# LEADERSHIP, DIGITAL CULTURE, AND COMPETENCY:
# Key Success Factors for Digital Transformation in Egypt's Public Sector

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## Abstract

This This study investigates the critical success factors (CSFs) influencing digital transformation (DT) in Egypt's public sector (PS), with a particular focus on leadership strategies (LS), digital culture (DC), and human digital competencies and skills (DCS). By examining these factors and their interrelationships within technological centers (TCs) affiliated with local government units (LGUs), the research aims to identify essential elements impacting the success of digital transformation initiatives (DTIs) in the socio-economic and public administration context of Egypt. Specific challenges in Egypt's PS, such as bureaucratic resistance and underdeveloped infrastructure, underscore the importance of this research.

Quantitative data was collected through a structured, self-administered questionnaire targeting employees in TCs.

The findings reveal significant positive impacts of LS, DC, and DCS on DT success. Vision-oriented LS emerged as a critical determinant, with leaders fostering alignment and goal communication achieving superior DT outcomes in PS organizations. DC was similarly essential, as organizational acceptance of change and innovation strongly correlated with more effective DTI implementation. Furthermore, DCS played a vital role, with higher employee digital literacy and technical proficiency enhancing transformation success.

This study contributes to academic discourse by addressing gaps in the literature regarding DT in developing countries, particularly within PS settings, where cultural, structural, and resource-related challenges differ from the private sector. These results highlight the interplay between LS, DC, and DCS, emphasizing the need for a holistic approach to address Egypt's PS challenges. The findings also offer practical insights for policymakers and practitioners crossing similar socio-economic environments. By fostering strong leadership, cultivating advanced digital cultural practices, and enhancing digital competencies, organizations can achieve sustainable DT outcomes.

**Keywords:** Digital Transformation, Public Sector, Egypt, Leadership, Digital Culture, Digital Competencies and Skills, Success Factors, Organizational Change

## 1. Introduction

The effective implementation of DTIs in the PS presents a significant challenge for governments worldwide. In Egypt, where digital transformation is a cornerstone of the Sustainable Development Strategy (SDS): Egypt Vision 2030, understanding the CSFs for DT is essential to ensure its success. By identifying these factors, governments can enhance the sustainability and impact of DT efforts, aligning them with broader economic and social objectives (Castro & Lopes, 2022; Kamel, 2021a). The unique challenges of Egypt's PS—such as complex regulatory frameworks, diverse stakeholder expectations, and demands for transparency and accountability—further emphasize the need for a tailored approach to DT (Kamel, 2021b).

Research underscores the importance of an integrated, multifaceted approach to successful digital transformation (SDT), encompassing technological, organizational, and cultural dimensions (Weerasinghe et al., 2023). Strong leadership has been consistently identified as a critical determinant of SDT, enabling leaders to champion digital initiatives, foster a culture of innovation, and guide employees through resistance to change (Abu Mansour, 2022; M. H. Lee et al., 2018; Elgohary & Abdel-Aziz, 2023). Furthermore, employee engagement and alignment with a shared digital vision are vital for overcoming barriers that often hinder transformation in the PS.

In addition to leadership, a robust technology infrastructure is necessary to support current operations and adapt to future advancements. This adaptability ensures that DT efforts remain resilient amid rapidly evolving technologies (H. Zaied A et al., 2017). Addressing these needs requires a comprehensive understanding of CSFs, particularly the roles of LS, DC, and DCS.

This research investigates the impact of LS, DC, and DCS on the success of DTIs in Egypt's PS, focusing on TCs within LGUs. By adopting a mixed-methods approach, this study combines quantitative data from structured questionnaires with theoretical insights from the literature. This method enables an inclusive exploration of how success factors are applied in practice, addressing the unique challenges and opportunities in Egypt's PS (Gebba & Zakaria, 2015; H. Zaied A et al., 2017).

## 2. Literature Review

### 2.1 Digitization, Digitalization, and Digital Transformation

The terms digitization, digitalization, and digital transformation are repeatedly used interchangeably (Xanthopoulou & Plimakis, 2021), yet they represent dissimilar processes that have exclusively evolved over time. Although digitization and digitalization primarily involve technology, digital transformation is fundamentally about the customer. The processes of organizational change and the incorporation of a digital culture should be initiated and supported by executives

(Gillin, 2016; Schwertner, 2017; Hemerling et al., 2018). Understanding these differences is crucial for comprehending the scope and impact of technology in contemporary society.

Digitization refers to the process of converting analog information into digital form. Historically, digitization began with the advent of computers and the need to store data in a more efficient, less space-consuming manner. The transformation of text, images, and sound into binary code marks the core of this process (Manyika & Lund, 2016). This foundational step paved the way for more advanced digital technologies by providing the raw data necessary for further manipulation and processing.

Digitalization, on the other hand, extends beyond mere data conversion to involve the use of digital technologies to change business models and afford new revenue and value-producing opportunities. The concept of digitalization gained momentum in the late 20th century as businesses started integrating digital tools into their operations, thereby enhancing efficiency and customer experiences (Parviainen et al., 2017). This phase involves implementing digital tools to improve existing processes rather than merely digitizing information.

Digital Transformation represents the most comprehensive evolution among the three terms. It signifies an essential change in how organizations operate and deliver value to customers, driven by digital technology. This transformation is not just about adopting new technologies but about a cultural shift within organizations to

continuously challenge the current situation, experiment, and adapt (Westerman, Bonnet, & McAfee, 2014). Digital transformation comprises rethinking business models, organizational structures, and customer interactions to align with the capabilities and opportunities presented by digital technologies.

The historical context and definitions of these terms highlight their distinct yet interconnected nature. While digitization is the conversion of analog to digital, digitalization involves leveraging these digital tools to improve processes, and digital transformation is about holistic changes to business models and strategies. Each stage builds on the previous one, creating a continuum of technological and organizational advancement that defines the modern digital landscape.

## 2.2 The Mutual Shaping of Digital Transformation

The mutual shaping perspective highlights the mutual relationship between technology and societal dynamics, where each influences the other. DTIs, particularly in the PS, are deeply embedded in social, political, and institutional contexts, making their success contingent on a nuanced understanding of these factors (Lips, 2019; Williams, 2019).

While technology enables transformation, its implementation and outcomes are shaped by leadership choices, digital culture, and employee skills. Conversely, these factors progress in response to technological advancements, creating a continuous series of mutual influence (König, 2013) This

framework explains the variation in DT consequences across contexts, even when similar technologies are placed.

Leadership strategies play a pivotal role in guiding DTIs. Leaders set the vision, allocate resources, and align organizational goals with technological initiatives. Effective leaders foster strategic alignment by ensuring that technological goals address both organizational priorities and societal needs (Dutton, 2023). This includes managing resistance to change and ensuring stakeholder engagement particularly in bureaucratic environments (Krige, 2006)

Clear communication and inclusive decision-making enhance LS by reducing resistance and building cooperation amongst stakeholders (Aybar, 2017). Leaders who understand the mutual shaping dynamic can better adapt their strategies to the unique challenges of their organizational and societal contexts.

Digital culture reflects the values, norms, and attitudes within an organization that influence its readiness to adopt and sustain digital innovation. A supportive DC fosters collaboration, adaptability, and a willingness to embrace change traits for successful DTIs (Sebastian et al., 2017).

In the PS, entrenched bureaucratic practices often create resistance to new technologies (Lips, 2019). By cultivating DC that values experimentation, continuous learning, and cross-functional collaboration, organizations can mitigate these barriers and enhance the mutual shaping process. DC also influences how

technologies are perceived and utilized, shaping their impact on organizational goals (Williams, 2019)

Digital competencies are critical for realizing the potential of DT. Employees' abilities to use, adapt, and innovate with digital tools determine whether DTIs achieve their intended outcomes. A lack of digital skills often leads to gaps between the expected and actual benefits of technology (König, 2013).

The mutual shaping perspective highlights the involved interaction between societal, organizational, and technological factors, emphasizing how LS, DC, and DCS shape and are shaped by DTIs. This dynamic interaction provides a clear understanding of how transformation clarifies, particularly within the PS, where challenges such as bureaucratic resistance, skill gaps, and cultural inertia often hinder progress. To build on this conceptual foundation, it is essential to examine the theoretical frameworks that have shaped on DT and public management. These frameworks not only expand the understanding of the mechanisms driving DT but also illuminate the blocks and enable the attainments of sustainable outcomes. The next section explores key theories and models of DT in the PS, offering critical insights into their applicability and limitations, and setting the stage for a more detailed analysis of the factors that underpin successful DTIs.

## 2.3 Theories on Digital Transformation

Table (1) Comparative analysis of Digital Transformation Theories

| Theory/Framework | Key Focus | Strengths | Limitations | Applicability to PS |
|---|---|---|---|---|
| Technology Acceptance Model (TAM) | User acceptance of technology | Simple and widely applied | Limited to user behavior | Partially applicable |
| Unified Theory of Acceptance and Use of Technology (UTAUT) | User acceptance influenced by social, organizational, and cultural factors | Comprehensive; includes moderators | Complex application | Relevant to leadership and culture |
| Organizational Change Theories | Change management strategies | Focus on leadership and culture | Requires contextual adaptation | Critical for addressing resistance |
| Digital Maturity Models (DMM) | Assessment of organizational readiness for DT | Structured framework | Focuses on static assessments | Highly relevant for assessing readiness in Egypt's TCs |

DT in the PS has been studied through various theoretical lenses, each providing unique insights into the factors that drive or hinder these initiatives. This research adopts the DMM as the theoretical framework to guide the analysis of DTIs within the EPS. The DMM is selected for its robust approach to evaluating an organization's digital capabilities across multiple dimensions, which are critical for achieving SDT.

DMM is vital framework that help organizations assess their readiness for DT and track their progress. These models provide a structured approach to evaluating various dimensions of an organization's digital capabilities, identifying areas for improvement, and guiding the development of digital strategies. Understanding digital maturity is crucial for assessing how well an organization can leverage digital technologies to achieve strategic goals and remain competitive in a rapidly evolving environment.

Several scholars have contributed to the development and refinement of digital maturity models. For instance, Gurumurthy & Schatsky (2019) emphasized the importance of integrating digital capabilities into all aspects of an organization to achieve true digital maturity. Schumacher et al. (2016) discussed the evolution of digital maturity models and their role in guiding organizations through their DT journeys. Basl & Republic (2018), Jussupova et al. (2019), and Kaplan & Norton (2017) also provided valuable insights into the components that constitute a robust digital maturity model. As well Thordsen et al. (2020) highlighted the need for a comprehensive approach that includes strategic, cultural, technological, and operational dimensions. Additionally, Steinlechner and his colleagues (2021) developed a digital competence maturity model in order to measure maturity on individual employee level. This model deliberates digital competences as an essential for value creation activities.

## 2.4 Digital transformation implications across various sectors.

DT across various sectors exhibits unique challenges and critical success factors tailored to the specific needs and objectives of each domain. In the PS, LS, DC, and DCS are consistently emphasized as fundamental pillars for managing complexity and driving SDT. These factors enable PS organizations to adapt to dynamic environments, overcome bureaucratic challenges, and strategically align resources. LS is

critical for setting a clear vision, fostering collaboration, and aligning teams with transformation goals. Meanwhile, a strong DC promotes openness to innovation, adaptability, and cross-departmental cooperation, while DCS ensures employees possess the technical skills and growth mindset needed to leverage digital tools effectively. Together, these factors are instrumental in ensuring successful DTIs within complex public settings.

In local governments, DT supports SD and citizen engagement through technology adoption. Norris and Reddick (2013) emphasize the role of e-government practices in enhancing service delivery, while Mergel (2019) highlights the need for tailored digital strategies that address the specific governance structures and community needs within local settings.

In the education sector, factors such as technology integration, top management support, and cultural adaptation play a crucial role in enhancing learning experiences and administrative efficiency. Alojail et al. (2023) stress the importance of leadership strategies in aligning technological advancements with educational goals to achieve meaningful transformation.

For healthcare, DT focuses on the role of the leaders in adopting the user-centric approaches and robust regulatory frameworks that enhance patient care while addressing privacy and security concerns. Palaskas (2022) discusses the importance

of prioritizing patient needs while maintaining compliance with strict legal standards.

This broad overview underscores the diversity of DT implications across sectors while highlighting interconnected themes like leadership, digital culture, skilled workforce strategy, and technology integration. These insights provide valuable lessons for the PS, which faces unique challenges such as regulatory complexity, stakeholder diversity, and the need for transparency and accountability. The following section focuses specifically on the CSFs within the PS, with an emphasis on how LS, DC, and DCS can be leveraged to achieve SDT in Egypt's local government.

## 2.5 Digital transformation critical success factor in the public sector

DT in the PS involves utilizing digital technologies to improve public services, enhance transparency, and increase efficiency. Unlike the private sector, the PS often faces greater complexity and slower progress due to challenges such as bureaucratic inertia, restrictive funding and procurement processes, and the need for substantial staff upskilling (Gartner, 2022). Despite these hurdles, DT offers significant benefits, including enhanced service delivery, reduced corruption, and further open and inclusive governance (O'Neill, 2009).

Reaching SDT in the PS requires addressing several CSFs. First and foremost is LS, which provides vision and direction,

fosters collaboration, and ensures alignment of teams with transformation objectives. Leaders play a pivotal role in establishing a supportive DC characterized by openness to innovation, adaptability, and a proactive approach to digital tools and technologies. DC is essential for creating an environment conducive to digital maturity in public institutions (Kaplan & Norton, 2017; Jussupova et al., 2019).

Equally important are DCS, which include digital literacy, technical proficiency with advanced tools, and a mindset emphasizing continuous learning. These competencies ensure that employees can effectively leverage digital platforms and tools, aligning DTIs with organizational goals and driving transformation (Gurumurthy & Schatsky, 2019; Thordsen et al., 2020). Additionally, reengineering processes to integrate digital advancements improves operational efficiency and aligns public organizations with modern expectations (Weldon, 2013).

Egypt possesses significant potential for DT in the PS due to ongoing governmental initiatives and its strategic focus on improving public service delivery. The "Digital Egypt" strategy, spearheaded by the Ministry of Communications and Information Technology (MCIT), emphasizes enhancing ICT infrastructure, increasing digital literacy, and fostering innovation. Technological Centers established as part of the national strategy, play a critical role in centralizing and streamlining services

within LGUs. These centers are designed to enhance citizen engagement, reduce bureaucracy, and improve service SD.

Additionally, Egypt's growing ICT sector, robust mobile penetration (estimated at over 100% by the MCIT, 2023), and improving E-Government Development Index (EGDI) ranking indicate promising advancements in digital capabilities. Investments in telecommunications infrastructure and the establishment of smart cities further highlight the country's readiness for adopting DT.

For Egypt's PS, the integration of these CSFs offers a tailored roadmap for navigating DT challenges. Addressing resource constraints, overcoming resistance to change, and fostering a culture of innovation and collaboration are essential steps toward achieving SDT. The insights gained from this analysis will guide the identification of existing gaps in the literature and inform actionable strategies for implementing effective DTIs in Egypt's unique public sectors.

## 2.6 Strategies for Digital Transformation in Egypt's Public Sector

The Egyptian government has adopted several strategies to drive DT in the PS:

***Integration of Technological Centers***: TCs have been introduced across governorates, focusing on the single-window model to centralize services and improve efficiency.

***Focus on Digital Skills Development***: Programs under the "Digital Egypt" initiative target enhancing digital literacy among employees through tailored training, particularly in LGUs.

***Public-Private Partnerships***: Collaborations with private sector companies and international organizations, such as the United Nations Development Programme (UNDP), aim to provide technical expertise and funding for digital projects.

***Policy Alignment:*** The government has ensured that DT initiatives align with the Sustainable Development Strategy: Egypt Vision 2030, linking technological advancements with broader socio-economic objectives.

## 2.7 Challenges in Implementing Digital Transformation in Egypt

Despite its potential, Egypt's journey toward DT faces several challenges:

***Bureaucratic Resistance***: Entrenched practices and rigid organizational structures hinder the pace of transformation.

***Infrastructure Disparities***: Significant gaps exist in digital readiness between urban and rural areas, with less-developed governorates facing slower adoption of DT initiatives.

***Skills Gaps***: Limited digital competencies among employees in LGUs result in inconsistent implementation and utilization of digital tools.

## 2.8 *Resource Constraints*: Budget limitations and a lack of dedicated funding for DT projects restrict the scalability and sustainability of initiatives.

***Citizen Resistance***: Public resistance to adopting digital platforms, particularly among older demographics, highlights the need for awareness campaigns and inclusive approaches.

This empirical context underscores the importance of the study's focus on LS, DC, and DCS. By addressing these challenges, the study provides a framework for overcoming barriers and leveraging Egypt's potential. The strategies and challenges discussed align with the research hypotheses and emphasize the role of LS in fostering a cohesive DC and enhancing DCS to achieve sustainable DT success in the PS.

While theories provide the foundational understanding of DT, CSFs offer actionable insights into the practical elements required for success. These factors address the operational, cultural, and strategic dimensions necessary for implementing and sustaining DT initiatives. The following table presents a detailed exploration of CSFs, emphasizing the role of LS, DC, and DCS in driving transformation in Egypt's PS.

### 2.9 Table (2): Comparative Analysis of CSFs for Digital Transformation:

| CSF | Public Sector Application | Key Challenges | Opportunities | Examples from Literature |
|---|---|---|---|---|
| Leadership Strategies (LS) | Vision articulation, group goals, individualized support | Bureaucratic resistance | Alignment of teams and goals | Abu Mansour (2022); Lee et al. (2018) |
| Digital Culture (DC) | Fostering innovation, adaptability, collaboration | Resistance to change, hierarchical barriers | Enabling innovation | Sebastian et al. (2017); Mergel et al. (2019) |
| Digital Competencies and Skills (DCS) | Training in digital literacy, technical proficiency | Skill gaps, resource limitations | Improved employee efficiency | Vuorikari et al. (2016); Ferrari (2013) |

## 2.10 Conceptual framework

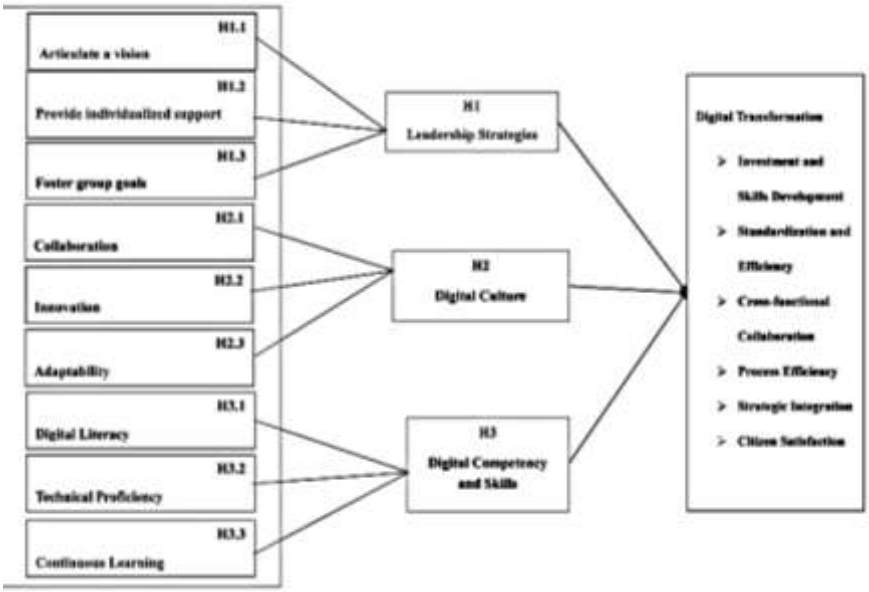


**Figure (1). Research Framework**

**Source: Developed by the researcher**

## 3. Hypotheses Development

### *H1: Impact of Leadership Strategies on Digital Transformation Success*

***Leadership strategies*** play a fundamental role in shaping the success of DT initiatives by guiding organizational priorities, fostering collaboration, and addressing challenges such as resistance to change and skill gaps. This section develops hypotheses around three key dimensions of LS; articulating a

vision, providing individualized support, and fostering group goals, and their impact on DT success.

***Articulating a Vision:*** The articulation of a clear and compelling vision is fundamental for guiding DT efforts. Leaders who effectively communicate a vision for DT provide a sense of purpose and direction, aligning organizational goals with technological advancements. This clarity helps reduce ambiguity, build trust, and foster employee engagement with the transformation process (Dutton, 2023; König, 2013). In the PS, a clearly articulated vision is essential for navigating bureaucratic complexity and ensuring that DT aligns with broader national or organizational objectives.

***Hypothesis H1.1: The articulation of a clear vision by leaders positively influences the success of digital transformation initiatives in the public sector.***

***Providing Individualized Support***: Effective leaders provide individualized support to employees, recognizing their unique needs and challenges during DT. This approach builds trust, enhances motivation, and facilitates the adoption of new tools and processes (Aybar, 2017). Individualized support is particularly critical in the PS, where employees may face resistance to change or skill gaps that hinder the effective implementation of DT initiatives.

***Hypothesis H1.2: Leaders who provide individualized support significantly enhance employee acceptance and commitment to digital transformation initiatives in the public sector.***

***Fostering Group Goals:*** Fostering shared goals and collaboration among employees is another critical leadership strategy that drives DT success. Leaders who emphasize collective objectives create a sense of unity and teamwork, which is essential for breaking down silos and encouraging cross-functional collaboration (Krige, 2006). In the PS, where departmental division often hinders efficiency, fostering group goals ensures alignment and coordination across teams.

***Hypothesis H1.3: Leaders who foster group goals positively impact the success of digital transformation initiatives by enhancing cross-functional collaboration and teamwork.***

***H2: Impact of Digital Culture on Digital Transformation Success***

DC is a critical enabler of DT success, reflecting the values, norms, and behaviours within an organization that shape its readiness to adopt and sustain digital innovation. In the PS, fostering a strong DC is essential for overcoming resistance to change, encouraging innovation, and ensuring cross-departmental collaboration. This research develops hypotheses around three key dimensions of DC; collaboration, innovation, and adaptability, and their influence on the success of DT initiatives.

***Collaboration:*** A collaborative digital culture promotes cross-functional teamwork and communication, breaking down silos and encouraging shared ownership of DT initiatives. Collaboration facilitates the seamless integration of new technologies across departments, enhances problem-solving, and ensures that diverse perspectives are considered in decision-making (Mergel, 2019). In the PS, collaboration is particularly important for aligning different units and stakeholders, enabling a coordinated approach to DT.

***Hypothesis H2.1: A digital culture that fosters collaboration positively influences the success of digital transformation initiatives in the public sector.***

***Innovation:*** A culture that values innovation encourages experimentation, creativity, and a willingness to embrace change. Innovation-driven organizations are better equipped to identify and implement vital solutions, enabling them to stay ahead in a rapidly evolving digital landscape (Sebastian et al., 2017). In the PS, fostering a culture of innovation helps overcome bureaucratic inertia and drives the adoption of novel technologies that improve service delivery and efficiency (Harshak et al., 2013).

***Hypothesis H2.2: A digital culture that promotes innovation positively impacts the success of digital transformation initiatives in the public sector.***

***Adaptability:*** Adaptability reflects an organization's ability to respond to evolving challenges, technologies, and citizen

needs. A culture that values adaptability ensures that employees and processes remain flexible and resilient in the face of change (Abhari et al., 2021; Lips, 2019) In the PS, adaptability is crucial for addressing the dynamic requirements of public service delivery and managing the complexities of digital initiatives.

***Hypothesis H2.3: A digital culture characterized by adaptability enhances the success of digital transformation initiatives by increasing organizational flexibility and resilience.***

### *H3: Impact of Digital Competencies and Skills on Digital Transformation*

DCS are essential for the successful implementation of DT initiatives, as they enable employees to effectively use, adapt, and innovate with digital tools and processes. In the PS, where digital literacy gaps and resource constraints are common, enhancing DCS is a critical factor for ensuring that DT efforts achieve their intended goals. The research develops hypotheses around three key dimensions of DCS; digital literacy, technical proficiency, and continuous learning, and their influence on the success of DT initiatives.

***Digital Literacy:*** Digital literacy represents the foundational ability of employees to understand and use basic digital tools and technologies effectively. Without sufficient digital literacy, employees may struggle to adopt new systems, leading to inefficiencies and resistance to change (Vuorikari et al., 2016). In the PS, improving digital literacy is particularly

important for addressing skill gaps and enabling employees to perform their roles effectively in a digital environment.

***Hypothesis H3.1: Higher levels of digital literacy among employees positively influence the success of digital transformation initiatives in the public sector.***

***Technical Proficiency*** Technical proficiency involves advanced skills required to operate specialized digital tools, manage complex systems, and drive innovation. Employees with strong technical competencies are better equipped to troubleshoot issues, customize technologies to meet organizational needs, and ensure the seamless integration of new systems (Verina & Titko, 2019). In the PS, technical proficiency is critical for handling the unique requirements of governmental processes and ensuring the sustainability of DT efforts.

***Hypothesis H3.2: Technical proficiency in advanced digital tools positively impacts the success of digital transformation initiatives in the public sector.***

***Continuous Learning:*** A culture of continuous learning ensures that employees remain adaptable and up-to-date with the latest technological advancements. Encouraging ongoing training and professional development not only enhances individual performance but also fosters an organizational mindset geared toward innovation and improvement (Eom & Lee, 2022). In the PS, where rapid technological changes can outpace existing

skills, fostering continuous learning is vital for maintaining operational efficiency and resilience.

***Hypothesis H3.3: A growth mindset and commitment to continuous learning among employees positively influence the success of digital transformation initiatives.***

.Continuous learning emerges as a vital component in addressing the dynamic challenges of DT, particularly in the PS where technological advancements continually reshape operational demands. By fostering a mindset of growth and adaptability, continuous learning enables employees to remain proficient and responsive, thus reinforcing the success of DTIs. Building on this foundational concept, the following part delves into the research methodology employed to explore the influence of LS, DC, and DCS—key determinants of DT success in Egypt's PS. Using Saunders' research onion model as a guiding framework, the methodology outlines a systematic approach for collecting and analysing data, ensuring a comprehensive evaluation of these factors across Egypt's TCs.

**Table(3): Sample Population**

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| Gender | Female | 214 | 0.54 |
| | Male | 183 | 0.46 |
| Age | 20 – 24 | 18 | 0.05 |
| | 25-34 | 40 | 0.10 |
| | 35-44 | 174 | 0.44 |
| | 45-54 | 133 | 0.33 |
| | 55-60 | 28 | 0.07 |

| | | | |
|---|---|---|---|
| | **65 or older** | **3** | **0.01** |
| **Education** | **Bachelor's degree** | **264** | **0.67** |
| | **Doctoral degree** | **18** | **0.05** |
| | **High school or equivalence** | **76** | **0.19** |
| | **Master's degree** | **38** | **0.10** |
| **Years of experience** | **1-3 years** | **106** | **0.27** |
| | **4-6 years** | **95** | **0.24** |
| | **7-10 years** | **48** | **0.12** |
| | **Less than 1 year** | **35** | **0.09** |
| | **More than 10 years** | **113** | **0.28** |
| **Role** | **Back Office Representative** | **37** | **0.09** |
| | **Cashier** | **8** | **0.02** |
| | **Data entry** | **2** | **0.00** |
| | **Head of Technological Centres Monitoring Committee** | **42** | **0.10** |
| | **Member of Technological Centres Monitoring Committee** | **37** | **0.09** |
| | **System Supervisor** | **98** | **0.25** |
| | **Technological Centre Manager** | **111** | **0.28** |
| | **Front desk employee** | **63** | **0.16** |

## 4. Research Methodology

The research adopts Saunders' research onion model (2013) as a guiding framework, which systematically breaks down the methodological choices into six layers: research philosophy, research approach, research strategy, methodological choices, time horizon, and techniques and procedures. This model provides a comprehensive pathway, moving from the philosophical foundations of the study to the detailed, practical steps involved in data collection and analysis (Saunders et al., 2023).

## 4.1 Research Approach

This study uses a deductive approach, starting with existing theories about leadership, organizational agility, and digital transformation, and testing these theories through empirical data gathered from the public sector in Egypt

## 4.2 Research Strategy

The study adopts a quantitative Approach, integrating quantitative strategy to capture the multifaceted nature of digital transformation.

The primary strategy involves quantitative surveys administered to employees across technology centers in various governorates. This method provides a structured and systematic approach to assess the impact of LS, DC, and DCS, as critical factors on the success of DTIs. The use of standardized questionnaires allows for rigorous statistical analysis, facilitating the quantification of relationships and the testing of hypotheses to identify key drivers and barriers (Kabir, 1994).

To complement the survey data, semi-structured interviews are conducted with key leaders and experts of DT in the PS. These interviews provide deeper insights into the contextual factors influencing digital transformation, exploring specific challenges, leadership behaviours, and implementation nuances that are not easily captured through quantitative methods.

### 4.3 Time Horizon

The research adopts a cross-sectional time horizon, collecting data at a single point in time to assess the current state of digital transformation initiatives across Egypt's Technology Centers.

### 4.4 Techniques & Procedures

Data collection of this study involves questionnaires for quantitative analysis (Barroga et al., 2023). The data analysis procedures include statistical analysis for survey data and thematic analysis for interview data.

### 4.5 Target Population

The target population for this research includes employees who are involved in LGUs across Egypt, specifically within TCs that implement DTIs. These centers, integral to citizen service delivery, represent a practical case for studying DTI success because of their critical role in digitizing public services across Egypt's 27 governorates.

This population was chosen because it covers various roles directly linked to the implementation, management, and evaluation of DTIs, providing inclusive insights into operational challenges and successes. Key groups include decision-makers, managers, supervisors, and front-line employees, all of whom contribute to the functioning of TCs and interact with the digital systems and processes that define SDT.

## 4.6 Sample size

The size of the sample used in the study is decided by Cochran (1963)

n=(z^2*p*(1-p))/e^2 =( 〖(1.96)〗 ^2*(0.5)(1-0.5))/ 〖0.05〗 ^2 ≈384<397

Therefore, the sample need to exceed 384 respondents to obtain a margin of error of 0.05. A number of 500 respondents were targeted, each of them was sent the link for the google form. The response rate was found to be 79.4%. All of the responses were complete, therefore none needed to be eliminated.

## 4.7 Sampling technique

Non-random sampling technique.The target population in the study were all the employees responsible for the operating of the digital transformation process. The sample was selected through a convenient sampling technique. This is due to the absence of a clear sampling frame. According to Golzar et al. (2022), convenient sampling technique is a cost-effective method that could present representative results under certain conditions. In the study, the condition of diversification of sample is met, therefore it is believed the study could rely on the sample as it would be representative of the whole population.

## 4.8 Statistical tools

The study uses rigorous quantitative research method with the use of a number of statistic instruments and strategies to analyse the data and compare hypotheses. IBM SPSS Statistics

version 26 and SmartPLS version 3 are chosen as the primary methodological analytical tools for this research, each of which has a different but interconnected analytical function. The first stage of analysis utilizes descriptive statistics by means of SPSS 26 in order to acquire a prima vista view of the data framework as well as the character of the sample. These include measures of central-tendency such as mean, median and mode while dispersion is the standard deviation and variance; distribution characteristics are skewness and kurtosis. Such descriptive analyses allow in creating the first impression of the various aspects of the dataset under analysis to detect a range of artifacts which could distort subsequent analysis (Fedele, 2021).

Correlation analysis is then conducted to examine the strength and direction of relationships between the study variables. The findings of this analysis serve as a preliminary step to better understand the relationships between constructs and also confirm initial assumptions of theoretical foundation of the study. The regression coefficients obtained from the SPSS 26 output represent the first level of estimates of the effects posited in the research model (Seeram, 2019). The study then moves to a more complex evaluation approach, by employing Structural Equation Modelling (SEM) aided by SmartPLS version 3. The current research is well suited for the SEM analysis because this method addresses the issues of measurement error during the estimation of relationships between multiple dependent and

independent variables. The assessment of the measurement model precedes the SEM analysis, followed by the assessment of the structural model (Naveed et al. 2020).

CFA is performed as a major step in the validation of the proposed measurement model. The analysis also supports the theoretical relationship of factor loadings to the prespecified constructs in that, it gives assurance that the measures used reflect the intended constructs. In the CFA process, measurements for factor loading, construct reliability, convergent validity, and discriminant validity are tested, so the soundness of the measurement scales is determined (Feng et al. 2017).

In particular, path coefficients analysis determines the key assessment of the structural model and gives the possibility of estimating the strength and statistical significance of hypothesized relationships between the given constructs. These coefficients measure the endogenous and exogenous relations between variables where the research hypotheses will be examined. In the current analysis, bootstrapping procedures are used to check the significance of the path coefficients as well as to obtain the confidence intervals (Sarstedt et al. 2021).

Front lockers technique is used to ascertain the validity of the hypothesized structural relations in the proposed model. It is advantageous in comprehending how one variable interacts with others to cause a change besides identifying the process by which various variables are changed by others (Darren et al. 2023).

Confirmatory fit assessment is performed in order to determine to what extent the fit of the theoretical model to the empirical data is acceptable. The Standardised Root Mean Square Residual (SRMR), the Normed Fit Index (NFI), and model predictive relevance ($Q^2$) values are considered. These indices offer additional information about aspects of model fit not captured by other indices, thus provide a balanced assessment of the model fit for the underlying data relations (Chin et al. 2020).

Using this general quantitative approach, this study wants to ensure both variability and accuracy, as well as methodologically sound techniques to test the research hypotheses. Descriptive statistics, correlation analysis, and other methods of advanced SEM help to address the research questions, and build sound conclusions.

## 5. Results

### 5.1 Data Management

The data cleaning is a basic step in the process of analysing data. This is explainable by the fact that if there are any issues in the dataset, this would reflect in producing unreliable results. Observing the dataset, there was no issues as

1. There was no repetitions or multicollinearity between the statements
2. There was no contradiction between the statements such that the reliability nd validity was above threshold for each of the variables

3. To code each of the answers, those who strongly disagree was coded "1" while those who strongly agree were coded "5".

Upon evaluating the dependability of the dimensions, it was noticed that all measures of Cronbach's alpha exceeded 0.7 (Cheung et al., 2023), indicating a high level of internal consistency. In contrast, all dimensions demonstrated a composite reliability above 0.7 and an average variance extracted above 0.5 (Nasution et al., 2020), confirming their validity. Given that the Variance Inflation Factors (VIFs) are below five, it can be inferred that multicollinearity does not pose a problem in the model (Nasution et al., 2020). Furthermore, all item loadings surpassed 0.5, underscoring the significance of the statements (Cheung et al., 2023).

**Table (4). Hetero-Monotrait HTMT Discriminant Validity analysis**

| | Digital Competency and Skill | Digital Culture | Digital Transformation | Leadership Strategy |
|---|---|---|---|---|
| **Digital Competency and Skill** | | | | |
| **Digital Culture** | **0.851** | | | |
| **Digital Transformation** | **0.622** | **0.642** | | |
| **Leadership Strategy** | **0.291** | **0.305** | **0.484** | |

**Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3**

Discriminant validity is satisfied if HTMT values are below 0.9 (Rasoolimanesh, 2022). As HTMT values range from 0.291 to 0.851, the overall discriminant validity is still good. The

constructs are empirically distinct. Thus, the constructs are appropriate for the model.

**Table (5). Fornell-Larcker Criterion Discriminant Validity analysis**

| | Digital Competency and Skill | Digital Culture | Digital Transformation | Leadership Strategy |
|---|---|---|---|---|
| Digital Competency and Skill | 0.777 | | | |
| Digital Culture | 0.769 | 0.728 | | |
| Digital Transformation | 0.549 | 0.597 | 0.767 | |
| Leadership Strategy | 0.257 | 0.302 | 0.447 | 0.832 |

**Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3**

For Digital skills, the square root of the AVE is 0.777, which is greater than its correlations with Digital Culture (0.769), Digital transformation (0.549) and Leadership strategy (0.257). This indicates good discriminant validity for this construct. For Digital culture, the square root of the AVE is 0.728, which is greater than its correlations with Digital transformation (0.597), Digital Skills (0.769) and Leadership strategy (0.302). This indicates good discriminant validity for this construct. For Digital Transformation, the square root of the AVE is 0.767, which is greater than its correlations with Digital Skills (0.549), Digital Culture (0.597) and Leadership strategy (0.447). This indicates good discriminant validity for this construct. Therefore, based on the Fornell-Larcker criterion, your model demonstrates good discriminant validity (Guenther et al., 2023). These results are consistent with the results of the HTMT. Thus, the discriminant validity is ensured.

Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3

The model in the figure is showing the relationships between four latent variables: leadership strategy, digital culture, digital skills and digital transformation. Each of these latent variables is measured by several observed variables (indicators), represented as sub-elements in the graph each had loading higher than 0.6.

***Table (6). Bootstrapping results of the path analysis in structural equation model***

| | Original Sample | Standard Deviation | T Statistics | P Values |
|---|---|---|---|---|
| Digital Competency and Skill -> Digital Transformation | 0.202 | 0.119 | 1.698 | 0.09 |
| Digital Culture -> Digital Transformation | 0.354 | 0.103 | 3.442 | 0.001 |
| Leadership Strategy -> Digital Transformation | 0.288 | 0.057 | 5.039 | 0 |

**Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3**

Observing each hypothesis some insights can be obtained, the first hypothesis was that leadership strategy have positive significant impact on digital transformation. As the leadership strategy were clearer and guided towards the vision, this would result in better progress for the digital transformation for different organizations. Sow and (Sow & Aborbie, 2018) had consistent results as they also believed that leadership is a deterministic factor when it comes to the digital transformation.

The second hypothesis was that digital culture have positive significant impact on digital transformation. As the digital culture is more accepting to change, the better the digital transformation will be applied. It is considerably important to understand the digital culture as it was one of the most deterministic factors. The results were consistent with El Rashied (2022), the study mentions the impact of digital culture on how employees engage in ICT sector.

Regarding the third hypothesis, it stated that digital competency and skills have positive significant impact on digital transformation. As the employee had higher skills and more competent, the better the digital transformation would occur in the organization. This comes in line with Andriole (2018) who believed that advance computing skills like cloud computing, artificial intelligence, cyber security and block chains are required by digital transformation process. Bouaziz (2020) also conducted a literature review on the phenomenon. The conclusion was digital government competencies and skills are required for designing, implementing, managing, and using new digital tool.

**Table (7). Model evaluation metrics of the structural equation model**

| | R Square | R Square Adjusted | SRMR | d_ULS | d_G | Chi-Square | NFI | Q2 |
|---|---|---|---|---|---|---|---|---|
| Digital Transformation | 0.451 | 0.444 | 0.075 | 3.499 | 1.286 | 1617.622 | 0.737 | 0.257 |

**Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3**

The R Square for Digital transformation is 0.451, indicating that 45.1% of the variability in Digital Transformation can be explained by the model. $Q^2$ is a measure of the model's predictive relevance. A $Q^2$ value greater than zero indicates the model has predictive relevance, while a value less than zero indicates it does not. The $Q^2$ value for Digital Transformation is 0.257, indicating the model has predictive relevance for this construct (Purwanto, 2021). SRMR is a goodness of fit measure. Values close to zero are generally considered good. The model has an SRMR of 0.075, which is considered good for the model (Cheung et al., 2023). In addition, the Normed Fit Index was relatively higher than 0.7 thus, the model if good fit for data.

**multi-group analysis**

Multi-group analysis is a statistical technique used to compare the effects of variables across different groups within a dataset. In research, it's particularly valuable for understanding whether relationships or effects observed in one group hold consistently across others. This approach is commonly used in structural equation modelling. In this study, it was believed there would be differences between gender, governorates and roles. This is due to the significant results of Welch Satterthwaite tests, where there was a significant difference between these groups. Further bootstrapping and path analysis were thus used to highlight these insights.

***Multi-group analysis by gender***

**Table (8). Bootstrapping results of the structural equation model for different gender groups**

| Hypothesis | Measure | Female | Male |
|---|---|---|---|
| Digital Competency and Skill -> Digital Transformation | B | 0.356 | 0.103 |
| | Stdev | 0.157 | 0.156 |
| | T | 2.274 | 0.659 |
| | P-value | 0.023 | 0.51 |
| Digital Culture -> Digital Transformation | B | 0.271 | 0.408 |
| | Stdev | 0.138 | 0.15 |
| | T | 1.959 | 2.73 |
| | P-value | 0.051 | 0.007 |
| Leadership Strategy -> Digital Transformation | B | 0.217 | 0.354 |
| | Stdev | 0.08 | 0.087 |
| | T | 2.719 | 4.084 |
| | P-value | 0.007 | 0 |

**Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3**

For females, all the three variables are believed to have a significant positive impact on digital transformation at 90% confidence level. The digital skills had the highest significant impact on digital transformation at 0.05 level of significance. Digital Culture had the second highest significant effect on digital transformation at 0.1 level of significance. At 0.01 level of significance, leadership strategy came last in terms of effect on digital transformation.

On the other hand, males witnessed only the effect of digital culture and leadership strategy on digital transformation at 99% confidence level. However, there was no significant evidence that skills and competency had an impact on digital transformation.

***Multi-group analysis by governorates***

**Table (9). Bootstrapping results of the structural equation model for different governorates**

| Hypothesis | Measure | Frontier | Lower Egypt | Metropolitan | Upper Egypt |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Digital Competency and Skill -> Digital Transformation | B | 0.139 | 0.034 | 0.405 | 0.644 |
| | Stdev | 0.136 | 0.16 | 0.246 | 0.276 |
| | T | 1.025 | 0.21 | 1.65 | 2.331 |
| | P-value | 0.306 | 0.834 | 0.1 | 0.02 |
| Digital Culture -> Digital Transformation | B | 0.465 | 0.537 | 0.377 | -0.033 |
| | Stdev | 0.136 | 0.143 | 0.207 | 0.271 |
| | T | 3.43 | 3.758 | 1.821 | 0.121 |
| | P-value | 0.001 | 0 | 0.069 | 0.904 |
| Leadership Strategy -> Digital Transformation | B | 0.471 | 0.241 | 0.172 | 0.234 |
| | Stdev | 0.101 | 0.075 | 0.179 | 0.155 |
| | T | 4.639 | 3.235 | 0.956 | 1.515 |
| | P-value | 0 | 0.001 | 0.339 | 0.13 |

**Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3**

Both frontier and Lower Egypt had witnessed the same effects of the factors on digital transformation. As digital culture and leadership strategies had positive significant impact on digital transformation at 99% confidence level. This shows that having culture that is open for the new tools and a leadership ready to integrate them, could have the deterministic effect needed to transform digitally any governmental organization.

For metropolitan areas like Cairo, Alexandria and Suez, the main concern was the culture only. For them, culture play as the sole factor responsible in affecting the digital transformation progress. This shows that, these governorates may have the leadership to integrate these tools and the know-how. However, if the culture of the organization or department is not willing to adapt to digitalization, all the progress would regress.

Lastly Upper Egypt, due to years of lack of knowledge of recent technologies, the real deterministic factor for them was the digital competency and skills. If the employee was skilled and

knowledgeable, it would help improve greatly their digital transformation progress. However, digital culture and strategy by leadership had no significant impact on digital transformation at 0.05 level of significance.

### *Multi-group analysis by role*

**Table (10). Bootstrapping results of the structural equation model for different job roles**

| Hypothesis | Measure | Back office representative | Front desk employee | System Supervisor |
|---|---|---|---|---|
| Digital Competency and Skill -> Digital Transformation | B | 0.069 | 0.424 | 0.407 |
| | Stdev | 0.2 | 0.256 | 0.161 |
| | T | 0.346 | 1.659 | 2.529 |
| | P-value | 0.73 | 0.098 | 0.012 |
| Digital Culture -> Digital Transformation | B | 0.558 | 0.059 | 0.241 |
| | Stdev | 0.162 | 0.202 | 0.128 |
| | T | 3.449 | 0.289 | 1.874 |
| | P-value | 0.001 | 0.772 | 0.062 |
| Leadership Strategy -> Digital Transformation | B | 0.37 | 0.478 | 0.331 |
| | Stdev | 0.192 | 0.115 | 0.113 |
| | T | 1.932 | 4.142 | 2.932 |
| | P-value | 0.054 | 0 | 0.004 |

| Hypothesis | Measure | Head of Technological Centres Monitoring Committee | Technological Centre Manager | Member of Technological Centres Monitoring Committee |
|---|---|---|---|---|
| Digital Competency and Skill -> Digital Transformation | B | 0.043 | 0.443 | -0.096 |
| | Stdev | 0.35 | 0.263 | 0.311 |
| | T | 0.123 | 1.681 | 0.308 |
| | P-value | 0.902 | 0.093 | 0.759 |
| Digital Culture -> Digital Transformation | B | 0.531 | 0.193 | 0.857 |
| | Stdev | 0.273 | 0.248 | 0.295 |
| | T | 1.942 | 0.778 | 2.908 |
| | P-value | 0.053 | 0.437 | 0.004 |
| Leadership Strategy -> Digital Transformation | B | 0.193 | 0.224 | 0.13 |
| | Stdev | 0.209 | 0.097 | 0.211 |
| | T | 0.924 | 2.306 | 0.617 |
| | P-value | 0.356 | 0.022 | 0.538 |

**Source: Calculations based on 397 individuals working in different sectors of digital transformation in government using SmartPLS 3**

For back office representatives, having an open digital culture is significantly associated with digital transformation. This highlights

the importance of digital values, norms, and behaviours in driving transformation within these organizations. This make sense since back office representatives are engineers who have all the skills required to deal with digital transformation, however, if their culture is not open to the change, they would cease to embrace the progress. At 90% confidence level, leadership and how they have vision regarding digital transformation in an organization, would deeply affect the progress. If the leadership prioritize the digital transformation or not remain the question for these representatives in dealing with the new tools.

For front desk employees, leadership strategy plays a key role in enabling digital transformation. This implies that a clear and supportive leadership approach is essential to guide and motivate front desk employees in adopting digital initiatives at 99% confidence level. At 90% confidence level, having the acquired skills to deal with these tools while serving the masses remain also a crucial factor for digital transformation. In case of incompetence of front desk employees, this will hinder the progress of digital transformation in different governmental sectors.

Both heads and members of technological centres monitoring committee believed that digital culture was the sole deterministic factor of the digital transformation progress. For them, the digital culture including their behaviour towards trying and integrating new tools in their daily work, is what mainly impacts the digital transformation and its adoption by different

organizations. Upon comparison between both roles, members; digital transformation in their work is affected even more by digital culture then those of their heads. On the contrary, Technological Centre Manager believed that digital competency and leadership will be the ones with a positive significant impact on digital transformation at 90% confidence level.

For system supervisors, all the three variables are believed to have a significant positive impact on digital transformation at 90% confidence level. The digital skills had the highest significant impact on digital transformation at 0.1 level of significance. At 0.1 level of significance, leadership strategy came second in terms of effect on digital transformation. Digital Culture had the third highest significant effect on digital transformation at 0.1 level of significance.

The final results show that observing individual's opinion in the sample, leadership skills is the highest deterministic factor, followed by digital culture and lastly by skills. The results show that the three hypotheses are accepted. As leadership strategy, digital culture and digital competency all had positive significant impact on digital transformation at 99% confidence level. In addition, digital culture had the highest significant impact on the odds of improving digital transformation from a level to a higher one, followed by leadership strategy then digital competency and skills. The model was significant at 99% confidence level and

was able to explain 36.2% of variation in digital transformation based on these independent variables.

## 6. Recommendations

On a practical level, the findings suggest that EPS leaders should prioritize creating and nurturing a digital-friendly culture. Leadership training should focus on cultivating digital mindsets among managers and leaders, enabling them to drive DT initiatives actively and effectively. The study shows that leadership plays a crucial role in setting the tone for organizational openness to digital change. Leaders who understand the value of DT, communicate its importance, and demonstrate a commitment to change will encourage employees to embrace DC and reduce resistance. To this end, leadership development programs for all government agencies should incorporate DT values, encourage the use of Innovation and support change management.

Furthermore, the results demonstrate that there is a necessity for the local approach in identifying appropriate strategies for DT implementation. For instance, in areas such as Metropolitan and Upper Egypt, which reveal greater effectiveness of the digital competency, more funds should be invested in enhancing participants' technical abilities and technology proficiency. On the other hand, there is a need to spend more time in Lower Egypt regarding the promotion of the DC that may require programs that encourages acceptation of new change and

flexibility at the working place. Raising the competencies of workers to the required level will be the task of the future training programs that will be developed on local specifics; it will make national DT strategy integrated and united at the same time while providing for the specifics of the regions.

The research also indicates that whilst developing these digital competencies should be a key focus for organizations alone the lines of skill development an emphasis on strong leadership and supportive culture should also been considered. It is a fact that policymakers and administrators should, therefore, enforce cross-department arrangement to foster technical as well as leadership competency. For example, technical training in technology adoption can be followed by workshops on change management and DC that would not only provide for improved technical skills, but would also assist the employees in seeing the big picture of DT in the company. This will help assure that every goal established toward increasing digital proficiency will be supported by the culture of the organization that fosters it.

By applying the qualitative analysis, leadership, digital culture and digital skills appeared to be the most deterministic factors in the success of digital transformation application. Studies like Zhang et al. (2023) suggest agility had an effect on digital transformation, however for it to appear as an effect it would require for the system to be already established for some time for the effect of operational agility require the operations to

be observable. Therefore, future scholars are recommended to consider the agility of the organizational structure as a deterministic factor alongside of the other proposed algorithm.

Last but not the least, there is necessary to create a digital environment to eliminate the digital divide by regions. These agencies will have to assess and enhance its telecommunications systems at the same time, especially for those regions and countries that are still left behind in terms of digital support. This would include the expansion of connectivity and digital access in all the regions as well as using is solutions which enhance secure and accessible central repository. Addressing infrastructure will help DT initiatives to have sustainable impact on DT efforts as well as on ability of public PS.

## 7. Conclusion

The purpose of this research is to investigate the key success factors that define successful DT strategy in the context of Egypt's public sector in the area of leadership and digital culture as well as digital competencies and skills. The findings presented in this study will give insights on the DT elements in their relation and effects on DT initiatives within the context of Egypt's local government units and its technological centers to provide a localized understanding of DT answering to the socio-political and organizational environment of Egypt. It also shows that digital culture and leadership have the greatest moderation upon DT success. Those executives who are advocates for digital change have a significant responsibility of

supporting, nurturing and fostering the culture of digital in organizations, which enables organization to drive and adopt innovation and change. Familiarity with digital technologies was shown to be less effective in isolation suggesting that skills must be supported with leadership and culture to have a positive effect upon DT outcomes.

This research adds to the DT literature by supporting the concept of a strong consideration of not only leadership and digital culture as principal determinants of DT success. In the past, DT theories have primarily focused on technology, as well as skills only. This research underscores that, especially within developing countries' public sectors, the social and organizational components of DT can be more influential than isolated technological or skill-based factors. As such, theoretical models on DT should incorporate a broader focus on leadership and digital culture. Future frameworks on DT should move away from purely skills-centered or technology-driven models and incorporate a holistic perspective that includes digital culture, leadership strategies, and adaptability to change as core elements.

Consequently, this study calls for a broader integration of the leadership strategy and digital culture literature in the context of DT research. Although both characteristics have been acknowledged, little is known about their combined effect on the success of DT. This study's future theoretical work is to assess the relationships between

the leadership support and digital culture on possible means exist in order to enhance the DT effectiveness.

On a practical level, the findings suggest that Egypt's public sector leaders should prioritize creating and nurturing a digital-friendly culture. Leadership training should focus on cultivating digital mindsets among managers and leaders, enabling them to drive DT initiatives actively and effectively. The study shows that leadership plays a crucial role in setting the tone for organizational openness to digital change. Leaders who understand the value of digital transformation, communicate its importance, and demonstrate a commitment to change will encourage employees to embrace digital culture and reduce resistance.

The study supports a lot of research evidence of the role of leadership strategies and digital culture in engendering DT. However, it also offers new findings that complement general data by exploring geographic and demographic differences of the EPS. For example, acceptation of the digital culture in the DT differs from one governorate to another for example Lower Egypt oppose to Metropolitan and Upper Egypt. Thus, the results raise the question of the necessity to have a more tailored approach to DT – that would take into account the peculiarities of different expanses and use correspondingly adjusted measures.

## 8. Limitation and Future Research

This study provides significant insights into the critical success factors (CSFs) influencing digital transformation (DT) in Egypt's public sector (PS). However, it is essential to acknowledge its limitations to frame the results within their context and pave the way for future research.

### 8.1 Limitations

Sample Size and Representation: The study utilized data from a specific subset of TCs within LGUs, which may not fully represent the broader spectrum of Egypt's PS. Future studies could expand the sample size to include additional government agencies or sectors.

***Cross-sectional Design***: The research adopts a cross-sectional methodology, which limits the ability to observe changes over time. Longitudinal studies are recommended to examine how CSFs evolve and influence DT success across different stages.

***Scope of Factors Studied***: While this research focuses on leadership strategies, digital culture, and digital competencies and skills, other variables like organizational agility, external stakeholder engagement, and macro-environmental factors as regulatory changes remain unexplored.

***local Scope***: The research highlights regional disparities in DT readiness and outcomes. However, the regional analysis could be expanded to provide deeper insights into how specific local conditions affect DT success.

## 8.2 Future Research

Future research could investigate DT from a comparative perspective, exploring how DT success factors operate across different regions or countries with similar socio-political conditions. By comparing Egypt's journey of DT in the PS with that of other developing nations, researchers could develop a more generalized framework for DT success factors that accounts for regional variances in digital readiness, infrastructure, and culture. Such comparative studies would enrich the body of knowledge on DT, offering policymakers and practitioners in various regions actionable insights on implementing effective DT strategies tailored to their unique contexts. Therefore, this study has laid an essential foundation for understanding DT in the EPS, and these recommendations provide directions for expanding on its findings to create a comprehensive and practical framework for DT across diverse environments.

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