Artificial Intelligence and Strategic Decision-Making Enhancement in Small and Medium-Sized Enterprises: A Comprehensive Framework Analysis and Evidence from Leading Implementations

Khababa Ala Eddine, University of Algiers 3 (Algeria), khababa.ala-eddine@univ-alger3.dz

Received: 14/05/2026 *Accepted: 25/07/2026* *Published:30/09/2026*

Abstract:
This study examines the role of artificial intelligence (AI) in improving strategic decision-making processes within small and medium-sized enterprises (SMEs) using an integrated conceptual framework. Using a comparative analytical approach, it combines the TOE framework, UTAUT, Resource-Based View (RBV), Dynamic Capabilities, and Diffusion of Innovation theories, supported by international experiences. The study concludes that the successful adoption of AI depends on organizational readiness, strategic resources, dynamic capabilities, and institutional support. This study provides a comprehensive framework for future research and policy development in developing economies.

Keywords: Artificial Intelligence, Small and Medium Enterprises, Strategic Decision-Making, Digital Transformation, Integrated Theoretical Frameworks.
Jel Classification Codes : O33, L25, M15.

1 INTRODUCTION

Artificial intelligence (AI) is now an existential imperative underpinning digital transformation rather than a mere strategic option, particularly given the ferocity of competitive pressures and the accelerating pace of technological and economic change. What was once limited to technology-intensive sectors has spread outward, permeating virtually every economic domain. AI has become accessible to small and medium-sized enterprises, which historically operated without substantial resources. These enterprises are the connective tissue of global economic activity and contend with a convergence of pressures, including globalization-driven competition, volatile shifts in market and consumer expectations, and chronic constraints on capital and human resources.

Against this backdrop, AI functions less as an incremental efficiency tool and more as a structural equalizer. It enables SMEs to overcome the limitations imposed by scale, enhancing their ability to compete on a level playing field with larger, more resource competitors.

1.1 The Problem

Despite the marked increase in academic and practical interest in artificial intelligence and digital transformation, it remains unclear how SMEs can effectively utilize this technology to improve the quality of their strategic decision-making, particularly in the context of developing countries. A significant proportion of previous studies have focused on technical aspects or on large corporations, leaving SMEs without integrated practical frameworks and strategies suited to their specific circumstances. Furthermore, the literature suffers from a weak link between theoretical foundations and practical field experiences, and from the dominance of models derived primarily from advanced economic environments that differ from the Algerian context. From this perspective, the central problem that this study seeks to address is the following question:

What are the integrated theoretical frameworks, practical mechanisms and appropriate policies that enable SMEs to utilize artificial intelligence to improve the quality of their strategic decision-making, and how can these frameworks and mechanisms be adapted to

suit the specificities of developing countries in general, and the Algerian context in particular?

1.2 Research Gap and Theoretical Originality

Previous studies have predominantly relied on single-theory approaches or limited the integration of two or three complementary theories (Awa et al., 2015; Estensoro et al., 2022; Nguyen et al., 2022). The Technology–Organization–Environment (TOE) framework explains contextual readiness; the Unified Theory of Acceptance and Use of Technology (UTAUT) focus on behavioral acceptance; the Resource-Based View (RBV) emphasizes strategic resources; Dynamic Capabilities explain organizational adaptation; and the Diffusion of Innovation (DOI) theory addresses the diffusion of technological innovations. While these theories have advanced our understanding of AI adoption, they offer fragmented explanations and fail to capture the interaction between contextual readiness, behavioral acceptance, strategic resources, organizational adaptation, innovation diffusion, and strategic decision-making.

This study proposes a sequential, integrative conceptual framework that combines these theories within a unified analytical structure for small and medium-sized enterprises (SMEs) to address this gap. Rather than merely integrating existing theories, the proposed framework explains AI adoption as a continuous organizational process that links contextual readiness, technology acceptance, strategic resources, organizational adaptation, innovation diffusion, strategic decision-making, and organizational performance. Furthermore, the framework explicitly incorporates institutional and resource constraints that characterize developing economies, particularly the Algerian context. This extends the explanatory scope of existing AI adoption frameworks.

1.3 Objectives of the study

This study aims to achieve a set of main objectives, as follows:

- Developing an integrated theoretical framework that explains the adoption of artificial intelligence and digital transformation in small and medium-sized enterprises (SMEs) based on the TOE, UTAUT, and RBV models, dynamic capabilities, and the theory of innovation diffusion.

- Clarifying the role of artificial intelligence in improving the quality of strategic decision-making within small and medium-sized enterprises by enhancing information, reducing uncertainty, and increasing the efficiency of resource allocation.
- To analyze leading international experiences in AI adoption within SMEs, particularly in Singapore, South Korea, and Estonia, and identify common success factors.
- To assess the current state and challenges of AI adoption in Algeria under the "Digital Algeria 2030" strategy.
- Presenting a practical vision and recommendations to help SMEs and decision-makers in Algeria adopt AI gradually and effectively.

1.4 Research Propositions

This study is based on a review of scientific literature and a comparative analysis of leading international experiences. It proposes a set of analytical propositions that explain how artificial intelligence enhances strategic decision-making in small and medium-sized enterprises (SMEs).

- **Proposal 1:** Technological readiness-including digital infrastructure, data quality, and the flexibility of adopted technical solutions-contributes to enhancing the ability of small and medium-sized enterprises to effectively adopt artificial intelligence applications.
- **Proposal 2:** Organizational and human capabilities-particularly senior management support, a culture of innovation, and digital competencies-play a critical role in maximizing the strategic value derived from Al adoption within SMEs.
- **Proposal 3:** Environmental and institutional factors, such as government policies, digital support programs, and competitive pressures, directly influence the pace and effectiveness of Al adoption within SMEs.
- **Proposal 4:** The integration of the Technology-Organization-Environment (TOE) framework, the Unified Theory of Acceptance and Use of Technology (UTAUT), Resource and Capabilities Theory (RBV), Dynamic Capabilities Theory, and Innovation Diffusion Theory provides a more comprehensive explanatory framework for understanding Al adoption and improving the quality of strategic decision-making within SMEs.

1.5 Study methodology

This study adopts a comparative analytical-conceptual research approach, aiming to develop a comprehensive theoretical understanding of the role of artificial intelligence in improving the quality of strategic decision-making within small and medium-sized enterprises.

To enhance methodological rigor, the study is based on a structured analytical literature review, supported by a comparative analysis of a few leading international experiences in the field of digital transformation and the adoption of artificial intelligence applications

1.5.1 The Literature Review

A review of scientific literature was conducted using peer-reviewed academic databases, including: Scopus, Web of Science, ScienceDirect, Emerald, Springer,Google Scholar.

The search focused on studies that addressed: The adoption of artificial intelligence, Digital transformation, Strategic decision-making, Small and medium-sized enterprises, Technology adoption frameworks.

The study primarily relied on studies published between 2019 and 2025 to ensure the literature was up-to-date and aligned with the rapid developments in the fields of artificial intelligence and digital transformation.

A set of keywords was also used individually and in combination, including Artificial Intelligence, SMES, Strategic Decision-Making, Digital Transformation, TOE Framework, UTAUT, Dynamic Capabilities, Al Adoption.

After the screening and analysis process, the studies most relevant to the study's objectives and research questions were selected.

1.5.2 The Comparative Analytical Approach

The study also employs a comparative analytical approach by examining a number of leading international experiences, namely: Singapore, South Korea, Estonia.

These cases were selected based on a set of criteria, namely:

- Level of national digital maturity.
- The effectiveness of government policies supporting artificial intelligence.
- The level of integration of small and medium-sized enterprises into the digital economy.
- Availability of measurable indicators on the outcomes of digital transformation.

The comparative analysis focuses on: Digital infrastructure, Institutional support, Mechanisms for adopting artificial intelligence, Human capital development, Strategic and organizational outcomes.

1.5.3 The Study's Analytical Framework

The study developed an integrated analytical framework that combines: The Technology-Organization-Environment (TOE) Framework; The Unified Theory of Acceptance and Use of Technology (UTAUT); Resource and Capabilities Theory (RBV); Dynamic Capabilities Theory; Innovation Diffusion Theory.

This framework is used to explain the interaction between technological readiness, organizational capabilities, and environmental factors, and their impact on enhancing the quality of strategic decisions through the adoption of artificial intelligence.

2 Expanded and advanced theoretical frameworks

2.1 The ‘Technology–Organization–Environment’ (TOE) Framework

The TOE Framework by Tornatzky & Fleischer (1990) is a pivotal model for understanding innovation adoption, illustrating that an organization’s decision is shaped by the interaction of three integrated contexts.

a. The Technological Context (T): This encompasses the characteristics of the technology itself, such as compatibility, complexity, relative advantages,

and testability, as well as critical factors for artificial intelligence such as data quality and output reliability.

b. The organizational context (O): addresses the internal characteristics of the organization, such as size, structure, prevailing culture, senior management support, available resources, and available skills (Nguyen et al., 2022, pp. 2–19; Tornatzky & Fleischer, 1990, pp. 152–154) **.**

c. Environmental context (E): covers surrounding external forces, such as competitive pressures, availability of partners, government policies, and legal frameworks (Awa et al., 2015, pp. 76–94; Tornatzky & Fleischer, 1990, pp. 152–154) .

When applying the framework to small and medium-sized enterprises (SMEs), the organizational context (O) becomes the most critical. Whilst these enterprises often lack abundant resources, which constitutes a barrier, their small size grants them significant organizational advantages such as flexibility and a greater capacity to adapt (Mladenova et al., 2025, pp. 216–238; Organisation for Economic Co-operation and Development, 2025) .

A recent study involving 12,108 European small and medium-sized enterprises (SMEs) confirmed this importance, concluding that organizational factors (particularly digital capabilities and an innovative culture) have a greater impact on the successful adoption of artificial intelligence than technological factors alone (XpertSoft Editorial Team, 2025) . This illustrates that internal organizational readiness is often the decisive factor, rather than simply the availability of the technology.

2.2 The Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. (2003) proposed the Unified Theory of Acceptance and Use of Technology (UTAUT), to integrate eight previous models into a single, comprehensive framework. The theory identifies four key variables that influence intention to use and actual behavior:

- **Performance Expectancy:** The extent to which an individual believes that using technology will improve their job performance. In the context of small and medium-sized enterprises, this translates into managers' perception that artificial intelligence will enhance the quality and speed of

strategic decision-making (Feng & Haridas, 2025, pp. 2–18; Venkatesh et al., 2003, p. 248).

- **Effort Expectancy:** The degree of perceived ease of use. This dimension is crucial for small and medium-sized enterprises that may lack specialized technical skills(Venkatesh et al., 2003, p. 248).
- **Social Influence:** The degree to which the user is influenced by the opinions of significant others (such as management, colleagues, or competitors). Pressure from competitors who have successfully adopted AI may be a strong motivator for adoption(Asante et al., 2024, pp. 55–79; Venkatesh et al., 2003, p. 249).
- **Facilitating Conditions:** The provision of the necessary organizational and technical infrastructure to support usage, such as training, technical support, and adequate resources (Venkatesh et al., 2003, p. 250).

Recent studies have highlighted the need to extend the UTAUT model to include additional variables suited to specific contexts, such as small and medium-sized enterprises (Asante et al., 2024, pp. 55–79). Among the most notable of these additions are:

- Competitive pressure (arising from competitors).
- Innovation culture (the extent to which the organization embraces experimentation and calculated risk-taking).
- Government support (such as incentives and supportive policies).
- Trust (whether in the technology itself or in the supplier providing it).

2.3 Resource-Based View (RBV)

Resource-based theory (RBV), established by Wernerfelt and developed by Barney (1991), is based on the premise that an organization's sustainable competitive advantage stems from its possession of unique resources and capabilities that are difficult for competitors to imitate (Barney, 1991, p. 105). For these resources to be of strategic value, they must meet the strict VRIN criteria: they must be Valuable, Rare, Inimitable, and Non-substitutable.

When applying this framework to the context of digital transformation and artificial intelligence, the following critical resources can be identified:

- **Advanced digital human capital:** This refers to the specialized skills and expertise of employees in areas such as data analysis and automation. The importance of this resource is highlighted in the study (Chen, 2025, pp. 33–42), which surveyed 313 managers in small and medium-sized enterprises and found that employees' digital capabilities lead directly and significantly to improved financial and entrepreneurial performance.
- **Advanced technological infrastructure:** This refers to systems and services (such as cloud computing) that enable efficient data processing. It has been demonstrated that small and medium-sized enterprises that invested early in robust digital infrastructure have achieved a tangible competitive advantage (Estensoro et al., 2022, pp. 778–792).
- **Organizational and managerial capabilities:** This refers to the ability to organize limited resources efficiently, allocate them effectively according to priorities, and adapt operations to environmental changes (Barney, 1991, p. 106).

2.4 The Theory of Dynamic Capabilities: The Contemporary Version

2.4.1 The Theory of Dynamic Capabilities

The Dynamic Capabilities theory was developed to address the shortcomings of the "Resource-Based View (RBV)" in explaining the sustainability of competitive advantage within rapidly changing environments (Teece, 2007, p. 1326).

Dynamic capabilities are defined as an organization's ability to "integrate, build and reconfigure" its internal and external competencies in response to acute environmental changes (Teece, 2007). Unlike the RBV theory's focus on "fixed" resources, this theory focuses on 'dynamic processes' and the capacity for continuous development (Teece, 2007, p. 1328; Zhou et al., 2019, pp. 731–747).

Teece (2007) identified three key components of these capabilities:

- **Sensing:** the ability to detect and identify emerging opportunities and threats in the environment, such as monitoring new technologies or competitors' moves (Teece, 2007, p. 1328; Zhou et al., 2019, pp. 731–747).

- **Seizing:** The ability to effectively mobilize resources to exploit identified opportunities, including making investment decisions, allocating resources and taking calculated risks.
- **Transforming:** The ability to adapt and continuously restructure processes and business models, and to use mistakes as opportunities for learning.

Studies have demonstrated a strong positive relationship between these capabilities and sustainable organizational performance. In a study of 190 Colombian companies, it was found that organizations with high dynamic capabilities achieved superior performance, particularly in conditions of uncertainty (Zhou et al., 2019, pp. 731–747).

2.4.2 Theory of Innovation Diffusion

Rogers (1983) developed the Diffusion of Innovation (DOI) theory to explain how innovations spread through social systems over time. According to this theory, adopters are classified into five categories based on their adoption behavior: innovators, early adopters, early majority, late majority, and laggards (Rogers, 1983, pp. 247–251). The theory also argues that the rate of innovation diffusion is influenced by five characteristics: relative advantage, compatibility, complexity, trialability, and observability. In the context of SMEs, AI offers significant relative advantages; however, its complexity and limited trialability, particularly due to financial constraints, remain important barriers to adoption.

In the context of SMEs, AI often offers clear advantages, but its high complexity and limited trialability, primarily due to financial constraints, remain significant barriers to adoption. The TOE framework, UTAUT, RBV, Dynamic Capabilities, and Diffusion of Innovation theory each provide valuable insights into AI adoption; however, they only explain specific dimensions of the process when applied independently. No single perspective captures the interaction between contextual readiness, behavioral acceptance, strategic resources, organizational adaptation, innovation diffusion, and strategic decision-making. Therefore, integrating these complementary theories provides a more comprehensive framework for understanding AI adoption and its impact on SME performance.

3 Comparison with Existing Integrated Frameworks and Theoretical Advancement

Previous studies have integrated AI adoption theories by combining the Technology–Organization–Environment (TOE) framework with the Unified Theory of Acceptance and Use of Technology (UTAUT) (Awa et al., 2015, pp. 76–94), TOE with the Resource-Based View (RBV) (Nguyen et al., 2022), and RBV with Dynamic Capabilities (Estensoro et al., 2022, pp. 778–792). Although these studies have advanced the understanding of AI adoption, they remain limited because they integrate only a few theoretical perspectives, treat AI adoption as a static phenomenon, and are largely grounded in the institutional conditions of advanced economies. Consequently, they provide only a partial explanation of AI adoption in SMEs operating in developing countries.

To address these limitations, this study proposes a sequential, multilevel framework integrating the TOE framework, UTAUT, RBV, Dynamic Capabilities, and the Diffusion of Innovation (DOI) theory. Rather than simply combining existing theories, the proposed framework conceptualizes AI adoption as a continuous organizational process linking contextual readiness, behavioral acceptance, strategic resources, organizational adaptation, innovation diffusion, strategic decision-making, and organizational performance. This integrated perspective provides a stronger theoretical foundation for understanding AI adoption in SMEs, particularly in developing economies.

Table 1: Comparison between Previous Integrated Frameworks and the Proposed Framework

Previous Study	Integrated Framework(s)	Research Focus	Main Limitation
Awa et al. (2015)	TOE + TAM + TPB	E-commerce adoption by SMEs	Focuses primarily on technology adoption behaviour without addressing strategic decision-making or organizational adaptation.
Nguyen et al. (2022)	Extended TOE	Digital transformation and online retail	Explains organizational readiness but provides limited attention to behavioural acceptance and strategic capability development.

		utilization	
Estensoro et al. (2022)	RBV + Dynamic Capabilities	Industry 4.0 transition in SMEs	Emphasizes internal resources and organizational capabilities while overlooking environmental readiness and technology acceptance.
Previous AI Adoption Frameworks	Two or three complementary theories	AI adoption or digital transformation	Mostly developed for large firms or advanced economies and provide fragmented explanations of AI adoption.
Proposed Framework (This Study)	TOE + UTAUT + RBV + Dynamic Capabilities + DOI	AI adoption, strategic decision-making, and SME performance	—
Previous Study	Integrated Framework(s)	Research Focus	Main Limitation
Proposed Framework (This Study)	TOE + UTAUT + RBV + Dynamic Capabilities + DOI	AI adoption, strategic decision-making, and SME performance	Provides a sequential explanatory logic linking contextual readiness, behavioural acceptance, strategic resources, organizational adaptation, innovation diffusion, strategic decision quality, and organizational performance within one coherent conceptual framework.

Source: Developed by the author based on Awa et al. (2015), Nguyen et al. (2022), Estensoro et al. (2022), Tornatzky and Fleischer (1990), Venkatesh et al. (2003), Barney (1991), Teece (2007), Rogers (1983), and the reviewed literature.

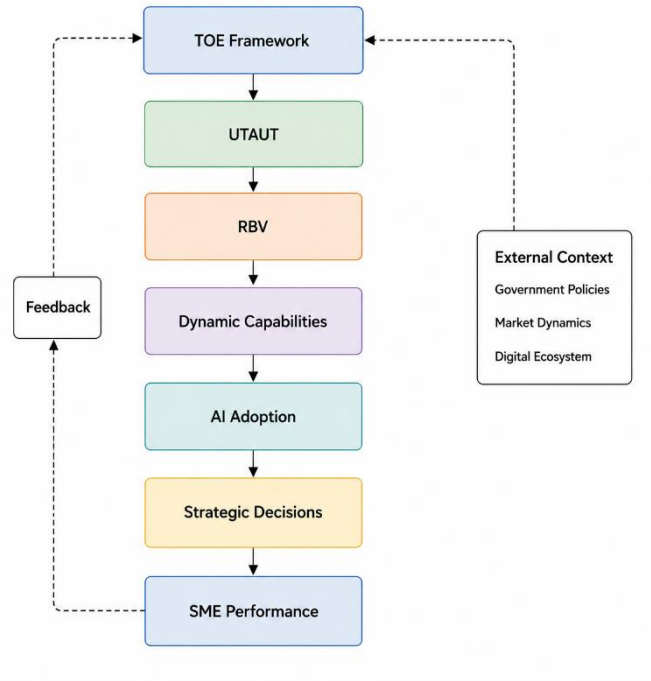
Unlike previous integrative studies, the proposed framework does more than increase the number of integrated theories. Rather, it establishes a sequential causal logic through which each theoretical perspective explains a specific stage in the adoption of artificial intelligence (AI). Accordingly, the framework provides a more coherent explanation of how small and medium-sized enterprises transition from environmental readiness to improved strategic decision-making and enhanced organizational performance. This sequential structure is the study's core theoretical contribution.

4 The Extended Integrated Conceptual Framework

4.1 An advanced integrative model that combines different theories

Unlike previous conceptual models, which were limited in their integration of theoretical perspectives, this study proposes a sequential, multilevel interpretive framework. Rather than being based on a mere mechanical aggregation of existing theories, this framework constitutes an integrated theoretical structure in which each theory explains a specific stage in the adoption of artificial intelligence. This sequential logic establishes clear theoretical interactions between contextual readiness, technology acceptance, strategic resource allocation, organizational adaptation, and the diffusion of innovation. Ultimately, it enhances strategic decision-making.

Figure 1: Theoretical Flowchart for Al Adoption and Performance



Source: Developed by the author based on Tornatzky and Fleischer (1990), Venkatesh et al. (2003), Barney (1991), Teece (2007), Rogers (1983), and the reviewed literature.

Figure 1 illustrates the integrated conceptual framework proposed in this study, which explains how artificial intelligence (AI) enhances strategic decision-making in small and medium-sized enterprises (SMEs). The framework conceptualizes the adoption of AI as a sequential organizational process driven by contextual readiness, technology acceptance, strategic

resources, organizational adaptation, and external conditions. The framework begins with the Technology–Organization–Environment (TOE) model and incorporates the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Resource-Based View (RBV). Dynamic Capabilities and the Diffusion of Innovation (DOI) theory explain organizational adaptation and the diffusion of AI, respectively. Together, these complementary perspectives improve strategic decision-making, strengthen organizational performance, and promote continuous learning via feedback mechanisms.

4.2 Theoretical mechanisms linking artificial intelligence to performance

AI enhances the quality of strategic decision-making through a set of integrated mechanisms. It begins by improving the quality of information available to decision-makers by processing big data with speed and exceptional accuracy. In parallel, predictive analytics and simulation models help reduce the uncertainty associated with strategic choices (Benbya et al., 2020).

At the operational level, automation and real-time analytics enable the organization to respond more quickly to market changes (Raisch & Krakowski, 2020).

Internally, intelligent algorithms improve the efficiency of allocating limited resources based on expected returns (Barney, 1991, pp. 99–120; Teece, 2007, pp. 1319–1350), whilst artificial intelligence systems enhance continuous organizational learning by analyzing past patterns and outcomes (Argote, 2013, pp. 31–56).

5 Leading international and Algerian experiences and comparative analysis

5.1 Singapore: ‘The Advanced Asian Model’

Singapore is a leading model of AI-driven digital transformation. The country has adopted a comprehensive national strategy to strengthen its economic competitiveness by investing in digital technologies and artificial intelligence (Infocomm Media Development Authority, 2024). Since 2017, the government has introduced targeted initiatives to support small and

medium-sized enterprises (SMEs), including the Productivity Solutions Grant (PSG) and the Chief Technology Officer as a Service (CTOaaS) platform. These initiatives provide financial assistance and technical consultancy to accelerate digital adoption (Infocomm Media Development Authority, 2024).

These initiatives have significantly improved the productivity and operational efficiency of AI adopters. However, AI adoption remains substantially lower among SMEs than among large enterprises, reflecting persistent challenges related to digital skill shortages, financial constraints, and the need for continued institutional support. Overall, Singapore's experience shows that successful AI adoption requires an integrated strategy combining government commitment, financial incentives, technical support, and human capital development (Infocomm Media Development Authority, 2024).

5.2 South Korea: ‘Smart Industrial Transformation’

South Korea has adopted a "Smart Transformation" strategy to strengthen the competitiveness of its manufacturing sector by promoting the widespread use of artificial intelligence and smart manufacturing technologies (Park, 2025). One key initiative is the "Win-Win Smart Factory" program, which provides SMEs with financial and technical assistance to improve quality, production efficiency, and process automation.

South Korea's experience shows that AI-driven smart manufacturing can greatly improve operational efficiency, product quality, and organizational productivity. It also underscores the importance of integrating advanced digital technologies with workforce development and organizational learning. However, financial constraints and a shortage of qualified digital talent remain significant barriers to the broader adoption of AI among SMEs.

5.3 Estonia: ‘A Model of Digital Governance’

Estonia is widely recognized as a global leader in digital governance. The country has implemented a comprehensive digital transformation strategy that has enabled nearly universal digital public services and

nationwide broadband connectivity (European Commission, 2024). This robust digital infrastructure fosters an environment conducive to innovation and AI adoption.

However, AI adoption among SMEs in Estonia remains below the European average, reflecting challenges related to digital maturity and the diffusion of advanced technologies. The Estonian experience shows that successful digital governance alone is not enough to speed up AI adoption. It must be accompanied by continuous support, targeted incentives, and capacity-building initiatives for SMEs (European Commission, 2024).

5.4 The Algerian experience: Algeria's Digital Strategy 2030

Given its traditional reliance on the oil and gas sectors, Algeria has sought in recent years to diversify its economic sources by investing heavily in the digital and knowledge economy as a strategic choice to achieve sustainable growth (High Commission for Digitalization, 2024, p. 8). In this context, the government has launched the 'Digital Algeria 2030' initiative, which is based on five complementary pillars:

A. Information and communications infrastructure: Developing and improving the quality of the telecommunications network, alongside establishing state-of-the-art data centers and strengthening national cloud computing services.

B. Human capital development and scientific research: Improving the digital skills of the workforce, expanding training programmes, and supporting scientific research in digital fields.

C. Digital governance: Digitizing government services and improving transparency and administrative efficiency to facilitate interaction between citizens and organizations with government bodies.

D. Digital economy: Supporting small and medium-sized enterprises in their digital transformation efforts, developing a national digital industry, and creating a legislative environment that attracts foreign investment in the digital sector.

E. Digital Society: Extending digital benefits to citizens, combating digital illiteracy, and encouraging active participation within the digital society.

Algeria's "Digital Algeria 2030" strategy aims to accelerate digital transformation by increasing artificial intelligence's contribution to economic growth, promoting digital entrepreneurship, and strengthening research and innovation capabilities. To support these goals, the government has introduced initiatives such as an AI investment fund, digital service platforms, financial incentives, and programs to bolster digital skills and assist SMEs (High Commission for Digitalization, 2024; Startup Researcher, 2025).

The implementation plan includes over 500 digital transformation projects, reflecting the government's dedication to developing a competitive digital economy. However, AI adoption is hindered by inadequate digital infrastructure, limited digital proficiency, financial constraints, fragmented institutional coordination, and reluctance to embrace organizational change (Akkarene & Bouda, 2025). These challenges underscore the necessity of an integrated policy approach that combines infrastructure development, investment in human capital, improved institutional coordination, and sustained support for SMEs.

5.5 Comparing the Algerian experience with international experiences

When comparing the Algerian experience with its international counterparts, a number of commonalities and fundamental differences emerge in the management of digital transformation and the adoption of artificial intelligence in small and medium-sized enterprises.

5.5.1 Points of similarity

All countries, whether developed or emerging, recognize the central role of artificial intelligence as a key driver of economic growth. There is a clear focus on supporting SMEs and a recognition of the vital need for robust digital infrastructure as the cornerstone of any effective strategy. There is also universal agreement that developing human capital and providing ongoing training programmes is a prerequisite for the success of digital transformation.

5.5.2 Key différences

In terms of funding, Singapore and South Korea rely on substantial and consistent government investment, whilst Algeria faces certain financial constraints despite recent initiatives such as the establishment of an $11 million investment fund. As for digital infrastructure, Singapore and Estonia succeeded in establishing strong foundations early on, whilst Algeria is still in the construction and development phase. Furthermore, Algeria suffers from a brain drain, whilst developed countries have more advanced digital labor markets.

5.5.3 Success factors

Experiences across all countries point to eight key factors that characterize successful programmes:

- A clear strategic vision and defined transformation goals.
- The presence of senior leadership that supports and guides change processes and allocates the necessary resources.
- Adopting a phased approach, starting with quick and effective projects.
- Focusing efforts on initiatives that deliver tangible added value.
- Sustained investment in human capital development.
- Ensuring data quality and accuracy as the foundation for artificial intelligence.
- Building effective partnerships with universities, companies and governments.
- Maintaining flexibility and continuous adaptation in plans and strategies based on feedback and results.

5.5.4 Application models by sector

- **Manufacturing sector:** Success centers on improving operational efficiency, enhancing quality, and adopting proactive maintenance, leveraging technologies such as the Internet of Things and data analytics, whilst facing challenges related to the integration of legacy systems, as seen in the Korean experience.
- **Retail and services sector:** Success is linked to understanding customers, personalizing service and increasing sales, with challenges related to data quality and the integration of service channels, as is the case in Singapore.

- **Government and public services sector:** Focuses on improving administrative efficiency and the quality of services provided to citizens through automation and advanced analytics, whilst facing challenges of bureaucracy and organizational resistance, as seen in Estonia and Algeria.

5.5.5 Stages of digital maturity and artificial intelligence

Digital transformation goes through several distinct stages:

- **Phase 1 "Basic digitization":** This involves converting paper-based processes to digital systems, establishing centralized databases, and using simple technical tools (3–6 months).
- **Phase 2 "Descriptive analytics":** This involves developing dashboards and performance indicators and using historical data to inform decision-making (6–12 months).
- **Phase 3 "Predictive Analytics":** involves the introduction of predictive models, the automation of certain processes, and the personalization of services (12–24 months).
- **Phase 4 "Prescriptive AI":** This is limited to the most mature organizations, where advanced analytics are used to support strategic decision-making and the creation of non-traditional business models (more than two years).

This comparison highlights the importance of the local context in designing digital transformation policies, emphasizing the need to combine strategic vision, resource support and human capital development to ensure long-term success in the implementation of artificial intelligence.

6 Challenges and Proposed Solutions

International experiences point to a range of technical, regulatory and human challenges facing organizations on their journey towards digital transformation and the adoption of AI, alongside practical solutions that have proven effective in mitigating these obstacles:

6.1 Technical challenges and solutions

- **Data quality and organization:** Organizations struggle with outdated, unstructured data or data containing errors. The solution lies in investing in data governance, establishing rigorous quality standards, and using

automated data cleansing tools to ensure data is fit for use in smart applications.

- **Integration with legacy systems:** Technical infrastructure is often ill-equipped to accommodate the transition; therefore, it is advisable to employ flexible cloud solutions and rely on application programming interfaces (APIs), whilst adopting a phased modernization strategy that enables a smooth transition without disrupting operations.
- **Cybersecurity and privacy:** Concerns regarding data breaches and protection are prominent; therefore, it is essential to implement strict security policies, ensure data encryption, and conduct regular security audits to guarantee compliance and trust in the digital system.

6.2 Organisational challenges and solutions

- **Limited financial resources:** This challenge can be mitigated by utilizing government support programmes, opting for cloud computing models that allow pay-as-you-go payment, and building strategic partnerships with technology providers to reduce initial costs.
- **Lack of skills and expertise:** This aspect requires investment in partnerships with universities to develop talent, organizing intensive training programmes within organizations, and engaging consultants to transfer knowledge to local teams.
- **Weak regulatory and legal framework:** Efforts are needed to update national legislation and develop a legal environment that supports innovation and keeps pace with the rapid pace of digital development.

6.3 Human challenges and solutions

- **Resistance to change and fear of job loss:** It is important to adopt change management methodologies such as the ADKAR model, as well as involving employees in the early stages of the transformation, ensuring clear communication and celebrating successes to foster acceptance of change.
- **Concerns about staff redundancies:** It is advisable to focus on reskilling staff and developing their skills to ensure a smooth transition of roles, whilst avoiding large-scale redundancies and creating new opportunities for growth and learning in the digital workplace.

This practical approach demonstrates that addressing challenges holistically, by combining technical solutions with human resource development and legal frameworks, is key to the successful implementation of digital transformation projects and the effective and sustainable adoption of artificial intelligence.

6.4 Theoretical and Practical Implications

This study contributes to scientific literature in several keyways.

First, the study presents an integrative conceptual framework that combines several key theories explaining the adoption of artificial intelligence within small and medium-sized enterprises, allowing for a more comprehensive explanation compared to relying on a single theoretical framework.

Second, the study helps bridge the gap between theoretical literature and practical applications by comparing leading international experiences and analyzing their applicability in developing environments.

Third, the study makes a specific contribution to the Arab and Algerian literature on the use of Al to support strategic decision-making within SMEs, an area that still suffers from a scarcity of applied and analytical studies.

Finally, the study provides a set of practical recommendations that can help decision-makers and managers of small and medium-sized enterprises adopt artificial intelligence in a gradual and sustainable manner.

7 Conclusion

This study shows that the successful adoption of AI in SMEs depends on effectively interacting technological readiness, organizational capabilities, institutional support, and dynamic adaptation. A comparative analysis of Singapore, South Korea, Estonia, and Algeria indicates that successful AI implementation requires a clear strategic vision, sustained government commitment, investment in digital infrastructure, and continuous development of human capital.

This study contributes to the literature by proposing a sequential, multilevel conceptual framework that integrates the technology–organization–environment (TOE) framework, the unified theory of

acceptance and use of technology (UTAUT), the resource-based view (RBV), dynamic capabilities, and the diffusion of innovation (DOI) theory. Unlike previous conceptual models, the proposed framework explains AI adoption as a continuous organizational process that links contextual readiness, behavioral acceptance, strategic resources, organizational adaptation, innovation diffusion, strategic decision-making, and organizational performance.

From a practical perspective, the findings emphasize the need to strengthen digital infrastructure, improve data governance, develop digital skills, reinforce public–private partnerships, and establish supportive regulatory frameworks to accelerate AI adoption in SMEs. Future research should empirically validate the proposed framework using quantitative and mixed-methods approaches across different sectors and developing-country contexts.

Bibliography List

Akkarene, R., & Bouda, N. (2025). Barriers to the integration of artificial intelligence in Algerian startups: A technology-organization-environment framework analysis. *Acta Universitatis Danubius. Œconomica*, *21*(5), 186–211.

Argote, L. (2013). Organization Learning: A Theoretical Framework. In L. Argote, *Organizational Learning* (pp. 31–56). Springer US. https://doi.org/10.1007/978-1-4614-5251-5_2

Asante, K., Novak, P., & Kwarteng, M. A. (2024). Environmental Sustainability Orientation, Dynamic Capability, Entrepreneurial Orientation, and Green Innovation in Small- and Medium-sized Enterprise. In T. J. Andersen (Ed.), *Sustainable and Resilient Global Practices: Advances in Responsiveness and Adaptation* (pp. 55–79). Emerald Publishing Limited. https://doi.org/10.1108/978-1-83797-611-920241004

Awa, H. O., Ojiabo, O. U., & Emecheta, B. C. (2015). Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. *Journal of Science &*

Technology Policy Management, *6*(1), 76–94. https://doi.org/10.1108/JSTPM-04-2014-0012

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Benbya, H., Davenport, T. H., & Pachidi, S. (2020). Artificial Intelligence in Organizations: Current State and Future Opportunities. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3741983

Chen, Y. (2025). Digital Platform Capability, Value Co-Creation, and SME Digital Transformation Performance: A Moderated Mediation Model. *Journal of Innovation and Development*, *10*(1), 33–42. https://doi.org/10.54097/rryvnp18

Estensoro, M., Larrea, M., Müller, J. M., & Sisti, E. (2022). A resource-based view on SMEs regarding the transition to more sophisticated stages of industry 4.0. *European Management Journal*, *40*(5), 778–792. https://doi.org/10.1016/j.emj.2021.10.001

European Commission. (2024). *Estonia 2024 digital decade country report.* European Commission. https://digital-strategy.ec.europa.eu/en/factpages/estonia-2024-digital-decade-country-report

Feng, K., & Haridas, D. (2025). A unified model integrating UTAUT-Behavioural intension and Object-Oriented approaches for sustainable adoption of Cloud-Based collaborative platforms in higher education. *Scientific Reports*, *15*(1), 24767. https://doi.org/10.1038/s41598-025-08446-9

High Commission for Digitalization. (2024). *National strategy for digital transformation in Algeria For a digital Algeria 2030* (p. 22). High Commission for Digitalization (HCN). https://www.hcn.dz/SNTN-En.pdf

Infocomm Media Development Authority, (IMDA). (2024). *Singapore digital economy report 2024* (p. 22). Infocomm Media Development Authority (IMDA). https://www.imda.gov.sg/-

/media/imda/files/infocomm-media-landscape/research-and-statistics/sgde-report/singapore-digital-economy-report-2024.pdf

Mladenova, I., Vladimirov, Z., & Harizanova, O. (2025). Digital transformation, organisational capabilities, and SME performance—Size matters. *Eastern Journal of European Studies, 16*(1), 216–238. https://doi.org/10.47743/ejes-2025-0110

Nguyen, T. H., Le, X. C., & Vu, T. H. L. (2022). An Extended Technology-Organization-Environment (TOE) Framework for Online Retailing Utilization in Digital Transformation: Empirical Evidence from Vietnam. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(4), 200. https://doi.org/10.3390/joitmc8040200

Organisation for Economic Co-operation and Development, (OECD). (2025). *Beyond Automation, a German textile SME's hybrid approach to smart manufacturing*. Organisation for Economic Co-operation and Development (OECD). https://www.oecd.org/en/publications/digital-for-smes-case-studies_d65e57f4-en/beyond-automation-a-german-textile-sme-s-hybrid-approach-to-smart-manufacturing_f09f712c-en.html

Park, D. (2025, October 20). Korea's AI Transformation Reaches Factory Floors: SMEs Demand Funding and Talent Support. *KoreaTechDesk*. https://koreatechdesk.com/korea-ai-transformation-smes-demand-funding-talent-support

Raisch, S., & Krakowski, S. (2020). Artificial Intelligence and Management: The Automation-Augmentation Paradox. *Academy of Management Review*, 2018.0072. https://doi.org/10.5465/2018.0072

Rogers, E. M. (1983). *Diffusion of innovations* (3. ed). Free Press [u.a.].

Startup Researcher. (2025). *Algeria launches $11M fund to boost AI and robotics* (Startup Researcher). https://www.startupresearcher.com/news/algeria-launches-11-million-ai-investment-fundalgeria-launches-11-million-ai-investment-fund

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic*

Management Journal, *28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Tornatzky, L. G., & Fleischer, M. (1990). *The processes of technological innovation*. Lexington Books.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward A Unified View. *MIS Quarterly*, *27*(3), 425–478. https://doi.org/10.2307/30036540

XpertSoft Editorial Team. (2025). *AI Adoption in European SMEs: What Changed from 2024 to 2025?* (Xpertsoft). https://xpertsoft.com/ai-adoption-in-european-smes-what-changed-from-2024-to-2025/

Zhou, S. S., Zhou, A. J., Feng, J., & Jiang, S. (2019). Dynamic capabilities and organizational performance: The mediating role of innovation. *Journal of Management & Organization*, *25*(5), 731–747. https://doi.org/10.1017/jmo.2017.20