perceived usefulness of the system. Additionally, this system necessitates a qualified staff to use it effectively, making training essential for employees to harness the ERP system efficiently. User efficiency can be challenging, as employees must adapt to new processes and workflows, highlighting the importance of empowering employees with digital proficiency (Zamzeer et al., 2020). Moreover, ERP systems handle sensitive company data, making security a paramount consideration. Robust security features are imperative to safeguard against data breaches and unauthorized access, thereby fostering trust (Daviy, 2023). In conclusion, ERP systems are inherently complex due to their offering a wide range of functionalities, including financial management, human resources management, supply chain management, customer relationship management, manufacturing, and more (Almajali et al., 2022). To promote ERP system efficiency, firms need to configure the system in a manner that is perceived as user-friendly by their employees. Consequently, ERP systems have become indispensable tools for all Jordanian industrial firms, aiding in operational enhancement, decision-making improvement, and competitive advantage in the market (Lutfi, 2023). Nevertheless, successful implementation and utilization require meticulous planning, user training, and continuous maintenance. Therefore, this study aims to explore the impact of technological factors on ERP systems efficiency within Jordanian industrial firms.

Technology factors influencing ERP system efficiency. Technology factors such as ease of use, trust, digital proficiency, and

perceived usefulness play a significant role in the efficiency of ERP systems (Lutfi & Alqudah, 2023). ERP systems are complex and integrated software solutions that impact various aspects of an organization, so the way employees and stakeholders perceive and interact with the technology can greatly influence its successful efficiency (Alrfai et al., 2023; Alshirah et al., 2021b). Here's how each of these factors can impact ERP system efficiency.

More precisely, if an ERP system is Easy to Use, it reduces the learning curve for employees, making it more likely for them to embrace the system. Also, users are more likely to adopt the system if it doesn't require extensive training or if it aligns with their existing skills and knowledge. An intuitive interface and streamlined processes can boost user productivity and satisfaction. Regarding the Trust factor, Trust in the system's ability to secure sensitive data is crucial. ERP systems often store and manage critical business information, and users must have confidence in the system's security measures (Saad et al., 2022). The system's reliability in providing accurate and consistent data is essential. Frequent errors or system failures can erode trust and hinder efficiency.

Furthermore, the level of digital proficiency among employees can influence their willingness to use an ERP system. Adequate training and support are necessary to bridge any knowledge gaps. That to say a lack of digital proficiency can result in resistance to change. So, organizations must invest in training and change management strategies to help employees adapt. Finally, users must see the system's value in their daily tasks and decision-making processes. If they perceive the ERP system as beneficial, they are more likely to embrace it (Zamzeer et al., 2020; Scholtz, Mahmud & Ramayah, 2016). Further, the ability to customize the ERP system to meet specific organizational needs can enhance its perceived usefulness (Smadi, 2016). A one-size-fits-all approach may not align with the organization's unique requirements. Successful ERP system efficiency often requires holistically addressing these technology factors (Lutfi & Alqudah, 2023). Ultimately, successful ERP system efficiency depends on a combination of these factors and careful management of the technological, human, and organizational aspects of the implementation process.

Ease of use and the ERP system efficiency. Ease of use in the context of any system, whether it's a software application, a piece of hardware, a process, or a physical product, refers to the degree to which the system is user-friendly and accessible to individuals who interact with it (Almaiah et al., 2022d; Egdair et al., 2015). As per Rogers et al. (2014), the adoption of new technology or systems might encounter obstacles if perceived as excessively complex—for instance, difficulties in aligning with existing processes. Therefore, the enhanced ease of use of technology promotes increased levels of utilization (Almaiah et al., 2022e). In the context of ERP system efficiency, ease of use refers to how user-friendly and intuitive the ERP system is for the individuals or employees who will be using it within an organization. It's a measure of how easily and comfortably people can interact with and navigate the ERP system to perform their daily tasks and responsibilities.

To make the ERP system easy to use it should be visually appealing and organized logically, with clear menus, icons, and navigation options. Users should be able to easily access the features and functions they need. The ERP system should be accessible to all users, including those with different levels of technical proficiency (Egdair et al., 2015). This means that it should not require advanced technical skills or knowledge to operate effectively. The ERP system should be designed in a way that minimizes the time and effort required for users to learn how to use it. Complex and convoluted systems can lead to resistance and frustration among users (Zamzeer et al., 2020).

Ease of use is a crucial factor in ERP system efficiency because it can significantly affect user satisfaction (Marei et al., 2022), productivity, and the overall success of the ERP implementation (Daviv, 2023). If users find the system difficult to use or if it disrupts their daily tasks, they may resist using it, which can lead to inefficiencies and hinder the organization's ability to fully realize the benefits of the ERP system. Therefore, ERP system vendors and firms should prioritize ease of use to encourage smooth efficiency and user acceptance.

In the context of this study, ease of use plays a crucial role in the ERP systems' efficiency among Jordanian industrial firms, as it does in organizations around the world. To promote ERP system efficiency in Jordanian industrial firms, these organizations must select or develop systems that prioritize ease of use. Additionally, addressing ease of use and user experience can lead to successful ERP implementations in Jordanian industrial settings, improving operational efficiency and competitiveness. Hence, based on the aforementioned we proposed the following hypothesis, *H₁: The ease of using the ERP system significantly influences its efficiency in Jordanian industrial firms.*

Trust and the ERP system efficiency. Trust refers to the confidence and reliance that an organization, its employees, and its stakeholders have in the ERP system's ability to deliver on its promises and meet their expectations. Trust in ERP system efficiency is crucial because ERP systems are complex, integrated software solutions that have a significant impact on various aspects of an organization's operations and data management (Rogers et al., 2014). Users need to have confidence that the system will consistently function as expected, providing accurate and timely data and facilitating smooth business processes (Egdair et al., 2015). Trust also involves the security and confidentiality of the data within the ERP system. Users need to believe that sensitive business information, financial data, employee records, and other critical data are adequately protected from unauthorized access or breaches.

Further, when trust is established, the firms are more likely to embrace the system, use it effectively, and continue to do so over time (Khalaf et al., 2023; Darwez et al., 2023). Conversely, a lack of trust can lead to skepticism, resistance, and reluctance to adopt or utilize the ERP system, which can hinder its effectiveness and success (Zamzeer et al., 2020). Therefore, building and maintaining trust is an essential aspect of ERP system efficiency and overall user satisfaction. In the context of Jordanian industrial firms, just as in other organizations, the protection of sensitive business data, financial information, and employee records is paramount (Smadi, 2016). Trust in the ERP system's ability to secure and maintain the confidentiality of this data is a critical factor. If employees and stakeholders trust the system's data security measures, they are more likely to be comfortable using the system for critical tasks (Egdair et al., 2015). Trust is also influenced by the transparency of system operations. When employees and stakeholders can see how the ERP system works and understand how data is managed and used, it builds confidence. Transparent practices help users trust that their data is handled responsibly and that the system's processes are well-defined. Hence this study proposed that in light of the DOI theory, the high level of trust will lead to a high level of ERP systems among Jordanian industrial firms, this drives the following hypothesis, *H₂: The trust in using the ERP system significantly influences its efficiency in Jordanian industrial firms.*

Perceived usefulness and the ERP system efficiency. Perceived usefulness, often referred to as the "perceived utility" or "perceived value" is a concept in the field of technology acceptance and user experience (Lutfi & Alqudah, 2023). It relates to an

individual's subjective evaluation of how beneficial or valuable they believe a particular technology, system, or product is in helping them achieve their goals or solve their problems (Alsyouf et al., 2023; Scholtz et al., 2016). Perceived usefulness is a critical factor in understanding how and why people choose to use or adopt technology (Lutfi et al., 2023a; Moore & Benbasat, 1991).

Perceived usefulness plays a significant role in the ERP systems' efficiency among Jordanian industrial firms. Jordanian industrial firms often implement ERP systems to streamline their operations, improve efficiency, and gain a competitive edge (Almajali et al., 2022). The perceived usefulness of an ERP system hinges on whether employees, especially key decision-makers, believe that the system can effectively support these business goals. The perceived usefulness of an ERP system is closely tied to its relevance to the daily tasks and responsibilities of employees (Egdair et al., 2015). If employees believe that the ERP system can simplify their work, enhance decision-making, and improve productivity, they are more likely to embrace its efficiency. When employees understand how the system will improve their work processes and contribute to the organization's success, their perception of its usefulness is likely to be more positive. Employees may initially have doubts about the perceived usefulness, but effective change management strategies can help alleviate these concerns and build confidence in the system. Hence, we proposed that the high level of perceived usefulness will support the ERP system's efficiency in Jordanian industrial firms, this drives the following hypothesis, *H₃: The perceived usefulness ERP system significantly influences its efficiency in Jordanian industrial firms.*

Digital proficiency and the ERP system efficiency. Digital proficiency, also known as digital literacy or digital skills, refers to the ability of individuals to use and navigate digital technologies and tools effectively. It encompasses a range of competencies and knowledge related to using computers, software applications, the internet, and other digital resources. Digital proficiency is essential in today's increasingly technology-driven world, as it empowers individuals to access information, communicate, solve problems, and perform tasks in various personal and professional contexts (Lutfi & Alqudah, 2023; Rawashdeh & Rawashdeh, 2023).

Digital proficiency plays a significant role in the successful efficiency of ERP systems. ERP systems are integrated software solutions that help organizations manage various business processes, such as finance, human resources, inventory, supply chain, and customer relationship management. When implementing an ERP system, it's essential to consider the level of digital proficiency within firms. Because adequate training is essential to ensure that employees can effectively use the ERP system. A digitally proficient workforce will adapt more quickly to new technologies and processes (Egdair et al., 2015; Almajali et al., 2022). Digitally proficient users are more likely to input data correctly and follow best practices for data management, reducing errors and ensuring the reliability of the system. So, digital proficiency is a critical factor in the successful efficiency and use of ERP systems (Lutfi & Alqudah, 2023). That to say, firms should invest in training and resources to ensure that their workforce has the necessary digital skills to maximize the benefits of ERP system implementation.

Furthermore, the efficiency and successful implementation of ERP systems in Jordanian industrial firms is affected by digital proficiency. The digital proficiency helps ensure that data entry and management within the ERP system are accurate and consistent. This, in turn, leads to higher data quality, which is crucial for effective decision-making and reporting (Alkhazaleh, & Marei, 2021). Many Jordanian industrial firms use various

digital tools and systems in their operations. Digital proficiency enables employees to integrate the ERP system with these existing tools, improving overall efficiency and connectivity (Smadi, 2016). With a proficient workforce, organizations may reduce the costs associated with additional training, support, and potential errors that could occur during ERP system efficiency. Finally, in the Jordanian industrial sector, having a digitally proficient workforce can provide a competitive advantage. Firms that can effectively utilize ERP systems are often better positioned for growth and efficiency. Hence, we proposed that in light of the DOI theory, the high level of digital proficiency will support the ERP system's efficiency in Jordanian industrial firms, this drives the following hypothesis, H_4 : *The digital proficiency of the ERP system significantly influences its efficiency in Jordanian industrial firms.*

The moderating effect of company size. This study proposed that the company size moderates the relationship between technology factors (i.e., ease of use, trust, digital proficiency, and perceived usefulness) and the efficiency of the ERP system in Jordanian industrial firms. Company size pertains to the quantity of resources possessed by the organization, encompassing various metrics such as total assets, sales figures, average sales, and average total assets (Mansour et al., 2024). Essentially, it delineates the extent of an organization's boundaries. Interpretations of company size can vary depending on perspectives and measurement criteria (Mansour et al., 2023b). While certain criteria may classify a company as large, another set of criteria might categorize a group of smaller companies differently. Additionally, company size correlates with the ratio of its size compared to another entity set (Mansour et al., 2024). However, asset size emerges as a preferred proxy for firm size (Dang et al., 2018; Wuryani, 2012; D'Amato & Falivena, 2020).

ERP systems in industrial firms serve as comprehensive software solutions that facilitate the integrated management of various core business processes. These systems are designed to streamline and optimize operations in industrial settings, including manufacturing, supply chain management, inventory control, and financial management (Zamzeer et al., 2020). ERP systems provide a centralized platform for real-time data access and reporting, enabling efficient decision-making and resource allocation (AboAbdo, Aldhoiena & Al-Amrib, 2019). They help industrial firms enhance productivity, reduce operational costs, improve quality control, and meet regulatory compliance standards. By integrating diverse functions and data, ERP systems play a key role in driving operational, competitiveness, and efficiency in the industrial sector.

The ease of use as one of the technology factors is regarded as a pivotal factor contributing to the successful integration of an organization's resource planning system. Consequently, ensuring user-friendliness in an ERP system entails designing it to be visually appealing and logically structured, featuring delineated menus, icons, and navigation pathways. It is imperative that users can readily access desired features and functionalities. Furthermore, an ERP system should cater to users of varying technical proficiency levels (Egdair et al., 2015). Additionally, the size of the firm may carry significance, as larger companies can develop ERP systems tailored to their specific requirements and the competencies of their workforce, whereas smaller enterprises may encounter constraints in this regard.

Typically, a deficiency in trust can result in skepticism, resistance, and reluctance to adopt or utilize the ERP system, potentially impeding its efficacy and achievement (Zamzeer et al., 2020). Hence, fostering trust stands as a crucial element in enhancing ERP system performance. Within organizations, safeguarding sensitive business data, financial records, and

employee information holds paramount importance (Smadi, 2016). Concurrently, larger enterprises may possess the capability to alleviate doubt, mistrust, and hesitation among their staff. Furthermore, large companies often attract skilled personnel with extensive technological proficiency, including experience with ERP systems, in contrast to their smaller counterparts.

The perceived usefulness of an ERP system relies on whether employees, particularly key decision-makers, are convinced that the system can effectively facilitate the attainment of business objectives. This perceived effectiveness is closely associated with the system's relevance to employees' daily tasks and duties (Egdair et al., 2015). When employees perceive that the ERP system can streamline their work processes, enhance decision-making, and boost productivity, they are more inclined to adopt it (Alqudah, 2023a). Initially, employees may harbor doubts regarding the perceived usefulness; however, robust change management strategies, often available in larger companies, can help assuage these concerns.

Moreover, not every company can ensure that its workforce possesses digital expertise; it requires investments in training, resources, and fostering a culture of ongoing learning. Companies must provide a variety of digital skills enhancement initiatives, ranging from online courses to internal workshops, tailored to employees' specific roles (Alqudah et al., 2023b; AboAbdo et al., 2019). However, larger enterprises typically have the resources to offer training programs to their employees and provide a diverse array of digital skills development opportunities for utilizing ERP systems, unlike smaller businesses.

On another hand, this study examines company size as a moderator variable, company size pertains to the quantity of resources possessed by the organization, encompassing various metrics such as total assets, sales figures, average sales, and average total assets. Essentially, it delineates the extent of an organization's boundaries. Interpretations of company size can vary depending on perspectives and measurement criteria. While certain criteria may classify a company as large, another set of criteria might categorize a group of smaller companies differently. Additionally, company size correlates with the ratio of its size compared to another entity set. However, asset size emerges as a preferred proxy for firm size (Dang et al., 2018; Wuryani, 2012; D'Amato & Falivena, 2020).

The size of a company may have a substantial influence on the availability of Digital Proficiency and the efficiency of ERP systems. While both large and small firms benefit from digital proficiency in terms of improved ERP system implementation and utilization, the impact varies. Larger firms often have more complex operations and may require a higher level of digital proficiency to navigate intricate processes and data management (Alqudah et al., 2023b). Further, Elton, Gruber, and Blake (2003) argue that companies possessing significant assets typically bear lower risk than those with fewer assets, attributed to their improved access to capital markets, resulting in superior performance relative to smaller firms. Conversely, smaller firms may find that digital proficiency can help them implement more cost-effective and readily scalable ERP solutions (AboAbdo et al., 2019; Alqudah, 2023b; Zaqeeba et al., 2024) (Fig. 1). The extent to which digital proficiency influences ERP efficiency is influenced by the specific needs and resources of firms of different sizes, and recognizing this interplay is crucial for successful ERP integration in Jordanian industrial contexts. Thus, based on the aforementioned, this study proposed that the company size moderates the relationship between technology factors (i.e., ease of use, trust, digital proficiency, and perceived usefulness) and ERP system efficiency in Jordanian industrial firms, this leads to the main hypothesis:

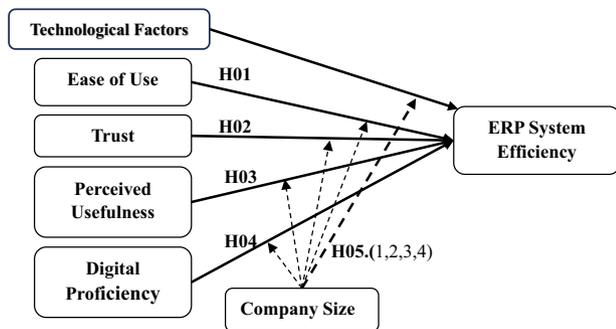


Fig. 1 Research model.

H₅: The sizes of Jordanian industrial firms moderate the effect of technology factors (i.e., ease of use, trust, digital proficiency, and perceived usefulness) on the ERP system efficiency.

The following sub-hypotheses branch out from the main hypothesis:

H_{5.1}: The sizes of Jordanian industrial firms moderate the effect of ease of use on the ERP system efficiency.

H_{5.2}: The sizes of Jordanian industrial firms moderate the effect of trust on the ERP system efficiency.

H_{5.3}: The sizes of Jordanian industrial firms moderate the effect of digital proficiency on the ERP system efficiency.

H_{5.4}: The sizes of Jordanian industrial firms moderate the effect of perceived usefulness on the ERP system efficiency.

Research methodology

This paper focuses on the technological factors influencing the efficiency of the ERP system in Jordanian industrial firms as the population of this study, as the population of the study is 55 listed industrial firms. Due to the small population, all the firms have been addressed as a study sample. As a sample for the study, department managers (IT Manager, Production Manager, Manager of Human Resources, and Financial Manager) were used as respondents for the study because they were qualified to answer the questionnaire variables. (220) questionnaires were distributed, four questionnaires for each company, and 92 questionnaires were retrieved and suitable for analysis, with a response rate of 42%, and this percentage is from the responses are acceptable for statistical analysis (Lutfi et al., 2022b; Alqudah, Amran & Hassan, 2019a). This study also examines company size as a moderator variable, which has been measured using the logarithm of total assets extracted from each firm’s annual report.

Measures. The questionnaire items utilized in this research were derived from surveys that had been validated and tested in previous studies. These measurements were employed to assess the variables contained in the questionnaire, including the dependent, independent, and moderator variables. The dependent variable gauges the efficiency of ERP systems within Jordanian industrial firms. The independent variables quantify the technological factors influencing the efficiency of ERP systems within these industrial firms. The moderator variables signify the varying sizes of industrial firms that may impact the connection between digital proficiency and ERP system efficiency. The details regarding the measurements for each variable investigated in the study are outlined in Appendix 1.

Data analysis and results. This study employed the “Statistical Package for Social Sciences (SPSS 25)” for data analysis The “data analysis involved the use of descriptive statistics, as well as the performance of simple linear regression and hierarchical

Table 1 Profiles of respondents.

	Category	Frequency	Percentage (%)
Age	21-30	0	0
	31-40	3	3
	41-50	64	70
	51-60	16	17
	<60	9	10
	Total	92	100
Education level	Bachelor	63	69
	Master	22	24
	PhD	7	7
	Total	92	100
Experience	2-4	0	0
	5-7	9	10
	8-10	71	77
	<10	12	13
	Total	92	100
Job title	IT manager	16	17
	Production manager	27	29
	Manager of human resources	31	34
	Financial manager	18	20
	Total	92	100

Table 2 Descriptive statistics.

Constructs	Items	Mean	Rank	Level
1. ERP system efficiency	7	4.03	3	High
2. Ease of use	4	3.54	5	Moderate
3. Trust	4	4.48	1	High
4. Perceived usefulness	4	4.21	2	High
5. Digital proficiency	4	3.85	4	High
6. Company size (Logarithm)	1	3.536321	6	Moderate

regression tests within the SPSS” software. In terms of gathering the demographic profile of the participants, four specific questions were utilized to elicit information about their age, educational background, years of professional experience, and job title. As shown in Table 1, the result indicates that a significant proportion of the respondents fell within the age bracket of approximately 41–50 years (64%). Additionally, the majority of participants held a bachelor’s degree (63%), with a notable 22% possessing a master’s degree. A substantial portion of the respondents had accumulated a minimum of 8 years of professional experience (90%). For job titles, (34%) of respondents were Human Resources’ Managers, (29%) were Production Managers, (20%) were Financial Managers, and (17%) were IT Managers. As a result, the demographic information about the respondents underscores their substantial knowledge and experience, making them well-suited to partake in the survey and provide reliable data for this study (Al Qudah, Osman & Al Qudah, 2014; Alrfai et al., 2023; Alghadi et al., 2023; Alqudah, Amran & Hassan, 2019b).

In terms of descriptive statistics, the mean values of the variables, as depicted in Table 2, exceeded the midpoint on the one-to-five scale. We categorized the five-point scale into three groups: low, medium, and high. Based on the following equation: They are represented numerically (5, 4, 3, 2, 1) respectively, the measure was calculated by using the following equation: The upper limit of the scale (5) – the lower limit of the scale (1)/ Number of categories required (3), $[5-1/3] = 1.33$ and then add the answer (1.33) to the end of each category. Hence, scores below 2.33 fall into the low category, scores above 3.67 are classified as high, and scores ranging between 2.33 and 3.67 are deemed

moderate, following the guidelines outlined by Hair, Hult, Ringle, and Sarstedt (2016).

As depicted in Table 2, the average values for the study variables fall within the range of 4.48 to 3.54. This implies that all the study variables exhibit a highly favorable mean level. To elaborate, the findings indicate that, according to the manager’s perceptions within Jordanian industrial firms, there is a notably high degree of ERP system efficiency, trust, perceived usefulness, and digital proficiency, found that ease of use has a moderate level.

Table 4 illustrates the outcomes of the Multiple Linear Regression test, revealing the regression coefficients for various technological factors (namely, ease of use, trust, perceived usefulness, and digital proficiency) as independent variables in relation to ERP system efficiency, serving as the dependent variable.

All variables demonstrated significance ($p < 0.01$), with one exception. In terms of t -values, the highest was associated with perceived usefulness (t -value = 1.772), indicating its substantial contribution to explaining the dependent variable (ERP system efficiency). Conversely, trust exhibited the lowest t -value (t -value = 1.068), signifying its non-significant impact on ERP system efficiency in Jordanian industrial firms (p -value > 0.05). The ease of use displayed a t -value of 3.415, indicating a significant effect on ERP system efficiency (p -value < 0.01), while digital proficiency had a t -value of 2.718, also signifying a noteworthy impact on ERP system efficiency (p -value < 0.01). The hypothesis testing results confirmed the significant influence of the independent variables (perceived usefulness, ease of use, and digital proficiency) on the dependent variable (ERP system efficiency), thereby being accepted as indicated in Table 3.

Notably, Table 3 underscores a significant correlation between technological factors (ease of use, perceived usefulness, digital proficiency) and ERP system efficiency, with the determination coefficient (R^2) at 0.329, signifying that ERP system efficiency elucidated 32.9% of the variation in technological factors, leaving 67.1% attributable to other factors.

In the examination through Hierarchical Regression, the outcomes pertaining to the Fifth Hypothesis are presented in Table 4. This hypothesis posited that the sizes of industrial firms in Jordan play a moderating role in influencing the impact of digital proficiency on ERP system efficiency.

It was found that there was a significant effect of the technological factors (ease of use, perceived usefulness, digital proficiency) combined on the ERP system efficiency, as the value of ($\Delta F = 39.158$) reached a significance level (Sig $\Delta F = 0.000$), which is less than 0.05, and the value of the coefficient of determination R^2 , which amounted to (0.408), indicated The percentage of change (40.8%) resulting from the ERP system efficiency can be justified by the dimensions of technological factors combined.

In the second model, the moderator variable (company size) was incorporated into the regression analysis. This resulted in a notable increase in the coefficient of determination R^2 by 10.9%, signifying statistical significance. Specifically, the ΔF value surged to 47.677, reaching a significant level (Sig $\Delta F = 0.000$) well below 0.05. The coefficient B for the variable (company size) stood at 0.362, with a significance level (Sig $T = 0.000$), indicating variations in the influence of technological factors on ERP system efficiency contingent upon differences in company size.

Table (5) shows that the results of the hierarchical regression confirmed that when the moderator variable (company size) was added to the regression model, the value of ΔF reached (19.262) at an insignificant level (Sig $\Delta F = 0.241$), which is higher than 0.05, and the value of the path coefficient reached for the company size amounted to (0.047), with an insignificance level (Sig $T = 0.253$), and this indicates the effect of ease of use on the ERP system efficiency will not be affected by differences size of the Jordanian industrial firms, Hence the first sub-hypothesis (H5.1) is rejected.

Table (6) shows that the results of the hierarchical regression confirmed that when the moderator variable (company size) was added to the regression model, the value of ΔF reached (4.904) at an insignificant level (Sig $\Delta F = 0.386$), which is higher than 0.05, and the value of the path coefficient reached for the company size amounted to (0.72), with an insignificance level (Sig $T = 0.138$), and this indicates the effect of Trust on the ERP system efficiency will not be affected by differences size of the Jordanian industrial firms, Hence the first sub-hypothesis (H5.2) is rejected.

Table (7) shows that the results of the hierarchical regression confirmed that when the moderator variable (company size) was added to the regression model, the value of ΔF reached (72.227) at a significant level (Sig $\Delta F = 0.000$), which is less than 0.05, and the value of the path coefficient reached for the company size amounted to (0.481), with a significance level (Sig $T = 0.000$), and this indicates the effect of Perceived usefulness on the ERP system

Table 3 The findings of multiple linear regression examination.

Constructs	t-value	Sig.	Result of hypothesis
Ease of use	3.415	0.000	Accepted
Trust	1.068	0.331	Rejected
Perceived usefulness	4.772	00.00	Accepted
Digital proficiency	2.718	00.03	Accepted

ERP system efficiency is the dependent variable

Table 4 The findings of the hierarchical regression analysis.

Dependent variable	Independent variables	First model			Second model		
		Path coefficient	t-value	Sig.	Path coefficient	t-value	Sig.
ERP system efficiency	Ease of use	0.346	3.415	0.000	0.082	1.122	0.095
	Trust	0.078	1.072	0.331	0.074	1.358	0.236
	Perceived usefulness	0.269	3.517	0.001	0.174	3.201	0.002
	Digital proficiency	0.273	3.574	0.000	0.209	3.447	0.000
	Company size				0.362	6.821	0.000
	R^2		0.408		0.526		
	ΔR^2		0.408		0.109		
	ΔF		39.158		47.677		
	Sig ΔF		0.000		0.000		

Bold: significant at $p < 0.05$ and $p < 0.01$.

Table 5 The findings of the hierarchical regression analysis for the first sub-hypothesis.

Dependent variable	Independent variables	First model			Second model		
		Path coefficient	t-value	Sig.	Path coefficient	t-value	Sig.
ERP system efficiency	Ease of use	0.441	8.337	0.00	0.59	1.042	0.117
	Company size				0.047	1.262	0.253
	R ²	0.240			0.435		
	ΔR ²	0.240			0.180		
	ΔF	23.343			19.262		
	Sig ΔF	0.097			0.241		

Bold: significant at $p < 0.05$ and $p < 0.01$.

Table 6 The findings of the hierarchical regression analysis for the second sub-hypothesis.

Dependent variable	Independent variables	First model			Second model		
		Path coefficient	t-value	Sig.	Path coefficient	t-value	Sig.
	Trust	0.081	1.337	0.145	0.662	1.395	0.117
	Company size				0.072	1.582	0.138
	R ²	0.12			0.14		
	ΔR ²	0.113			0.153		
	ΔF	6.392			4.904		
	Sig ΔF	0.148			0.386		

Bold: significant at $p < 0.05$ and $p < 0.01$.

Table 7 The findings of the hierarchical regression analysis for the third sub-hypothesis.

Dependent variable	Independent variables	First model			Second model		
		Path coefficient	t-value	Sig.	Path coefficient	t-value	Sig.
	Perceived usefulness	0.473	8.551	0.000	0.342	6.631	0.000
	Company size				0.481	8.557	0.000
	R ²	0.258			0.451		
	ΔR ²	0.258			0.183		
	ΔF	71.771			72.227		
	Sig ΔF	0.000			0.000		

Table 8 The findings of the hierarchical regression analysis for the fifth sub-hypothesis.

Dependent variable	Independent variables	First model			Second model		
		Path coefficient	t-value	Sig.	Path coefficient	t-value	Sig.
	Digital Proficiency	0.504	8.024	0.000	0.345	5.990	0.000
	Company size				0.476	8.223	0.000
	R ²	0.239			0.433		
	ΔR ²	0.239			0.185		
	ΔF	68.281			66.663		
	Sig ΔF	0.000			0.000		

efficiency will be affected by differences size of the Jordanian industrial firms, Hence the first sub-hypothesis (H5.3) is accepted.

Table (8) shows that the results of the hierarchical regression confirmed that when the moderator variable (company size) was added to the regression model, the value of ΔF reached (66.663) at a significant level (Sig ΔF = 0.000), which is less than 0.05, and the value of the path coefficient reached for the company size amounted to (0.467), with a significance level (SigT=0.000), and this indicates the effect of Digital Proficiency on the ERP system

efficiency will be affected by differences size of the Jordanian industrial firms, Hence the first sub-hypothesis (H5.4) is accepted.

Discussion and conclusion

This study conducted an analysis of the impact of technological factors on the efficiency of ERP systems in Jordanian industrial firms. It contributes to the existing literature on ERP systems by introducing technological factors as precursors to ERP system efficiency. Additionally, the study explores company size as a

moderating variable in the relationship between digital proficiency and ERP system efficiency. The findings of this study offer both theoretical and empirical support for the association between technological factors (with the exception of trust) and ERP system efficiency in Jordanian industrial firms.

More precisely, the study found that ease of use affecting positively the ERP system efficiency in Jordanian industrial firms (H1). That means when employees find an ERP system easy to use, they are more likely to engage with it effectively and incorporate it seamlessly into their workflow (Egdair et al., 2015). A user-friendly interface and intuitive functionalities reduce the learning curve, making it easier for employees to navigate the system and perform tasks efficiently (Abu Afifa et al., 2023). This heightened usability not only enhances individual user satisfaction but also contributes to increased overall system adoption and proficiency (Zamzeer et al., 2020). As employees become more adept at utilizing the ERP system without encountering significant usability barriers, it leads to smoother and more streamlined operations, ultimately positively impacting the overall efficiency of the ERP system within Jordanian industrial firms (Almajali et al., 2022).

Further, this study finds that the ERP efficiency system is not affected by the trust in Jordanian industrial firms (H2). The lack of a significant effect of trust on ERP system efficiency in Jordanian industrial firms can be justified by several factors. Firstly, it's possible that in the context of these firms, trust is not a predominant factor influencing the functionality or utilization of ERP systems (Daviy, 2023). Industrial processes and operations may be more influenced by other technological factors, rendering trust less critical in this specific scenario. Additionally, the nature of the industrial sector may prioritize technical functionalities and system performance over interpersonal trust (Zamzeer et al., 2020). Furthermore, if the organizations have robust security measures and established protocols, employees may place less emphasis on trust as a decisive factor in determining the efficiency of the ERP system. The absence of a significant impact could also be attributed to the study's specific focus on Jordanian industrial firms, where trust dynamics might differ from other organizational contexts.

The positive impact of perceived usefulness on ERP system efficiency in Jordanian industrial firms (H3) is justified by the notion that when employees perceive the ERP system as valuable and beneficial to their tasks, they are more likely to engage with it proactively. Perceived usefulness reflects the employees' belief that using the ERP system will enhance their job performance and contribute to achieving organizational goals (Egdair et al., 2015). In industrial settings, where operational efficiency is paramount, if employees perceive the ERP system as a tool that genuinely aids in their daily tasks, they are more motivated to embrace and utilize it effectively (Almajali et al., 2022). This positive perception can lead to a higher degree of system adoption, and proficient usage, and ultimately contribute to the overall efficiency of the ERP system within Jordanian industrial firms.

The positive impact of digital proficiency on ERP system efficiency in Jordanian industrial firms (H4) is substantiated by the premise that employees with higher digital proficiency possess the skills and capabilities needed to navigate and utilize the ERP system effectively (Egdair et al., 2015). In an era where technological tools play a pivotal role in industrial operations, employees adept in digital skills are better equipped to leverage the features and functionalities of the ERP system (Zamzeer et al., 2020). Their proficiency in handling digital tools and technologies enables them to optimize the use of the ERP system, leading to enhanced efficiency in various operational processes. Digital proficiency facilitates quicker adoption, reduces errors, and empowers employees to harness the full potential of the ERP

system, contributing significantly to its overall efficiency in the context of Jordanian industrial firms (Khammassi et al., 2024).

However, the study concludes that the moderating influence of company size on the correlation between technology factors (such as ease of use, perceived usefulness, and digital proficiency combined) and ERP system efficiency is statistically significant (H5). This suggests that the relationship between technology factors and ERP system efficiency will be positively affected by the varying sizes of Jordanian industrial firms. Specifically, the impact of technology factors on ERP system efficiency is expected to be more pronounced in larger Jordanian industrial firms. Additionally, this study investigated company size as a moderating variable for each technology factor.

The findings indicate that the impact of perceived usefulness on ERP system efficiency is positively influenced by differences in the sizes of Jordanian industrial firms (H5.3). This suggests that the effect of perceived usefulness on ERP system efficiency is amplified in larger Jordanian industrial firms, as employees are more likely to adopt the system when they perceive it as streamlining work processes, enhancing decision-making, and boosting productivity. Although employees may initially harbor doubts regarding the perceived usefulness, robust change management strategies, often available in larger companies, can help alleviate these concerns. Furthermore, the results indicate that the impact of digital proficiency on ERP system efficiency is positively influenced by differences in the sizes of Jordanian industrial firms (H5.4). This suggests that the effect of digital proficiency on ERP system efficiency is heightened in larger Jordanian industrial firms, as they typically have the resources to offer training programs to employees and provide various opportunities for digital skills development to utilize ERP systems, unlike smaller businesses.

On the other hand, the findings reveal that the associations between Trust (H5.1) and Ease of Use (H5.2), and ERP system efficiency are unaffected by the differences in the sizes of Jordanian industrial firms. This outcome can be explained by the possibility that, within the context of Jordanian industrial firms, the influence of Trust and Ease of Use on ERP efficiency remains relatively consistent regardless of company size. It implies that the benefits attributed to Trust and Ease of Use of ERP systems are not significantly impacted by the scale of the company (AboAbdo et al., 2019). The uniformity in technological adoption patterns, similar infrastructural challenges, or a consistent industry-specific environment could contribute to this observed lack of significance. Furthermore, methodological factors such as the approach used to measure Trust and Ease of Use, as well as the categorization of company size, might influence the detection of a notable moderating effect. The summary of the SPSS analysis results for the study model is presented in Fig. 2.

Finally, this study expands the landscape of accounting and auditing research by presenting evidence on the impact of

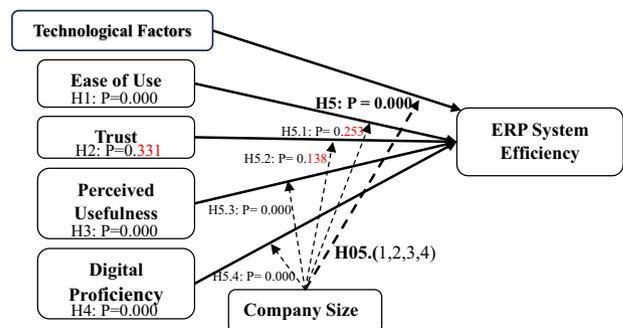


Fig. 2 Research model and results of the study hypotheses.

technological factors, namely ease of use, digital proficiency, and perceived usefulness, on the efficiency of ERP systems within the Jordanian industrial sector, a developing nation. Additionally, it enriches the domain of the DOI theory by affirming its applicability in elucidating ERP systems' efficiency dynamics in the Jordanian industrial context. Notably, this research offers novel insights by examining the utilization of ERP systems within the framework of a developing nation, a departure from the predominant focus on Western developed nations in previous studies. This shift is crucial as the relevance and importance of ERP systems in developing nations, exemplified by Jordan, differ from their status in more developed contexts like the United Kingdom. The study contributes to the validation of the DOI theory in explaining ERP systems within the Jordanian industrial sector, shedding light on the use and efficiency of ERP systems in Jordan and potentially providing applicable insights for other developing nations with similar contexts.

Implications. The current study offers several noteworthy practical and theoretical implications. From a theoretical perspective, there is a scarcity of research that delves into the role of technological factors in accounting systems. This study strongly reinforces the idea that the integration of technological factors significantly enhances the efficiency of ERP systems in firms. Prior research on ERP system efficiency has primarily concentrated on factors influencing their efficiency, rather than examining elements that can facilitate their successful implementation, such as technological factors. Moreover, exploring the influence of company size as a moderating factor in the relationship between digital proficiency and ERP system efficiency within the context of Jordanian industrial firms, even if seemingly inconsequential, presents an intriguing avenue for research that could yield valuable insights, particularly applicable to similar developing countries.

From a practical standpoint, the empirical findings suggest that Jordanian firms should give careful consideration to their ERP systems and technological components. It's imperative for them to recognize the necessity of allocating adequate resources for the efficient operation of ERP systems. A well-functioning ERP system can significantly streamline financial activities in Jordanian firms, resulting in reduced effort, cost, and time expenditure. These conclusions have the potential to provide valuable guidance to decision-makers in Jordan as they formulate regulations and strategies to facilitate the effective adoption of ERP systems across Jordanian firms.

Limitations and future research. No research is devoid of constraints, and the current study is no exception. It exhibits certain limitations. Firstly, this investigation concentrated solely on the impact of technological factors on ERP system efficiency. Subsequent research endeavors could explore alternative factors and conduct comparisons to yield supplementary insights. Secondly, the reliance on Jordanian data restricts the scope of this study. Future research is advised to expand its scope by incorporating data from diverse countries to gain a deeper understanding of how cultural differences might influence the research context. Thirdly, the utilization of ERP systems in Jordan is still in its nascent stage. Therefore, future research could investigate how ERP systems affect a company's financial performance in this evolving context. Fourthly, it is crucial for future works to carefully consider control variables to enhance the robustness of their research, researchers should thoroughly account and identify for potential control factors that could influence the findings. This can help to provide a more comprehensive understanding of the relationships being studied. By paying close attention to control variables and employing rigorous methodologies in future studies,

researchers can ensure the credibility and integrity of their study results, ultimately contributing to the advancement of knowledge in their field. Further, the outcomes of the present investigation are derived from Jordanian industrial companies that are publicly listed. Therefore, any extrapolation of these findings to alternative contexts should be approached carefully. The results may likely vary in dissimilar levels, sectors, or countries. Lastly, this study has focused exclusively on Jordanian industrial firms as its research subjects. Future research initiatives could explore different sectors to enhance the breadth of knowledge in this field.

Data availability

The dataset collected and/or analyzed during the present study is not publicly accessible due to confidentiality agreements with participants. The participants had furnished personal data and agreed to answer probing questions in the questionnaire upon the precondition that none of their data would be shared subsequently, except in case of extremely reasonable requirements. Hence, upon a reasonable request, the supporting data of the current research can be provided by the corresponding authors.

Received: 14 December 2023; Accepted: 14 May 2024;

Published online: 25 May 2024

References

- Alkhazaleh AMK, Marei A (2021) Would irregular auditing implements impact the quality of financial reports: case study in Jordan practice. *J Manag Inf Decis Sci* 24(6):1–14
- Alsharif AH, Salleh NZM, Alrwad M, Lufti A (2024) Exploring global trends and future directions in advertising research: a focus on consumer behavior. *Curr Psychol* 43(7):6193–6216
- AlQudah NF, Mathani B, Aldiabat K, Alshakary K, Alqudah HM (2022) Knowledge sharing and self-efficacy role in growing managers' innovation: does job satisfaction matter? *Hum Syst Manag* 41(6):643–654
- Almahirat M (2016) The impact of critical success factors of the organization resource planning system on institutional performance—Islamic International Arab Bank: an applied study. unpublished Doctoral thesis. International Islamic Sciences University, Jordan
- Alqudah H, Lufti A, Al Qudah MZ, Alshira'h AF, Almaiah MA, Alrawad M (2023a) The impact of empowering internal auditors on the quality of electronic internal audits: a case of Jordanian listed services companies. *Int J Inf Manag Data Insights* 3(2):100183
- Alqudah H, Amran NA, Hassan H, Alessa N, Almaiah MA (2023b) Examining the critical factors of internal audit effectiveness from internal auditors' perspective: moderating role of extrinsic rewards. *Heliyon* 8(1):1–17
- Alghadi M, Alqudah H, Ananzeh H, Al-Matari Y (2023) Enhancing cyber governance in Islamic banks: the influence of artificial intelligence and the moderating effect of Covid-19 pandemic. *Int J Data Netw Sci* 1(8):1–12
- Shehadeh M, Atta A, Barrak T, Lufti A, Alrawad M (2024) Digital transformation: An empirical analysis of operational efficiency, customer experience, and competitive advantage in Jordanian Islamic banks. *Uncertain Supply Chain Management* 12(2):695–708
- Alqudah HM (2023a) The mediating role of digital competency between top management support and the electronic internal audit tasks' effectiveness. *Int J Acad Account Financ Manag Res* 12(7):71–80
- Alqudah H (2023b) Empowering internal auditors' creativity in Jordanian ministries: the effect of knowledge sharing and job satisfaction. *Int J Acad Manag Sci Res (IJAMSR)* 7(12):173–179
- Alqudah HM, Amran NA, Hassan H (2019a) Factors affecting the internal auditors' effectiveness in the Jordanian public sector: the moderating effect of task complexity. *EuroMed J Bus* 14(3):251–273
- Alqudah HM (2015) Factors affecting accounting information system effectiveness among Jordanian companies. Doctoral dissertation, School of Business Innovation & Technopreneurship, Universiti Malaysia Perlis
- Alqudah HM, Amran NA, Hassan H (2019b) Extrinsic factors influencing internal auditors' effectiveness in Jordanian public sector. *Rev Eur Stud* 11:67
- Alqudah HM (2023) The mediating role of digital competency between top management support and the electronic internal audit tasks' effectiveness. *Int J Acad Account Financ Manag Res* 12(7):71–80

- AboAbdo S, Aldhoiena A, Al-Amrib H (2019) Implementing enterprise resource planning ERP system in a large construction company in KSA. *Procedia Comput Sci* 164:463–470
- Alqudah H (2024) Empowering internal audit managers' creativity in Jordanian ministries: the effect of knowledge sharing and job satisfaction. *Int J Acad Manag Sci Res* 7(12):73–179
- Abu Afifa M, Saleh I, Vo Van H (2023) Accounting information quality in the digital era—a perspective from ERP system adoption?. *Glob Knowl Memory Communication*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/GKMC-03-2023-0101>
- Alqudah H, Al Qudah M, Abo Huson Y (2024) A decade of green economic literature: an analysis-based bibliometric. *Int J Energy Econ Policy* 14(2):1–21
- Alshirah M, Alshirah A, Lutfi A (2020) Audit committee's attributes, overlapping memberships on the audit committee and corporate risk disclosure: evidence from Jordan. *Accounting* 7(2):423–440
- Alshirah MH, Alshira'h AF, Lutfi A (2021a) Political connection, family ownership and corporate risk disclosure: empirical evidence from Jordan. *Meditari Account Res* 30(5):1241–1264
- Almaiah MA, Hajje F, Shishakly R, Amin A, Awad AB (2022a) The role of quality measurements in enhancing the usability of mobile learning applications during COVID-19. *Electronics* 11(13):1951
- Alsyouf A, Lutfi A, Alsubahi N, Alhazmi FN, Al-Mugheed K, Anshari RJ, Albugami M (2023) The use of a Technology Acceptance Model (TAM) to predict patients' usage of a personal health record system: the role of security, privacy, and usability. *Int J Environ Res Public Health* 20(2):1347
- Almaiah MA, Alfaisal R, Salloum SA, Hajje F, Thabit S, El-Qireem FA, Al-Marouf RS (2022b) Examining the impact of artificial intelligence and social and computer anxiety in e-learning settings: Students' perceptions at the university level. *Electronics* 11(22):3662
- Almaiah MA, Alfaisal R, Salloum SA, Al-Otaibi S, Shishakly R, Al-Marouf RS (2022c) Integrating teachers' TPACK levels and students' learning motivation, technology innovativeness, and optimism in an IoT acceptance model. *Electronics* 11(19):3197
- Almaiah MA, Al-Rahmi A, Alturise F, Hassan L, Aldhyani TH (2022d) Investigating the effect of perceived security, perceived trust, and information quality on mobile payment usage through near-field communication (NFC) in Saudi Arabia. *Electronics* 11(23):3926
- Almaiah MA, Al-Rahmi AM, Alturise F, Alrawad M, Alkhalaf S, Awad AB (2022e) Factors influencing the adoption of internet banking: an integration of ISSM and UTAUT with price value and perceived risk. *Front Psychol* 13:919198
- Alshirah M, Alshirah A, Saad M, Ibrahim NMES, Mohammed F (2021b) Influences of the environmental factors on the intention to adopt cloud based accounting information system among SMEs in Jordan. *Accounting* 7(3):645–654
- Almajali DA, Omar F, Alsokkar A, Alshrideh AAS, Masa'Deh RE, Dahalin Z (2022) Enterprise resource planning success in Jordan from the perspective of IT-Business strategic alignment. *Cogent Soc Sci* 8(1):2062095
- Al Qudah HMA, Osman A, Al Qudah HM (2014) The effect of human resources management practices on employee performance. *Int J Sci Technol Res* 3(9):129–134
- Alrfai MM, Alqudah H, Al-Kofahi M, Alrawad M, Almaiah MA (2023) The influence of artificial intelligence on the AISs efficiency: moderating effect of the cyber security. *Cogent Soc Sci* 9(2):2243719
- Ahmi A, Saidin SZ, Abdullah A (2014) IT adoption by internal auditors in public sector: a conceptual study. *Procedia-Soc Behav Sci*. 164:591–599
- D'Amato A, Falivena C (2020) Corporate social responsibility and firm value: do firm size and age matter? Empirical evidence from European listed companies. *Corp Soc Responsib Environ Manag* 27(2):909–924
- Dang C, Li ZF, Yang C (2018) Measuring firm size in empirical corporate finance. *J Bank Financ* 86:159–176
- Darwez F, Alharbi F, Ifa A, Bayomei S, Mostfa E, Alrawad M (2023) Assessing the impact of oil price volatility on food prices in Saudi Arabia: insights from nonlinear autoregressive distributed lags (NARDL) analysis. *Econ Innovat Econ Res J* 11(2):5–23
- Daviy A (2023) Does the regional environment matter in ERP system adoption? Evidence from Russia. *J Enterp Inf Manag* 36(2):437–458
- Egdair IM, Rajemi MF, Nadarajan S (2015) Technology factors, ERP system and organization performance in developing countries. *Int J Supply Chain Manag* 4(4):82–89
- Elton EJ, Gruber MJ, Blake CR (2003) Incentive fees and mutual funds. *J Financ* 58(2):779–804
- Hair JF, Risher JJ, Sarstedt M, Ringle CM (2019) When to use and how to report the results of PLS-SEM. *Eur Bus Rev* 31:2–24
- Hamza Mohammad AA (2020) Factors affecting internal audit effectiveness Jordanian public sector: moderating effect of task complexity. Doctoral dissertation, Universiti Utara Malaysia
- Jaradat Z, Shbail MA, Baker MB (2022) Environmental and organisational factors affecting the adoption of enterprise resource planning systems in the Jordanian banking sector. *Int J Bus Inf Syst* 41(1):82–107
- Khammassi I, Boufateh T, Naoui K, Alrawad M, Lutfi A (2024) The role of stress tests in enhancing bank transparency: a comparative study of Islamic and conventional banks. *Econ* 2(1):1–100. <https://doi.org/10.2478/eoik-2024-0003>
- Khalaf AM, Binti Wan Ismai WN, Marei A, Saleh MW, Mansour M (2023) The framework for system trust's effect on the organizational commitment in the Jordanian public sector. Taking into consideration the role of the timeliness factor. *Scientific Papers of the University of Pardubice. Series D, Faculty of Economics & Administration*. 31(2)
- Lutfi A, Alqudah H, Alrawad M, Alshira'h AF, Alshirah MH, Almaiah MA, Alardi MF (2023a) Green environmental management system to support environmental performance: what factors influence SMEs to adopt green innovations? *Sustainability* 15(13):10645
- Lutfi A, Alqudah H (2023) The influence of technological factors on the computer-assisted audit tools and techniques usage during COVID-19. *Sustainability* 15(9):7704
- Lutfi A, Alkelani SN, Alqudah H, Alshira'h AF, Alshirah MH, Almaiah MA, Abdelmaksoud O (2022b) The role of e-accounting adoption on business performance: the moderating role of COVID-19. *J Risk Financ Manag* 15(12):617
- Lutfi A (2021) Understanding cloud-based enterprise resource planning adoption among SMES in Jordan. *J Theor Appl Inf Technol* 99(24):5944–5953
- Lutfi A, Al-Khasawneh AL, Almaiah MA, Alshira'h AF, Alshirah MH, Alsyouf A, Ali RA (2022c) Antecedents of big data analytic adoption and impacts on performance: contingent effect. *Sustainability* 14(23):15516
- Lutfi A (2023) Factors affecting the success of accounting information system from the lens of DeLone and McLean IS model. *Int J Inf Manag Data Insights* 3(2):100202
- Lutfi A, Alrawad M, Alsyouf A, Almaiah MA, Al-Khasawneh A, Al-Khasawneh AL, Ibrahim N (2023) Drivers and impact of big data analytic adoption in the retail industry: a quantitative investigation applying structural equation modeling. *J Retail Consum Serv* 70:103129
- Lutfi A (2022) Understanding the intention to adopt cloud-based accounting information system in Jordanian SMEs. *Int J Digit Account Res* 22:47–70. https://doi.org/10.4192/1577-8517-v22_2
- Lutfi A (2020) Investigating the moderating role of environmental uncertainty between institutional pressures and ERP adoption in Jordanian SMEs. *J Open Innov Technol Mark Complex* 6(3):91
- Marei A, Mustafa JA, Othman M, Daoud L, Lutfi A (2023) The moderation of organizational readiness on the relationship between toe factors and fintech adoption and financial performance. *J Law Sustain Dev* 11(3):e730–e730
- Marei A, Al-Haddad S, Daoud L, Habashneh A, Fariz R, Aldamisi R (2022) The impact of innovation on customer satisfaction in the commercial banks: business performance as a mediating variable. *Uncertain Supply Chain Manag* 10(3):887–894
- Mansour M, Saleh MW, Marshdeh Z, Marei A, Alkhodary D, Al-Noهود S, Lutfi A (2024) Eco-innovation and financial performance nexus: does company size matter? *J Open Innov Technol Market Complex* 10(1):1–11. <https://doi.org/10.1016/j.joitmc.2024.100244>
- Mansour M, Hashim HA, Almaqtari FA, Al-ahdal WM (2023a) A review of the influence of capital structure on the relationship between corporate governance and firm performance. *Int J Procure Manag* 17(1):79–105
- Mansour M, Al Zobi M, Al-Naimi A, Daoud L (2023b) The connection between capital structure and performance: does firm size matter? *Invest Manag Financ Innov* 20(1):195–206
- Ministry of Industry and Trade (2022) https://portal.jordan.gov.jo/wps/portal/Home/GovernmentEntities/Ministries/Ministry/Ministry%20of%20Industry%20and%20Trade/!ut/p/z/0/04_Sj9cPykssy0xPLMnMz0vMAfij08ziHU1cQ0wN3B09A42CTAwcf fycXd19grwCg4z0g1Pz9L30o_alkIQUJaak6hdku4cDAP15I20/. Accessed in 15/4/2023
- Moore GC, Benbasat I (1991) Development of an instrument to measure the perceptions of adopting an information technology innovation. *Inf Syst Res* 2(3):192–222
- Noureddine M (2021) The impact of the success factors of implementing an enterprise resource planning system on improving the performance of the Naqash Beverages and Savory Establishment. *Res J Kasdi Merbah Univ Ouargla* 21(1):332–317
- Rawashdeh A, Rawashdeh B (2023) The effect cloud accounting adoption on organizational performance in SMEs. *Int J Data Netw Sci*. 7(1):411–424
- Rogers EM, Singhal A, Quinlan MM (2014) Diffusion of innovations. In: An integrated approach to communication theory and research. Routledge. pp. 432–448
- Saad M, Lutfi A, Almaiah MA, Alshira'h AF, Alshirah MH, Alqudah H, Abdelmaksoud O (2022) Assessing the intention to adopt cloud accounting during COVID-19. *Electronics* 11(24):4092
- Scholtz BM, Mahmud I, Ramayah T (2016) Does usability matter? An analysis of the impact of usability on technology acceptance in ERP settings. *Interdiscip J Inf Knowl Manag* 11:309

- Siam W (2015) Organizational resource planning systems and enhancing the quality of internal auditing in Jordan. *Intern Audit J* 105:6–17
- Smadi ZMDA (2016) The operational benefits of enterprise resource planning (ERP): a case study on food processing and manufacturing companies in Jordan. *Int J Bus Soc Sci* 7(2):21–38
- Wuryani E (2012) Company size in response to earnings management and company performance. *J Econ Bus Account Ventur* 15(3):491–506
- Zaitoun M, Alqudah H (2020) The impact of liquidity and financial leverage on profitability: the case of listed Jordanian Industrial firm's. *Int J Bus Digit Econ* 1(4):29–3
- Zamzeer M, Alshamaileh Y, Alsawalqah HI, Al-Hassan M, Fannas EJA, Almu-bideen SS (2020) Determinants of cloud ERP adoption in Jordan: an exploratory study. *Int J Bus Inf Syst* 34(2):204–228
- Zaqeeba N, Alqudah H, Alshirah A, Lufti A, Almaiah M, Alrawd M (2024) The impact of using types of artificial intelligence technology in monitoring tax payments. *Int J Data Netw Sci* 8(3):1577–1586

Acknowledgements

This research was funded through the annual funding track by the Deanship of Scientific Research, from the Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [GrantA279].

Author contributions

Conceptualization, HA, AL; Methodology, HA, AL, MAA; Resources, MA, KIA; Writing—original draft preparation, HA, AL, NZ; Writing—review and editing, All authors; Project administration, MA, KIA, NZ. Correspondence to HA, AL; Funding, AL. All authors have read and agreed to the submitted version of the manuscript. Additionally, all authors have read, thoroughly reviewed, and approved the final submitted manuscript for publication.

Competing interests

The authors declare no competing interests.

Ethical approval

The procedures used in this research adhere to the principles of the Declaration of Helsinki. The corresponding author obtained permission to conduct the study. The research was carried out in accordance with the Helsinki Declaration guidelines and has

been approved by the Permanent Committee for Scientific Research Ethics at the Deanship of Scientific Research, King Faisal University (GrantA279). Informed consents were obtained from participants prior to the survey to ensure respondents had a good understanding of the study objectives.

Informed consent

The survey was conducted upon informed consent previously gained from participants, who agreed to provide data for data analysis for this study. We informed each respondent of their rights and to safeguard their personal information.

Additional information

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1057/s41599-024-03198-9>.

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