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Impact of digital transformation on the direct management of Jordan's public utilities

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Abstract

Digital transformation has become an urgent imperative of life imposed by the accelerated development in the use of information technology means, in which the countries of the world are racing to take advantage of the enormous advantages offered by digital and technical tools, especially in the management of public utilities in the country. The study aimed to examine what this is and the impact of this transformation, which puts public utilities in the face of significant and new challenges. The study found results, the most important of which was that there were efforts by specialists to attract and exploit technology due to the importance of digital transformation. The study recommends promoting and supporting the digital transformation of all public facilities to improve the efficiency and governance of their performance and electronic services.

Keywords: Digital Transformation, Direct management, Public utilities, Jordan

Introduction

The world has witnessed a major technological and information revolution at the end of the twenty-first century, rapidly evolving in various fields, especially in public facilities of the state such as education, health, recreation, economics, administration, and other transactions, where digital transformation imposed a new administrative reality and modern technological methods, different from previous traditional administrative dealings. The digital transformation of public utilities not only means the application of new technology within facilities, but is a comprehensive and integrated program that affects the modus operandi of the public utility. The digital transformation also contributes to enhancing the functioning and management of e-government and connecting its public facilities. It helps improve the operational efficiency and quality of services provided to citizens and the public. Public utilities have become required to provide services that match the digital transformation of global technology to save time, effort, and costs due to the importance and vitality of these public utilities, which serve a large segment of society. With the benefit of AI and cybersecurity technologies to provide creative, innovative, and secure services in the optimal use of digital infrastructure in its different dimensions, such as software, communication networks, databases, and human knowledge skills for the digital transformation of direct management as a method of public utility management, down to digital public utilities.

The problem with the study is that digital transformation has become a necessity, especially for public utilities, to increase the efficiency of services provided to citizens and beneficiaries and to provide a new model based on trust, inclusiveness, and responsiveness within the highest possible standards of governance digitally, but we see that public utilities in Jordan face significant challenges in achieving digital transformation, from infrastructure and

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financial financing to the availability of qualified human resources.

The highlights the importance of the study; we will learn about the impact of digital transformation on the direct management of public facilities in Jordan. And know the availability of the requirements of this transformation, and review the quality of services provided and digital culture in public facilities, to access the best possible use of the electronic services provided in these facilities. The importance of the study is also to highlight the efforts made by the Jordanian e-government, especially the Ministry of Digital Communication and Leadership. Digital transformation and the readiness of infrastructure to provide electronic services to public facilities in the country with ease and pleasure to citizens and beneficiaries. So, we had to do this study to recognize the impact of digital transformation on public utilities and develop proposals and recommendations for digital transformation.

Methodology

The study drew on the analytical inductive approach based on determining what digital transformation is and its impact on the direct management of Jordan's public utilities, examining, analyzing, and criticizing administrative legislation on the subject, while using the comparative approach in developed countries in this regard to identify imbalances in coming up with legal and realistic solutions.

Based on the above, this study will be divided into two researchers. The first research deals with digital transformation and public utility management, and this research will be divided into two parts. The first requirement deals with what digital transformation is the second requirement looks at the direct management of public utilities. To address the requirements of digital transformation and its implications for public utilities, it will be divided into two demands. The first requirement addresses digital infrastructure. The second requirement will examine the reality of Jordan's digital transformation.

Digital transformation and utility management

Technological advances have contributed to the development of administrative working methods, and the opportunity to improve administrative means of communication has forced state departments to shift from traditional decision-making and business delivery to digital transformation and modern electronic methods using internet networks, computers, and various software. Moreover, this digital transformation is linked to the creation of conditions and a climate conducive to the application and containment of the principles and specificities of the developed electronic administration, which requires a robust strategy, at a gradual pace, to achieve a sound application of the digitization of the administrative body Delays in its introduction or weak use will limit the potential for the benefits of digital transformation (1). Information has become the primary source of competitive advantage for the General Facility in Jordan; we had to look for new prospects in the digital economy information society. By converting the majority of government administrative functions to electronic to achieve public benefit and providing more opportunities for citizens to participate in the formulation of public administrative policies, In addition to the changing role of e- government in anticipating and rolling out proactive services, It has high quality standards in its general administrative facilities This is what will be addressed in this study, which will be divided into two demands: the first requirement addresses what digital transformation is, and the second requirement addresses the method of direct management of public utilities (2).

The concept of digital transformation

Digital transformation is one of the most important concepts in recent times in all spheres of the economy, service, administration, and other life. Because this shift is important in sustainable development, it is no longer an optional issue for public utilities and institutions that deal directly with citizens. It has become a methodology and style that contributes to better and more sophisticated electronic government services than before. Countries are racing to keep pace with this digital transformation and its modern technologies, especially in light of global crises such as the coronavirus pandemic.

Many definitions of digital transformation are defined as the process by which enterprises acquire a lot of digital innovation, which has been upgraded and developed through the use of a global network,

by changing different working standards and procedures, and the tasks to be accomplished in the enterprise (3). Digital transformation is the ongoing process through which enterprises adapt to the needs and expectations of customers, the general public, and their respective markets, achieved by employing digital capabilities to innovate new business models, services, and products that seamlessly integrate digital and manual processes within both the business and customer experience. Simultaneously, this approach aims to enhance operational efficiency and improve overall organizational performance (4).

In addition, digital transformation involves the application of Information and Communication Technology (ICT) across institutions and organizations, whether governmental or private. This includes the use of broadband networks, internet services, and mobile communication technologies, which fundamentally reshape the interaction between citizens, businesses, and government bodies. The goal is to develop institutional performance and service delivery, while also improving operational efficiency and increasing productivity across public facilities in the state, ultimately saving both time and effort (5).

Furthermore, digital transformation seeks to improve the structure and function of public utilities by introducing major changes driven by information, computing, and communication technologies. It is important to note that both internal and external users of digital services play a vital role in these transformation efforts. Their involvement is essential through the integration of dynamic capabilities, such as co-designing digital services, co-producing outputs, and participating in digital governance systems. These practices aim to make public utilities more efficient and transparent.

Especially in an era where global changes are occurring rapidly, top leadership within the country must have access to timely and accurate information. Accordingly, this ensures the ability to make informed, swift decisions. Consequently, the use of smart working systems to analyze data and interactions has become critical, as it contributes to the continuous refinement of processes and facilitates corrective action necessary to maintain the effective operation of public utilities. Moreover, digital transformation is being actively adopted in essential sectors such as health, education, and justice. These sectors are increasingly implementing digital-based methodologies to improve service delivery. This includes processing large volumes of data, leveraging artificial intelligence technologies, innovating services and products, and offering new service channels. All these efforts are directed toward significantly enhancing performance, reducing time and costs, increasing flexibility, and boosting the quality of services. Additionally, such transformation contributes to streamlining procedures and maximizing productivity (6). It is also crucial to distinguish between digital transformation and digitization. While digitization primarily focused on optimizing processes and reducing costs through modern technology, digital transformation embodies a broader digital vision centered on customer-focused values. In general, digitization can be considered a component of digital transformation, but the latter goes beyond by reimagining services and strategies in the context of a digital-first era (1). To begin with, digital transformation is a significant factor in the success of administrative public facilities in any country. It restructures these facilities through the integration of modern technologies, including hardware, software, data systems, and human resources. These components collectively enable data usage and analysis, supporting informed decision-making and ensuring optimal implementation of services. Furthermore, the process of digital transformation demands specific operational methods and the development of technical and digital capabilities, which are essential for the delivery of services within public institutions. In this regard, various technologies are employed to facilitate communication and information exchange, such as websites, satellite channels, smartphones, and online platforms.

Direct management of public utilities

In parallel, public utilities are considered vital projects, as they are closely linked to the State's strategic sectors. These utilities represent the visible and practical manifestation of administrative activity carried out by the State or by individuals under its supervision. Their primary objective is to meet the public's general needs and promote the public interest. According to the provisions of Article 120 of the current Jordanian Constitution, the Executive Authority is granted the competence to organize and

manage all types of government departments, be they administrative, economic, professional, national, or local public facilities.

There are several models for managing public utilities, depending on their nature and field of activity. One of these models is the public enterprise model, where utilities are granted a degree of financial and administrative independence while remaining under the guardianship of the central government. Another model is the concession or privilege model, where management is temporarily assigned to an individual or company through an administrative contract, allowing them to operate and benefit from the utility for a specific period. However, this study focuses on the direct management model, wherein the government, either through central or local authorities, administers and regulates the facility using its own financial and human resources. This method is commonly practiced in systems governed by common law, wherein the government assumes full responsibility and bears all risks associated with facility management. Decisions issued by the administration are considered administrative and thus fall under the jurisdiction of the Jordanian administrative judiciary.

Consequently, traditional public utilities of national significance, such as those related to security, defense, judiciary, health, and education, are managed through direct administration. These facilities typically do not generate profits and are therefore unattractive to private sector involvement. Moreover, the State often regards it as inappropriate to permit private entities to participate in managing these sovereign facilities due to their critical importance to national interests. Given that such utilities often operate under public authority and apply common law methods, their administration is best retained under full government control (7).

The link between modernization and digital transformation

Moreover, the development and digital transformation of public utilities are strongly associated with the State's broader policy of modernization and improving administrative efficiency. Modern technologies have enhanced relationships between public administrations and citizens by simplifying procedures and improving the quality of services provided (8). In this context, modern management of public utilities increasingly relies on advanced digital tools to complete tasks more quickly and efficiently. Digital transformation has enabled the shift from traditional paperwork to digital processes, with public utilities being among the primary beneficiaries of these technological advancements. As a result, most contemporary public institutions have invested heavily in data and knowledge-based tools to enhance their performance. Their operations are now largely integrated with Information and Communication Technologies (ICTs), and the majority of their transactions have transitioned to paperless or digital formats. With the widespread use of the Internet, a range of digital concepts—such as electronic governance, digital communication, e-services, and e-human resources—have emerged as core components of public service delivery. These developments reflect the evolution of public institutions into modern, IT-driven organizations that leverage digital tools across their entire range of services (3).

Leadership development and digital transformation in public utilities

This shift requires a transformation in the concept of management leadership, moving beyond the traditional focus on the individual competencies of leaders toward a more collaborative leadership model. This model should be based on participation, complementarity, and strategic alignment with other leaders with a comprehensive vision that transcends the boundaries of individual facilities. Through interrelationships that promote information exchange among decision-makers, organizations can foster a more connected and informed leadership structure (9). In this framework, leaders are expected to leverage the knowledge and expertise of their staff and engage talented personnel as vital contributors to organizational success.

Digital transformation requirements and implications for public utilities

For government reforms related to digital transformation in public facilities to be effective, corporate digital governance systems and processes must evolve to become more efficient and transparent. Given the rapidly changing global

landscape, senior leadership must have ready access to accurate information to make timely and informed decisions.

Additionally, there must be an organizational willingness to adopt and rely on digital platforms that align with modern mobility preferences. Governments, therefore, are under increasing pressure to transition to technological platforms that enhance communication with public utilities using innovative, responsive methods, especially when attempting to reconcile digital tools with traditional government models (10). Accordingly, a capable infrastructure is essential to support this transformation, which should be aligned with the principles of serious e-government implementation. In this study, we will explore the reality of digital transformation within Jordanian public utilities, as well as the obstacles and objectives associated with this shift. This analysis is divided into two main parts:

Digital infrastructure

Infrastructure development is a cornerstone of achieving the goals of sustainable development in any country. Strategic investment in infrastructure provides the backbone for robust economies and more inclusive societies. Specifically, digital infrastructure refers to the collection of technological resources required for the effective use of computerized data, devices, systems, and processes. These components are essential for enhancing societal operations and improving the quality of life for citizens (11).

Notably, this transformation is not a ready-made solution or an imported model to be applied as-is. Instead, it is a complex and integrated process involving technical, informational, legislative, environmental, and human factors (12). Therefore, the requirements for digital infrastructure are both numerous and interdependent, necessitating comprehensive preparation by e-government frameworks across public facilities. According to Bar (2018), digital transformation is applied across a spectrum involving technologies, data, human resources, and processes, as follows:

Technologies: Digital transformation relies on a system composed of hardware, software, data storage solutions, and robust IT environments. These environments are supported by operational information centers that ensure consistent performance. Moreover, they require professional teams to manage both local and cloud-based infrastructures, guaranteeing adequate service delivery to employees, users, and partners.

Data: Effective digital transformation requires that facility management adopt systematic data governance and analysis methods. This includes generating reliable, high-quality data and utilizing appropriate statistical tools for data search, forecasting, and informed decision-making.

Human Resources: Human capital remains a decisive factor in digital transformation. Without qualified personnel capable of data interpretation and strategic implementation, digital initiatives are likely to fail. Therefore, training and the recruitment of skilled professionals are essential.

Operations: It is critical for public utilities to construct a technical operations framework that enhances both internal and external performance. This involves establishing policies and procedures integrated with advanced applications, tools, and processed data to ensure optimal functionality.

Researchers agree that digital infrastructure is the foundation upon which the digital transformation of public utilities is built. Managed by e-government systems, this infrastructure integrates ICT tools to connect various public services. It comprises both physical components—such as servers and networks—and human elements, including programmers, analysts, and engineers.

Continuous training, database management, electronic networking, and support services are all fundamental to this ecosystem. Moreover, achieving a secure digital environment necessitates the implementation of robust cybersecurity measures and the application of artificial intelligence (AI) to provide intelligent, efficient e-services across public institutions. The subsequent sections will further elaborate on these aspects in detail. E-Government and Cybersecurity in the Digital Transformation of Public Utilities

E-Government and the role of public administration

E-government has emerged as a key driver in advancing the digital transformation of public utilities, particularly within the framework of direct government management. It is widely regarded as a strategic transformation aimed at enhancing the ICT capabilities of enterprises to continuously deliver integrated, high-quality public services. These efforts are designed not only to improve the efficiency of managing relationships with the public but also to support both the economic and social development of citizens and businesses. Furthermore, e-government facilitates the governance of civil society in numerous respects (13).

The implementation of e-government reflects a serious and comprehensive vision of public administrations toward profound modernization and internal process reorganization. This transformation requires the realization of openness, integration, interdependence, and the development of an information society that can efficiently handle technical and data-driven operations (14,32). A full shift to e-government is neither instantaneous nor simplistic. It encompasses two primary dimensions:

1. Digitization of Internal Operations—transforming internal functions into electronically managed processes.

2. Electronic Engagement with Beneficiaries—establishing digital workflows and services accessible to the public.

Hence, achieving these transformations involves navigating through sequential, interrelated stages (15), which collectively aim to:

1. Enhance the speed and effectiveness of coordination between government agencies and services.

2. Foster ongoing communication among employees.

3. Ensure the availability and security of citizen-related information and services.

4. Reduce dependency on traditional paperwork.

5. Increase transparency and accountability.

6. Overcome geographical and logistical barriers (16).

Within this context, the Jordanian government bears a significant responsibility in leading the development of infrastructure across public utilities. It must strive to reduce procedural burdens on citizens and beneficiaries and enable them to benefit from technological advancements anywhere and at any time, particularly by capitalizing on the digital transformation and the revolution brought about by widespread internet connectivity.

Cybersecurity: A pillar of secure digital infrastructure

As the world continues its shift toward digitization, characterized by the proliferation of internet networks, smart devices, and interconnected systems, cybersecurity threats have become increasingly significant. These threats carry profound legal, security, and economic consequences, prompting countries worldwide to adopt legal frameworks to regulate information security and ensure data protection (17,33). Secure digital infrastructure for public utilities hinges on the presence of effective cybersecurity mechanisms applied by both service users and public officials. So, this is crucial to ensure the confidentiality, integrity, and availability of sensitive information and data exchanged between public utility institutions and the individuals who rely on their services.

Cybersecurity is defined as a combination of administrative and technical measures employed to prevent unauthorized access, misuse, and tampering with electronic information and communication systems. These measures also guarantee system reliability, protect personal data, and shield citizens from cybersecurity-related risks (5).

In Jordan, the Cybersecurity Law of 2019 marked a significant milestone. This legislation was enacted to bolster national security capabilities in countering cybersecurity threats, including hacking and cyberattacks targeting the Kingdom's information systems, digital infrastructure, and electronic public services. The law prioritizes the protection of critical infrastructure and sensitive sectors, especially public

utilities.

To implement this vision, the Jordanian National Cybersecurity Council was established. Among its core mandates are:

1. Safeguarding national cybersecurity.

2. Ensuring the integrity of networks and information systems.

3. Overseeing the security of the Kingdom's digital infrastructure.

The presence of such institutions and legislation underscores the vital interdependence between cybersecurity and digital transformation, particularly within the realm of public utilities. Artificial Intelligence (AI):

The twenty-first century has witnessed a profound technological, informational, and industrial revolution, particularly within the framework of artificial intelligence (AI). This concept has evolved rapidly and remarkably, influencing various aspects of life and fundamentally reshaping public facilities and state institutions. AI is imposing a new reality characterized by modern administrative methods that differ significantly from traditional approaches. As such, state departments, public utilities, and infrastructure represent critical components required to meet the diverse and complex demands of the current era.

In light of this transformation, there is a pressing need to enhance these sectors by adopting advanced electronic management systems that integrate AI technologies. Achieving this, however, necessitates a strong governmental will aimed at modernizing and comprehensively developing institutional frameworks. Only then can the state keep pace with the rapid global advancements in technology, public services, and digital infrastructure.

In this context, the Jordanian legislature bears the responsibility of formulating and updating legal provisions, particularly in the administrative domain, to align with the evolving digital reality. This includes establishing well-defined policies within the AI-driven digital environment to effectively serve public facilities across the country. AI is broadly defined as a set of software systems—and potentially human-designed devices—with complex objectives, capable of operating in both physical and digital environments. These systems function through environmental perception, access to information, interpretation of structured and unstructured data, application of knowledge processing, and the determination of optimal actions to achieve specific goals. AI technologies may rely on symbolic rule-based systems or learned digital models and can adapt their behavior based on analysis of how their previous actions have influenced their environment (18).

Jordan's digital transformation reality

His Majesty King Abdullah II has placed considerable emphasis on advancing digital transformation and the e-government program in Jordan. In a significant step, His Majesty initiated this national initiative and entrusted the Ministry of Digital Economy and Entrepreneurship with its implementation. The Ministry is tasked with executing the digital transformation strategy and supporting the digital economy by leveraging Information And Communication Technology (ICT) to provide reliable, integrated digital services that enhance the efficiency and performance of government operations, particularly in public facilities. Among the key achievements of this strategy is the launch and continuous development of the e-government portal and its wide range of services . In alignment with this vision, the Jordanian state is working toward transforming e-government frameworks to improve performance levels across the public sector. The goal is to create a forward-looking and technologically advanced environment that delivers services electronically and efficiently. Furthermore, this transformation is being pursued by enhancing administrative performance, integrating government services into a centralized official platform, and building a streamlined digital ecosystem. As a legislative foundation, the Electronic Transactions Act was enacted in 2001 and subsequently updated in 2015 to support these developments.

To realize the objectives of e-government, Jordan's digital transformation strategy relies on a multifaceted approach that includes reengineering government procedures, identifying priority services, building and developing human capacities, enhancing

service delivery channels, facilitating access to electronic services, ensuring service quality, and automating government functions. Equally important is the creation and continuous refinement of an enabling legislative and regulatory environment that can accommodate emerging digital technologies and support innovation (6).

According to the above, the researchers assert that digital transformation is now an urgent and inescapable necessity for public utilities in Jordan. A conducive and adaptive legislative and technological environment is required—one that fosters entrepreneurship, supports qualified and well-trained human capital, and establishes a robust digital infrastructure. Moreover, the successful implementation of AI-driven digital transformation calls for an ecosystem that encourages innovation, ensures accurate and secure data collection and automation, and promotes systems that are interconnected across all government entities. These systems must manage vast amounts of data in short, measurable timeframes, optimizing operational efficiency. In the following two sections, we will examine the key impediments to digital transformation in Jordan as well as the gains achieved through its application in public utilities.

Impediments to digital transformation

In light of Jordan's limited natural resources, the Kingdom has increasingly relied upon innovation and human capital as key drivers of economic development. A notable demographic feature is the youthful composition of Jordan's population, with approximately 35% under the age of 15, according to the Department of General Statistics. This segment represents a strategic advantage that may be harnessed to cultivate a digital culture grounded in awareness, innovation, and entrepreneurship. However, translating this potential into tangible outcomes necessitates a comprehensive framework to disseminate digital awareness and enhance digital literacy across all segments of society.

Notwithstanding ongoing national efforts, the digital transformation of public utilities in Jordan faces several substantive legal, structural, and institutional impediments. Chief among these is the absence of a coherent legal and strategic vision that governs the transformation process in a unified and systematic manner. Numerous administrative bodies lack the requisite legal capacity, institutional readiness, and qualified personnel to adopt and lead digital transformation initiatives. Furthermore, the lack of standardized legal frameworks regulating the procedures of electronic government services results in operational inconsistencies across public institutions. In addition, legislative rigidity and the slowness in amending or enacting laws to accommodate digital transformation efforts contribute significantly to bureaucratic delays. These challenges are compounded by financial constraints, limited public-private partnerships, and resistance within certain public entities to adopt digital solutions. The lack of sufficient legal incentives and guarantees concerning data security and personal privacy further undermines public trust in electronic service platforms (6).

In response to these issues, the Jordanian government has initiated efforts to reform its administrative and financial systems through the development of an integrated and centralized legal structure aimed at enhancing digital governance across public utilities. Nevertheless, the implementation of interoperable digital projects continues to face institutional limitations related to legal compliance with approved standards and the insufficient legal and professional capacity within many government agencies.

To address these challenges, it is imperative to adopt clear and enforceable legal standards governing digital governance. Such standards must ensure the alignment of hierarchical and bureaucratic structures with the objectives of transparency, efficiency, and accountability. Legislative support must also extend to the creation of a comprehensive infrastructure development strategy, one that facilitates secure and efficient communication networks capable of managing digital interactions between institutions and the public (15). Moreover, legal measures should mandate the expansion and diversification of electronic services provided via government platforms. This requires conducting sector-wide assessments to determine service priorities and ensuring that legal provisions are in place to support the technical and infrastructural requirements of public utilities, including the use of medium- and large-scale servers to accommodate increased digital demand (13). Despite the clear governmental interest

in advancing digital transformation, disparities remain between public institutions in terms of legislative readiness, technological infrastructure, and human capital. Several institutions still lack the necessary legal and cultural preparedness to implement digital strategies in line with national objectives (19). A unified legal vision is essential to foster institutional integration and collaboration, enabling public utilities to operate within a coordinated and legally supported digital framework (9).

In conclusion, the legal and institutional obstacles hindering the digital transformation of public utilities in Jordan are multifaceted. Addressing these impediments requires a coordinated legislative approach aimed at bridging the digital divide, promoting inter-agency cooperation, and establishing a dynamic legal environment conducive to public-private partnerships. The success of such transformation depends not only on legislative enactment but also on sustained legal oversight, regulatory development, and societal engagement, including through civil society organizations and strategic media outreach to promote awareness of digital services and enhance public confidence in their use.

Gains of digital transformation

The government of Jordan, particularly through the Ministry of Digital Economy and Entrepreneurship, has demonstrated a firm commitment to advancing digital transformation across public utilities and government institutions. In collaboration with both public and private sector stakeholders, the Ministry has prioritized legislative development and the implementation of national initiatives aimed at modernizing the country's digital infrastructure. This includes the expansion of e-government platforms, the deployment of the National Fiber Optic Network, and the launch of comprehensive programs to enhance digital literacy and skills within the public sector, recognizing their economic and social significance (6).

Modern public institutions now rely heavily on knowledge management and data systems to carry out their core functions. The integration of Information and Communication Technologies (ICTs) has enabled a shift toward paperless administrative operations, resulting in more efficient, reliable, and accessible services. This digital transformation has become foundational to the operation of contemporary public utilities, which now use ICTs to optimize both internal procedures and service delivery (20).

The advantages of digital transformation are multifaceted. Firstly, it enhances the efficiency and effectiveness of internal government operations by reducing the time required to complete procedures while improving accuracy (21). Furthermore, it enables the real-time collection and dissemination of data, supporting continuous learning and more informed decision-making (22).

In addition, digital tools significantly contribute to promoting transparency and combating corruption by reducing human interference in administrative processes and limiting the opportunities for favoritism and nepotism (23,24). The transformation also results in lower operational costs by improving the quality and accessibility of services provided to citizens (25). These outcomes collectively strengthen public trust and increase satisfaction with government performance. Another key outcome is the creation of an environment that fosters excellence, innovation, and problem-solving (26). Through the use of digital platforms, institutions can develop competitive and creative solutions to public sector challenges while providing easier access to information for all stakeholders (27). This digital environment is particularly vital given the growing demand for public services, fueled by population growth and higher expectations for quality and efficiency (28).

To effectively measure and sustain these gains, researchers emphasize several foundational pillars. These include the development of a sound legislative and regulatory framework, the active engagement of service beneficiaries, optimization of government ICT expenditures, and enhanced collaboration with the private sector (29). Here, the concept of digital stewardship plays a central role. It enables government entities to lead sustainable transformation efforts and ensures the successful implementation of strategic digital projects. Such progress requires an environment conducive to innovation, supported by legal and institutional mechanisms that encourage adaptability and

forward-thinking governance (30). Ultimately, for Jordan to fully capitalize on the benefits of digital transformation in public utilities, it must remain aligned with international best practices in ICT. Leveraging the experiences of technologically advanced nations will strengthen Jordan's ability to innovate and build an inclusive, efficient, and future-ready public sector (31).

Conclusion

This study has examined the impact of digital transformation on the direct management of public utilities in Jordan, assessing the availability of essential requirements, the quality of digital services, and the extent of digital culture within these institutions. The objective was to identify how public utilities can effectively utilize electronic services to enhance performance and service delivery.

The findings reveal that digital transformation is no longer optional; it is a strategic necessity for improving the efficiency and responsiveness of public services. By embracing digital governance, public utilities can present a modern administrative model characterized by transparency, inclusivity, and accountability. However, despite ongoing efforts, the study identified considerable obstacles hindering the digital shift in Jordan's public utilities. These include limited infrastructure, insufficient funding, and a shortage of qualified human capital.

Nonetheless, the study acknowledges the vital role played by the Ministry of Digital Economy and Entrepreneurship in steering Jordan toward digital maturity. The government's ongoing initiatives to harness technology and artificial intelligence reflect a clear commitment to modernizing the public sector.

E-government has emerged as a pivotal component in this transformation, facilitating greater speed, connectivity, and coordination among public institutions. The government's vision includes integrating AI-driven solutions to deliver smarter, more secure electronic services under a comprehensive cybersecurity framework. Yet, persistent challenges such as a lack of strategic vision, inadequate digital skills, weak infrastructure, and constrained financial resources continue to impede progress.

Recommendations

In light of the findings, the study proposes the following key recommendations to support and enhance the digital transformation of public utilities in Jordan:

1. Strengthen Financial, Human, and Technical Support

Allocate sufficient resources to promote digital transformation initiatives across public utilities, ensuring the sustainability and scalability of digital services.

2. Promote Public Awareness and Digital Literacy

Intensify media campaigns and educational efforts to raise awareness about the importance of digital transformation. Encourage public engagement through social networks and community platforms.

3. Develop an Integrated Infrastructure Strategy

Formulate and implement a national strategy to upgrade digital infrastructure and ensure effective communication systems for data exchange between institutions and the public.

4. Enhance Inter-Governmental Coordination

Foster greater cooperation and integration among government entities to streamline processes, improve service delivery, and eliminate duplication of efforts.

5. Update and Harmonize Legal and Regulatory Frameworks

Modernize legislation to accommodate emerging technologies, safeguard digital data, and regulate the use of communication networks, ensuring compliance with international best practices.

6. Invest in Capacity Building

Provide specialized training programs to develop qualified human resources capable of adapting to technological advancements. Equip employees with skills in data analysis, cybersecurity, and digital service management to reflect positively on service

performance.

By implementing these recommendations, Jordan can strengthen its digital governance framework and ensure that its public utilities are better equipped to meet current and future challenges through innovative, efficient, and citizen-centered service delivery.

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