

Digital Transformation and Startups in Algeria: An Analytical Study

Received: 07/04/2026

Accepted: 26/06/2026

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Abstract

The present paper aims to examine the intersection of digital transformation and startup ecosystem development in Algeria, analyzing the structural, institutional, and socio-economic factors that shape entrepreneurial dynamics in a resource-dependent economy transitioning toward knowledge-based growth. Drawing on the National Systems of Innovation (NSI) framework and Digital Ecosystem Theory, this study assesses Algeria's policy frameworks, funding mechanisms, human capital development, and market conditions.

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The analysis reveals a paradoxical landscape: significant government commitment to digitalization juxtaposed with structural rigidities, regulatory fragmentation, and limited venture capital availability. The paper argues that while Algeria possesses foundational elements for startup growth, including a young educated demographic and increasing internet penetration, sustainable digital transformation requires institutional reforms, enhanced private sector engagement, and international partnership strategies.

Algerian policymakers should streamline institutional governance, deepen regulatory reforms, diversify financing mechanisms, modernize education systems, and strengthen international integration to foster a more dynamic startup ecosystem.

Keywords :

digital transformation, startups, entrepreneurship, Algeria, innovation ecosystem, North Africa, resource curse, economic diversification

Jel Classification Codes : O33, O38, L26, L86, O55, Q33

الملخص

يهدف هذا البحث إلى دراسة التقاطع بين التحول الرقمي وتطور منظومة المؤسسات الناشئة في الجزائر، من خلال تحليل العوامل الهيكلية والمؤسسية والاجتماعية-الاقتصادية التي تشكل ديناميكيات ريادة الأعمال في اقتصاد يعتمد على الموارد ويتجه نحو نمو قائم على المعرفة. وبالاعتماد على إطار الأنظمة الوطنية للابتكار (NSI) ونظرية النظم البيئية الرقمية، تقوم الدراسة بتقييم الأطر السياسية في الجزائر، وآليات التمويل، وتنمية رأس المال البشري وظروف السوق.

يكشف التحليل عن واقع متناقض يتمثل في التزام حكومي كبير بالرقمنة يقابله جمود هيكلي وتشتت تنظيمي ومحدودية في رأس المال الاستثماري. تبين النتائج بأنه رغم امتلاك الجزائر لمقومات أساسية لنمو المؤسسات الناشئة، مثل فئة سكانية شابة ومتعلمة وانتشار الإنترنت، فإن تحقيق تحول رقمي مستدام يتطلب إصلاحات مؤسسية، وتعزيز دور القطاع الخاص، وتطوير شراكات دولية. كما ينبغي على صانعي السياسات في الجزائر تبسيط الحوكمة المؤسسية، وتعميق الإصلاحات التنظيمية، وتنويع آليات التمويل، وتحديث أنظمة التعليم، وتعزيز الاندماج الدولي من أجل بناء منظومة أكثر ديناميكية للشركات الناشئة.

الكلمات المفتاحية:

التحول الرقمي، المؤسسات الناشئة، ريادة الأعمال، الجزائر، النظام البيئي للابتكار، شمال إفريقيا، مفارقة الموارد الطبيعية، التنويع الاقتصادي

1. Introduction

1.1 Background and Context

The global digital economy has fundamentally restructured competitive advantages, creating new pathways for economic development that transcend traditional industrialization sequences (Brynjolfsson & McAfee, 2014). For developing economies, digital transformation represents both an opportunity for leapfrogging development stages and a challenge requiring substantial institutional adaptation (Nambisan et al., 2017). Algeria, Africa's largest country by territory and a significant hydrocarbon producer, presents a compelling case study of digital transformation efforts within a resource-dependent economic structure.

Algeria's economy has historically been characterized by state dominance, hydrocarbon dependency (accounting for approximately 90% of export revenues and 60% of budget revenues), and limited private sector dynamism (International Monetary Fund, 2022). However, declining oil prices, youth unemployment pressures (exceeding 25%), and the imperative of economic diversification have catalyzed policy attention toward digital economy development (World Bank, 2021). The Algerian government's "Digital Algeria 2020" strategy and subsequent initiatives signal recognition that sustainable growth requires cultivating knowledge-intensive sectors and entrepreneurial ecosystems.

1.2 Research Problem and Questions

Despite policy pronouncements, Algeria's startup ecosystem remains underdeveloped compared to regional peers such as Morocco, Tunisia, and Egypt (Startup Genome, 2023). This paper addresses the central research question: What are the structural

determinants of digital transformation and startup ecosystem development in Algeria, and how do institutional configurations enable or constrain entrepreneurial dynamics?

Sub-questions include:

- How has Algeria's policy framework evolved to support digital entrepreneurship?
- What funding mechanisms and resource availability characterize the startup ecosystem?
- How do human capital, infrastructure, and market conditions influence startup viability?
- What role does the hydrocarbon-dependent economic structure play in shaping digital transformation trajectories?

1.3 Significance and Contribution

This study contributes to several literatures. First, it extends the National Systems of Innovation (NSI) framework to a hydrocarbon-dependent emerging economy context, addressing calls for more nuanced analysis of innovation systems in resource-rich developing countries (Intarakumnerd & Virasa, 2018). Second, it contributes to digital entrepreneurship literature by examining ecosystem development in a context characterized by state-led economic structures and institutional voids (Khanna & Palepu, 1997). Third, the paper offers practical insights for policymakers navigating the complexities of digital economy development in similar contexts.

2. Theoretical Framework and Literature Review

2.1 National Systems of Innovation and Digital Transformation

The National Systems of Innovation (NSI) framework, developed by Freeman (1987) and Lundvall (1992), provides a foundational lens for analyzing how countries generate, diffuse, and utilize knowledge for economic development. NSI emphasizes the interdependence among institutions, organizations, and policies in shaping innovation outcomes. In the digital era, this framework has been extended to encompass digital innovation systems, highlighting the role of digital infrastructure, platforms, and data ecosystems (Edquist & Zabala-Iturriagoitia, 2020).

For resource-dependent economies, the NSI framework must accommodate the "resource curse" thesis, which posits that abundant natural resources can distort economic structures, weaken institutions, and inhibit innovation-intensive development (Sachs & Warner, 2001). However, recent scholarship suggests that institutional quality and strategic policy interventions can mitigate resource curse effects, creating "resource blessings" through sovereign wealth funds, diversification investments, and knowledge economy initiatives (Wenar, 2016).

2.2 Digital Ecosystem Theory and Entrepreneurship

Digital ecosystem theory conceptualizes entrepreneurship as embedded within interconnected networks of actors, resources, and digital infrastructures (Autio, 2022). Unlike traditional industrial clusters, digital ecosystems are characterized by platform-based coordination, data-driven value creation, and rapid scalability (Jacobides et al., 2018). For emerging economies, digital ecosystems offer potential for "innovation without R&D" through technology adoption, adaptation, and frugal innovation (Zeschky et al., 2014).

The startup ecosystem literature identifies critical success factors including: (1) accessible financing (venture capital, angel investment, public funding); (2) skilled human capital; (3) supportive regulatory environments; (4) market access and demand; and (5) cultural tolerance for risk and failure (Stam & Spigel, 2018). In emerging markets, these factors are often underdeveloped, requiring ecosystem orchestration by government, universities, and corporate actors (Auto et al., 2018).

2.3 Conceptual Framework

This study integrates NSI and digital ecosystem perspectives to analyze Algeria's digital transformation and startup development. The framework posits that ecosystem outcomes emerge from the interaction of:

- Institutional Architecture: Policy frameworks, regulatory quality, and governance structures
- Resource Mobilization: Public investment, private capital, and international flows
- Human Capital Formation: Education systems, skills development, and diaspora engagement
- Market Dynamics: Domestic demand, international market access, and competitive conditions
- Structural Context: Hydrocarbon dependency, economic diversification pressures, and demographic trends

3. Methodology

This study employs a qualitative analytical approach combining document analysis, secondary data synthesis, and comparative case analysis. Given the exploratory nature of the research and limited availability of comprehensive primary data on Algeria's startup ecosystem, this methodology is appropriate for generating theoretically grounded insights (Yin, 2018).

3.1 Data Sources

Data sources include:

- Policy Documents: Algerian government strategies, ministerial reports, and regulatory texts (2015-2024)
- International Reports: World Bank, IMF, OECD, and UNCTAD assessments of Algeria's digital economy
- Ecosystem Data: Startup Genome Global Startup Ecosystem Reports, MAGNiTT venture investment data, and regional entrepreneurship monitors
- Academic Literature: reviewed studies on Algerian economic development, and resource-dependent innovation systems.

3.2 Analytical Approach

The analysis proceeds through structured thematic coding aligned with the conceptual framework dimensions. Comparative reference is made to regional peers (Morocco, Tunisia, Egypt) to contextualize Algeria's performance. Limitations include data availability constraints, rapidly evolving ecosystem conditions, and the challenge of assessing informal sector digital activities.

4. Digital Transformation Policy Landscape in Algeria

4.1 Evolution of Digital Strategy

Algeria's digital transformation agenda has evolved through distinct phases. The "Digital Algeria 2020" strategy, launched in 2013, represented the first comprehensive attempt to digitize public services, develop digital infrastructure, and promote the information technology sector (Republic of Algeria, 2013). While implementation was uneven, the strategy established foundational infrastructure including fiber optic expansion and data center development.

The subsequent "Digital Algeria 2025" strategy reflects lessons learned and heightened urgency following the 2014-2016 oil price collapse. This updated framework emphasizes startup ecosystem development, digital skills training, and public-private partnerships (Ministry of Post and Telecommunications, 2020). Notably, the strategy acknowledges the need for regulatory reform to enable entrepreneurship, including simplified business registration and foreign investment procedures.

4.2 Institutional Architecture

Digital governance in Algeria involves multiple institutional actors:

- Ministry of Post and Telecommunications: Primary policy coordination
- National Agency for Digital Development (AND): Implementation and ecosystem support
- Algerian Startup Fund (ASF): Public venture financing (established 2022)
- National Agency for Investment Development (ANDI): Foreign investment and business climate

- Ministry of Knowledge Economy and Startups: Created in 2022, signaling elevated political priority

This institutional multiplicity presents coordination challenges. Overlapping mandates, bureaucratic fragmentation, and inter-ministerial competition have historically impeded policy coherence (OECD, 2022). The 2022 creation of a dedicated Ministry for Knowledge Economy and Startups represents an attempt to streamline ecosystem governance, though effectiveness remains to be evaluated.

4.3 Regulatory Environment

Regulatory reforms have targeted longstanding barriers to entrepreneurship. The 2022 Startup Act (Loi relative aux startups) establishes a formal definition of startups, creates a certification process (label "Startup"), and offers associated benefits including tax incentives, simplified accounting, and facilitated foreign exchange access (Journal Officiel de la Republique Algerienne, 2022).

However, regulatory implementation faces persistent challenges. Bureaucratic procedures remain cumbersome, with Algeria ranking 157th globally in the World Bank's Ease of Doing Business indicators (prior to the report's discontinuation in 2020). Foreign exchange controls, while partially liberalized for startups, continue to constrain international transactions and repatriation of investment proceeds. Intellectual property protection mechanisms exist but suffer from enforcement gaps.

4.4 Infrastructure Development

Algeria has achieved substantial digital infrastructure deployment. Internet penetration exceeds 60%, with 4G coverage expanding nationally and 5G pilot programs initiated (ARPT, 2023). The country's fiber optic backbone exceeds 50,000 km, providing connectivity to major urban centers.

However, infrastructure utilization and quality present concerns. Average internet speeds remain below regional benchmarks, and rural connectivity lags urban areas significantly. Data center capacity, while expanding, is insufficient for large-scale cloud computing demands. These infrastructure limitations constrain startup scalability and cloud-native business model viability.

5. Startup Ecosystem Structure and Dynamics

5.1 Ecosystem Maturity and Composition

Algeria's startup ecosystem is nascent compared to regional leaders. According to Startup Genome (2023), Algiers ranks as an "Activation" phase ecosystem, characterized by early-stage startup activity but limited scaling success. Ecosystem value and startup density metrics trail Tunis, Casablanca, and Cairo by significant margins.

Sectoral composition reflects both opportunity structures and constraint adaptations:

- **E-commerce and Delivery:** Responding to underdeveloped retail infrastructure and growing urban consumer demand
- **Fintech:** Addressing financial inclusion gaps and limited traditional banking penetration
- **EdTech:** Leveraging youth demographics and education system pressures
- **Enterprise Software:** Serving public sector and SOE digitalization needs

Notably absent are deep-tech sectors (AI, biotech, clean tech) requiring substantial R&D investment and specialized talent pools, reflecting ecosystem immaturity and research commercialization gaps.

5.2 Financing Landscape

Access to capital represents a critical ecosystem constraint. Algeria's venture capital market is underdeveloped, with limited domestic VC funds and restricted international investor participation due to currency controls and investment climate concerns.

The Algerian Startup Fund (ASF), launched with 10 billion DZD (approximately \$70 million USD) in public capital, represents a significant policy intervention. The fund provides seed and early-stage financing, with mechanisms for co-investment with private partners. However, implementation challenges include:

- Slow deployment rates due to bureaucratic decision processes
- Limited private co-investment mobilization
- Concentration in Algiers and major cities
- Potential crowding-out of private capital formation

Alternative financing mechanisms remain limited. Angel investing is informal and underdeveloped. Crowdfunding faces regulatory ambiguity. Bank lending to startups is constrained by collateral requirements and risk aversion. International funding (accelerators, development finance) provides important but insufficient capital injection.

5.3 Human Capital and Talent

Algeria possesses significant human capital potential. The higher education system produces approximately 100,000 graduates annually, with increasing numbers in STEM fields

(Ministry of Higher Education, 2022). Coding bootcamps and digital skills programs have proliferated, supported by public and international initiatives.

However, talent constraints persist:

- **Skills Mismatch:** University curricula often lag industry requirements, particularly in agile development, data science, and digital marketing
- **Brain Drain:** Significant emigration of skilled tech workers to Europe, Canada, and Gulf states, attracted by higher wages and better opportunities
- **Language Barriers:** Limited English proficiency constrains international market access and global partnership formation
- **Gender Gap:** Female participation in tech entrepreneurship remains low, reflecting broader societal patterns

Diaspora engagement represents an underutilized resource. The significant Algerian tech diaspora in France, Canada, and elsewhere could potentially contribute capital, mentorship, and market access, but systematic engagement mechanisms are lacking.

5.4 Market Conditions and Demand

Domestic market characteristics shape startup opportunities and constraints. Algeria's population of 45 million, concentrated in urban coastal areas, provides a sizable consumer base. However, purchasing power constraints, informal economy prevalence, and payment infrastructure limitations affect monetization potential.

Public sector and state-owned enterprise (SOE) digitalization represents a significant demand source. Government contracts for digital services, e-government solutions, and enterprise software provide revenue opportunities for startups. However, procurement processes often favor established firms and SOE-affiliated entities, creating barriers for new entrants.

International market expansion remains challenging. Currency controls complicate foreign revenue repatriation. Limited international investment and partnership networks constrain global scaling. Regional market integration within the Arab Maghreb Union remains underdeveloped, limiting natural geographic expansion pathways.

5.5 Case Illustrations

Case 1: Temtem (Mobility Platform)

Temtem, an on-demand transportation platform founded in 2017, represents a rare Algerian startup scaling success. The platform adapted ride-hailing models to local regulatory and payment constraints, integrating cash payments and navigating transport sector regulations. Acquisition by a regional mobility conglomerate in 2022 demonstrated exit pathway viability, though such successes remain exceptional.

Case 2: Djezzy Digital (Telecom Innovation)

Djezzy, a major mobile operator, has developed internal innovation programs and startup partnerships. This corporate-startup collaboration model leverages established infrastructure and customer bases while accessing entrepreneurial agility. However, such programs remain limited in scale and scope compared to regional corporate innovation leaders.

Case 3: Fintech Emerging Players

Several fintech startups have emerged to address financial inclusion, including mobile payment solutions and SME lending platforms. Regulatory sandbox approaches by the Bank of Algeria have enabled limited experimentation, though full regulatory authorization remains pending for most models.

6. Discussion: Structural Constraints and Transformation Potential

6.1 The Hydrocarbon Economy Paradox

Algeria's digital transformation efforts occur within a structural context shaped by hydrocarbon dependency. The "resource curse" dynamics identified in innovation systems literature are evident: state revenue dependence on oil and gas reduces fiscal pressure for taxation and accountability, while public sector dominance crowds out private initiative (Sachs & Warner, 2001).

However, the resource base also provides potential transformation resources. Sovereign wealth mechanisms could theoretically fund digital infrastructure and startup capital. The imperative of diversification creates political space for reform. The key question is whether digital economy development represents genuine structural transformation or merely rhetorical adjustment maintaining existing power and economic structures.

6.2 Institutional Quality and Implementation Gaps

The gap between policy pronouncement and implementation represents a central ecosystem challenge. Algeria's digital strategies are ambitious in scope, but execution suffers from:

- Bureaucratic inertia and risk aversion

- Corruption and rent-seeking in procurement and licensing
- Limited horizontal coordination across ministries and agencies
- Insufficient private sector and civil society consultation in policy design

These implementation gaps reflect broader governance challenges that digital transformation alone cannot resolve. Effective ecosystem development requires parallel institutional reforms enhancing transparency, accountability, and regulatory quality.

6.3 Regional Comparative Positioning

Comparative analysis with regional peers illuminates Algeria's relative positioning:

Tunisia benefits from Startup Act legislation (2018), more developed VC ecosystem, stronger diaspora linkages (particularly with France), and smaller but more agile government structure. However, Tunisia faces macroeconomic instability and political transition challenges.

Morocco leverages strategic geographic positioning, stronger tourism and manufacturing bases for digital application, and more developed international investment linkages. Royal leadership provides sustained policy attention to digital economy development.

Egypt offers massive domestic market scale, significant international investor interest, and vibrant (if competitive) startup ecosystem. However, Egypt faces currency volatility and regulatory complexity.

Algeria's relative advantages include larger hydrocarbon resources for potential investment, significant domestic market, and strong educational foundations. Disadvantages include more restrictive business climate, weaker international integration, and institutional fragmentation.

6.4 The Role of International Factors

International dynamics significantly shape Algeria's digital transformation trajectory. Geopolitical positioning between European, Chinese, and Gulf interests influences technology partnership opportunities. EU partnership programs (including Digital for Development initiatives) provide technical assistance and market access pathways. Chinese technology investment offers infrastructure financing but raises data governance and dependency concerns.

Diaspora relations, particularly with the large Algerian communities in France and Canada, represent underexploited assets. Systematic diaspora engagement policies could enhance capital flows, knowledge transfer, and market access.

7. Conclusions and Recommendations

7.1 Summary of Findings

This analysis reveals a complex landscape for digital transformation and startup development in Algeria. Significant policy attention and public investment have created foundational infrastructure and institutional frameworks. However, structural constraints—including hydrocarbon dependency, bureaucratic inefficiency, limited private capital formation, and skills mismatches—impede ecosystem maturation.

The central finding is that Algeria's digital transformation faces an "implementation paradox": adequate strategy and resources exist at the macro level, but micro-level execution fails due to institutional fragmentation, regulatory complexity, and risk-averse administrative cultures. Startup ecosystem development requires not just digital infrastructure and funding programs, but fundamental reforms in business climate governance, education system adaptation, and international economic integration.

7.2 Theoretical Implications

The study contributes to NSI and digital ecosystem literatures by demonstrating how resource-dependent economies face distinctive innovation system challenges. The Algerian case suggests that digital transformation in such contexts requires "institutional layering"—building new ecosystem institutions while reforming existing structures—rather than expecting digital development to automatically catalyze broader institutional change.

7.3 Policy Recommendations

For Algerian Policymakers:

- **Streamline Institutional Architecture:** Consolidate startup ecosystem governance under a single agency with clear mandate and accountability, reducing inter-ministerial fragmentation.
- **Deepen Regulatory Reform:** Extend Startup Act implementation to address remaining bureaucratic barriers, particularly foreign exchange regulations, business registration, and public procurement access.
- **Diversify Financing Mechanisms:** Develop tax incentives for private angel investment, establish public-private co-investment funds with professional management, and create diaspora investment vehicles.
- **Reform Education Systems:** Align university curricula with digital economy skills requirements, expand work-integrated learning programs, and develop English language proficiency initiatives.
- **Enhance International Integration:** Pursue targeted diaspora engagement programs, negotiate digital trade provisions in bilateral agreements, and participate actively in regional economic integration initiatives.

For International Partners:

- **Technical Assistance:** Support institutional capacity building in ecosystem governance, regulatory design, and entrepreneurial finance.
- **Market Access:** Provide preferential market access for Algerian digital services, recognizing development potential and geopolitical significance.
- **Investment Facilitation:** Develop risk mitigation instruments encouraging private investment in Algerian startups.

7.4 Future Research Directions

This study opens several research avenues. Future work should examine:

- Longitudinal tracking of Startup Act implementation and ecosystem evolution
- Comparative analysis of resource-dependent economy digital transformation strategies
- Gender dynamics in Algerian tech entrepreneurship
- Impact assessment of specific policy interventions (ASF, regulatory sandboxes)
- Diaspora engagement models and their ecosystem contributions

7.5 Concluding Remarks

Algeria stands at a critical juncture in its economic development trajectory. The imperatives of hydrocarbon transition, youth employment, and global digital integration create both urgency and opportunity for startup ecosystem development. Success requires moving beyond strategy documents to sustained implementation, beyond public investment to private sector activation, and beyond domestic focus to international integration. The analytical framework developed in this study provides a foundation for ongoing assessment of this important but under-researched case in digital economy development.

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