

The Impact of (Ai) Artificial Intelligence Entrepreneurship on Economic Growth: An ARDL Approach from- 2000 to 2022-

أثر الذكاء الاصطناعي وريادة الأعمال على النمو الاقتصادي:
دراسة بنموذج ARDL خلال الفترة - 2000 إلى عام 2022 -
Sissani Midoun ^{1,*}, Nardjes Frioua ²,
¹, University of Tiaret, Algeria.
², Blida 2 University, Algeria.

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Abstract: This Article examines the dynamic effects of artificial intelligence (AI) and entrepreneurship on economic growth from 2000 to 2022, in a few Arab nations: Saudi Arabia, Egypt, Jordan, the United Arab Emirates, and Algeria. We examine the short- and long-term correlations between GDP growth, entrepreneurship metrics, and AI-related factors using an Autoregressive Distributed Lag (ARDL) model. The findings show a strong positive correlation over the long term between economic growth, AI use, and entrepreneurial activity, particularly in the United Arab Emirates and Saudi Arabia. Jordan exhibits a moderately beneficial influence, whereas Egypt and Algeria show mixed results. These results point to the significance of supporting entrepreneurial ecosystems and AI innovation in order to promote sustainable growth in the area.

Keywords: Entrepreneurship, Artificial Intelligence, Economic Growth .

JEL Codes: O33, L26, C32, O57

المخلص : هذه المقالة تدرس الآثار الديناميكية للذكاء الاصطناعي وريادة الأعمال على النمو الاقتصادي من عام 2000 إلى عام 2022، في عدد من الدول العربية: المملكة العربية السعودية، ومصر، والأردن، والإمارات العربية المتحدة، والجزائر. وندرس الارتباطات قصيرة وطويلة الأجل بين نمو الناتج المحلي الإجمالي، ومقاييس ريادة الأعمال، والعوامل المتعلقة بالذكاء الاصطناعي، باستخدام نموذج الانحدار الذاتي ذي الفارق الزمني للوزن (ARDL). وتُظهر النتائج وجود ارتباط إيجابي قوي على المدى الطويل بين النمو الاقتصادي، واستخدام الذكاء الاصطناعي، والنشاط الريادي، لا سيما في الإمارات العربية المتحدة والمملكة العربية السعودية. ويُظهر الأردن تأثيرًا إيجابيًا معتدلًا، بينما تُظهر مصر والجزائر نتائج متباينة. وتشير هذه النتائج إلى أهمية دعم منظومات ريادة الأعمال والابتكار في مجال الذكاء الاصطناعي لتعزيز النمو المستدام في المنطقة.

الكلمات المفتاح : ريادة الأعمال، الذكاء الاصطناعي، النمو الاقتصادي.

I- Introduction :

No doubt that Algeria's dependence on hydrocarbons , which account for 30% of its GDP and 93% of its exports, raises major economic issues (World Bank, 2022). Policymakers are looking into

* sissani . midoun sissani.midoun@univ-tiaret.dz.

alternate development paths, such entrepreneurship and AI-driven enterprises, in light of the need for economic diversification. Moving away from hydrocarbons and toward a knowledge-based economy is the aim of the revolutionary shift taking place in Arab countries. The two main forces behind this change are entrepreneurship and artificial intelligence (AI), with entrepreneurship encouraging innovation and job creation while AI boosts productivity and efficiency across a range of industries. Because of this diversification need, officials are already exploring alternatives. This study looks at how these two elements might affect economic growth, particularly in Arabic countries. Both artificial intelligence (AI) and entrepreneurship have become transformative forces of economic growth in the modern global economy. It has long been known that entrepreneurship may spur innovation, the creation of jobs, and structural change, especially in developing nations looking to branch out from more established sectors. Meanwhile, productivity, decision-making, and the nature of employment have all undergone significant changes due to the quick development and incorporation of AI technology into economic systems (Brynjolfsson & McAfee, 2017).

According to the World Bank (2023), global GDP growth in 2022 was about 3.1%, with significant regional variances. Advanced economies grew at an average rate of 2.5 percent, while low-income countries grew at a rate of 4.3%, mostly as a result of entrepreneurship and digital transformation initiatives. With over 300 million participants across 49 economies, early-stage entrepreneurship is becoming increasingly crucial for economic resilience, according to the Global Entrepreneurship Monitor (GEM, 2022).

Nonetheless, it is anticipated that AI will increase global GDP by up to \$15.7 trillion by 2030, of which \$6.6 trillion would come from increased productivity and \$9.1 trillion from gains to consumption (PwC, 2019). Countries that strategically engage in AI research, education, and infrastructure are expected to see substantial economic returns.

AI and entrepreneurship are viable paths to sustainable development in the Arab world, as many countries transition away from dependency on oil. Countries such as Saudi Arabia and the United Arab Emirates are at the forefront of AI adoption, while Algeria and Egypt are aggressively transforming their corporate settings to foster entrepreneurial ecosystems.

The purpose of this study is to experimentally evaluate how AI and entrepreneurship affect economic growth in Arab nations, with an emphasis on Algeria. The study examines both short-term and long-term correlations between these factors using panel data from 2000 to 2022 using the Autoregressive Distributed Lag (ARDL) methodology.

2. Definitions and Conceptual of (AI) Artificial intelligence and Entrepreneurship

2.1. Definition of (AI) Artificial intelligence :

- ✓ **Artificial intelligence** :(AI) is defined as an artificial intelligence (AI) simulates human cognitive functions such as learning, thinking, and problem-solving. (Russell & Norvig, 2021).

- ✓ **AI** is a computer science field that aims to develop systems capable of human-like intelligence, such as perception, decision-making, and language comprehension. (Bishop, 2006).
- ✓ **Artificial Intelligence:** According to (Bishop, 2006) the purpose of artificial intelligence (AI), as an area of computer science, is to develop machines that can sense, make decisions, and interpret language—tasks that typically require human intelligence.
- ✓ **Artificial intelligence (AI) :Automation,** which encompasses technology designed to mimic human cognitive abilities, enables data analysis and autonomous decision-making in a wide range of applications. (Tegmark, 2017).
- ✓ **Artificial Intelligence (AI):** Refers to semi-autonomous or autonomous systems that operate intelligently by assessing their surroundings and acting to achieve specified objectives (Poole et al., 1998).

In the twenty-first century, entrepreneurship and artificial intelligence (AI) have a substantial impact on innovation, competitiveness, and economic growth. These dynamics have the ability to transform established industries, increase productivity, and create new opportunities in the rapidly changing global economy of Arab nations, including Algeria. Entrepreneurship and artificial intelligence (AI) can significantly contribute to Algeria's economic diversification and long-term development by fostering a creative culture, enhancing productivity, and addressing social challenges.

2.2. Definitions of Entrepreneurship

- ✓ **Entrepreneurship:** It involves the discovery, creation, and pursuit of chances to launch new goods, services, or enterprises, frequently requiring innovation and the willingness to take risks. (Hisrich, Peters, & Shepherd, 2017).
- ✓ **Entrepreneurship** refers to the ability and willingness to organize, manage, and assume the risks of a business venture in pursuit of profit and growth (Drucker, 1985).
- ✓ **Entrepreneurship:** It is defined as the capability and readiness to coordinate, oversee, and accept the uncertainties associated with a business initiative aimed at achieving profit and expansion. (Shane & Venkataraman, 2000).
- ✓ **Entrepreneurship :** It is defined as an active journey of imagination, transformation, and innovation that demands a commitment of effort towards bringing fresh concepts and answers to fruition. (Kuratko, 2017).
- ✓ **Entrepreneurship :** Can be defined as the processes involved in starting and managing a company, such as creating new ideas, gathering resources, and making strategic choices. (Barringer & Ireland, 2019).

Entrepreneurship serves as a catalyst for economic advancement by generating job opportunities, fostering competition, and presenting innovative answers to market demands. In Algeria, a nation historically reliant on hydrocarbon exports, entrepreneurship paves the way for economic diversification. Startups along with small and medium-sized enterprises (SMEs) have the potential to enhance job creation, particularly for the youth demographic, which grapples with elevated unemployment levels. Initiatives launched by the government, such as the National Agency for the Development of Startups (ANDI), are designed to aid emerging businesses through financial support, educational resources, and reforming regulations. Nevertheless, obstacles including bureaucratic red tape, insufficient access to capital, and a not-yet-fully-developed entrepreneurial environment need to be tackled in order to unleash this potential comprehensively.

3. Literature Review

According to research, entrepreneurship is important for fostering innovation and employment creation, which enhances economic development (Acs et al., 2012). In a similar line, incorporating artificial intelligence has proven to increase productivity and pave the way for creative business frameworks (Brynjolfsson & McAfee, 2017). Recent initiatives and overarching strategies in the Arab world (such as Saudi Arabia's Vision 2030) are aimed at accelerating digital changes and cultivating innovation ecosystems. Nonetheless, there is a scarcity of empirical research linking AI with entrepreneurship and growth in Arab countries. The relationship between entrepreneurial initiatives and economic growth is intensively investigated in economic study. Schumpeter (1934) was among the first to argue that entrepreneurs stimulate economic growth through invention and the process of "creative destruction." Expanding on this concept, Wennekers and Thurik (1999) proposed that entrepreneurial activities influence macroeconomic outcomes by introducing new products, encouraging competition, and increasing productivity.

Lehmann (2013) demonstrated that entrepreneurial activities promote economic growth by generating knowledge spillovers and increasing market efficiency. In parallel, Sautet (2013) showed how institutional quality enhances the positive effects of entrepreneurship on growth, particularly in developing countries.

Recent research has supported these claims. For example, Erken, Donselaar, and Thurik (2018) used panel data from OECD countries to show a significant and positive relationship between entrepreneurial activity and GDP growth. In the Middle East and North Africa (MENA), El Harbi, Anderson, and Mansour (2010) identified entrepreneurship as an important tool for economic diversification and employment development.

Despite being a relatively new topic in economic conversations, artificial intelligence is gaining recognition for its potential to improve growth. Brynjolfsson and McAfee (2017) defined AI as a versatile technology with the potential to transform entire industries. AI applications, ranging from predicting analytics to smart automation, have the potential to improve resource management, reduce transaction costs, and promote creativity.

From a broader economic perspective, Agrawal, Gans, and Goldfarb (2019) argue that artificial intelligence improves decisions made in the face of uncertainty, which is an important element determining productivity and investment levels. According to the International Monetary Fund

(2023), the integration of AI is expected to increase global productivity by 1.2% per year over the next 10 years, particularly in service-intensive economies.

Despite these benefits, the adoption of AI and commercial activities differs greatly by location. According to World Bank data (2023), wealthier countries have an average startup density of 12 per 1,000 people, whereas low-income countries have only 3.2. In the same spirit, financing for AI projects is largely concentrated in a few nations, with the United States and China accounting for more than 70% of global AI research and development spending.

In the Arab region, there is a growing emphasis on entrepreneurship and artificial intelligence. The UAE has announced its National AI Strategy 2031, with the objective of becoming a global center for AI, while Saudi Arabia's Vision 2030 outlines important investments in innovation and new enterprises. Algeria has begun measures to improve its startup ecosystem, such as the 2020 Startup Act and increased funding for technological incubators. However, challenges remain in the areas of digital infrastructure, regulatory systems, and human resource development.

The convergence of artificial intelligence and business presents a mutually beneficial opportunity: AI solutions can provide entrepreneurs with valuable insights, streamline processes, and boost growth potential, while entrepreneurial initiatives can accelerate the spread of AI through innovative business strategies (Lee, 2018). However, in fact, research into their combined impact on economic growth—particularly inside Arab countries—is scarce.

This study seeks to address this gap by conducting an econometric examination of the impact of entrepreneurship and artificial intelligence on economic advancement in the Arab area, with Algeria serving as a major case study. The study provides insight into both the immediate and long-term interactions between these critical variables by utilizing ARDL modeling.⁴ The effects of artificial intelligence and entrepreneurship on global labor and economic growth.

4.1. The Role of Entrepreneurship in Economic Growth :Entrepreneurship has long been recognized as an important factor in promoting economic progress (Acs et al. 2018). Startups create job possibilities, foster new ideas, and increase market competition. According to the Global Entrepreneurship Monitor, increased entrepreneurial activity correlates with GDP growth in both advanced and emerging markets.

4.2. AI’s Economic Impact: Global and Regional Perspectives

Artificial intelligence boosts efficiency, speeds up creativity, and changes employment landscapes (Brynjolfsson & McAfee, 2017). The implementation of this technology differs greatly by area, with the Middle East and North Africa (MENA) experiencing swift advancements in AI usage.

Table 1: AI Employment Index (2023)

Rank	Country	AI Employment Index (0-100)	Key Strengths
1	United States	87.4	Tech leadership, venture capital
2	China	82.1	Government-backed AI expansion
3	UAE	76.3	Smart city initiatives, AI governance
4	Saudi	71.8	Vision 2030, NEOM project

	Arabia		
5	Qatar	68.5	AI in finance and energy
7	Egypt	55.2	Growing tech hubs, outsourcing
8	Algeria	48.9	Emerging AI research, energy sector AI
9	Morocco	47.6	Digital transformation policies
10	Tunisia	45.3	Startup ecosystem, AI in healthcare

Source: Adapted from Stanford AI Index (2023) and WEF (2022)

4.3.1. AI's Impact on Employment in Arabic Countries

Table 2: AI-Driven Job Creation vs. Displacement in MENA (2025 Projections)

Sector	Jobs Created	Jobs Displaced	Net Change
Energy (Oil/Gas)	+1.2M	-0.8M	+0.4M
Healthcare	+0.9M	-0.3M	+0.6M
Finance	+0.7M	-0.5M	+0.2M
Manufacturing	+0.5M	-1.1M	-0.6M
Retail	+0.4M	-0.9M	-0.5M

Source: World Economic Forum (2023) and Brookings Institution (2022)

5. Data and Methodology

5.1 Data Sources

The study uses annual data from 2000 to 2022 for Algeria, Egypt, Saudi Arabia, UAE, and Jordan. Variables include:

- **GDP growth (GDPG):** Annual % change (World Bank)
- **Entrepreneurship Index (ENT):** Business density and new registrations (GEM, World Bank)
- **AI Readiness Index (AI):** AI infrastructure, skills, and adoption levels (Oxford Insights, WEF)
- **Gross Capital Formation (GCF):** % of GDP (World Bank)
- **Human Capital Index (HCI):** (World Bank)

5.2 Model Specification

We employ the ARDL bounds testing approach developed by Pesaran et al. (2001) to examine the short- and long-run relationships.

ARDL Equation:

$$\Delta GDPG_{it} = \alpha + \sum_{j=1}^p \beta_j \Delta GDPG_{it-j} + \sum_{k=0}^q \gamma_k \Delta ENT_{it-k} + \sum_{l=0}^r \delta_l \Delta AI_{it-l} + \sum_{m=0}^s \theta_m \Delta GCF_{it-m} + \sum_{n=0}^t \phi_n \Delta HCI_{it-n} + \lambda ECT_{t-1} + \epsilon_t$$

6. Empirical Results

Table 3 : Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
GDPG	3.4%	2.1%	-5.9%	9.8%
ENT	4.3	2.5	1.0	9.5
AI	52.4	10.6	31.2	75.8
GCF	22.3	5.2	12.4	35.1
HCI	0.58	0.09	0.42	0.71

6.2 Unit Root Test (ADF)

All variables are integrated of order I(0) or I(1), satisfying ARDL requirements.

6.3 ARDL Bounds Test

Table 04 : Arab countries satisfying ARDL requirements

Country	F-Statistic	Critical Value (5%)	Cointegration
Algeria	4.12	3.79	Yes
Egypt	3.65	3.79	No
Saudi Arabia	6.01	3.79	Yes
UAE	5.89	3.79	Yes
Jordan	4.01	3.79	Yes

6.4 Long-Run Coefficients (Selected Countries)

Table 05 : Long-Run Coefficients in some Selected Countries among them Algeria .

Variable	Algeria	Saudi Arabia	UAE	Jordan
ENT	0.38**	0.71***	0.65***	0.44**
AI	0.29*	0.55***	0.61***	0.33**
GCF	0.21	0.19	0.23	0.18
HCI	0.45**	0.60***	0.57***	0.41**

*p<0.10, **p<0.05, ***p<0.01

7. Entrepreneurship and AI Boost Algeria Growth

Algeria's economic framework has traditionally been deeply intertwined with hydrocarbon exports, which constitute approximately 93% of its export revenue and contribute 30% to the GDP according to the World Bank in 2022. This reliance exposes the economy to risks linked to fluctuations in oil prices. There are viable avenues for economic diversification and sustainable development through entrepreneurship and the integration of artificial intelligence. From 2018 to 2022, the Algerian economy saw considerable volatility. The GDP growth rate fell from 1.4% in 2018 to 0.9% in the following year, then suffered a substantial decline of -5.0% in 2020 primarily due to the impacts of the COVID-19 crisis. However, the economy showed signs of recovery with growth rates of 3.8% in 2021 and 3.6% in 2022. Unemployment trends reflected similar patterns, increasing from 12.15% in 2018 to a high of 14.04% in 2020, before dropping to 13.61% in 2021 and further to 12.44% in 2022. Although there is a scarcity of detailed information regarding the growth of the ICT sector and new business formations during this timeframe, the Algerian government has started taking steps towards economic diversification, such as investing in digital infrastructure and fostering entrepreneurial initiatives.

Table 6 : Key Economic Indicators of Algeria (2018-2022)

Year	GDP Growth (%)	Unemployment Rate (%)	ICT Sector Growth (%)	New Business Registrations
2018	1.4	12.15	8.3	12,450
2019	0.9	11.4	9.1	13,210
2020	-5	14.04	11.2	14,890
2021	3.0	13.61	13.5	16,740
2022	3.2	12.44	15.8	18,230

Source : Adel, K., & Sabah, G. (2025). The impact of digital transformation on e-commerce in Algeria: In the light of some ICT indicators. *International Journal of Economic Perspectives*, 19(1), 69–83. Retrieved from <https://ijeponline.lingcure.org/index.php/journal/article/view/826>

8. Current State of Entrepreneurship and AI in Algeria:

Algeria has seen a **46% increase in startup registrations** from 2018 to 2022 (National Statistics Office, 2023). Key sectors include:

Table 7: New Business Registrations by Sector (2022)

Sector	Number of Startups	% of Total
ICT & AI	5,832	32%
E-commerce	5,104	28%
AgriTech	2,735	15%
Renewable Energy	2,188	12%
Other Services	2,371	13%

The AI adoption index evaluates a nation's progress in artificial intelligence by considering aspects like research contributions, financial investments, availability of skilled professionals, and regulatory backing. As stated in the Stanford AI Index Report (2023), the forefront of AI innovation is dominated by the United States, China, and the

European Union, whereas countries in Africa and the Middle East, such as Algeria, are starting to make their mark.

8.1 AI Adoption in Algeria :

Algeria has begun laying the groundwork for incorporating artificial intelligence, focusing mainly on educational institutions and the telecom sector. The government has launched the National Strategy for Artificial Intelligence for the years 2021 to 2030 to encourage research and industry use of AI according to the Ministry of Higher Education and Scientific Research in 2021. Nevertheless, obstacles including inadequate funding, a lack of qualified experts, and insufficient digital infrastructure are impeding swift advancements.

8.2. Comparative Analysis: AI Index by Country:

The following table presents a comparative analysis of AI adoption across selected countries, including Algeria.

Table 8: AI Adoption Index by Country (2023)

Rank	Country	AI Investment (USD Billion)	AI Research Output (Publications, 2022)	AI Readiness Score (0-100)	Key AI Initiatives
1	United States	23.6	18,452	92.5	<i>National AI Initiative Act</i>
2	China	19.8	32,741	88.7	<i>Next-Generation AI Development Plan</i>
3	United Kingdom	6.2	7,892	85.1	<i>UK National AI Strategy</i>
4	Germany	5.5	6,543	83.4	<i>AI Made in Germany</i>
5	Canada	3.8	5,210	80.9	<i>Pan-Canadian AI Strategy</i>
...	...	...	...	...	...
45	South Africa	0.12	684	52.3	<i>SA AI Association</i>
52	Algeria	0.05	287	41.6	<i>National AI Strategy (2021-2030)</i>

Sources: Stanford AI Index (2023), OECD AI Policy Observatory, Algerian Ministry of Higher Education (2022)

9.Discussion

The findings from the ARDL analysis indicate that both entrepreneurial activities and artificial intelligence positively influence economic expansion over time, especially in Saudi Arabia and the UAE, which boast robust innovation strategies. On the other hand, Algeria and Egypt exhibit less pronounced effects, indicating an essential requirement for changes in policy and improvements in infrastructure.

10. Conclusion

This research reveals that both the fields of entrepreneurship and artificial intelligence play a crucial role in boosting economic advancement in Arab nations. The ARDL methodology indicates strong long-lasting impacts in countries that have embraced advanced digital strategies. It is vital for policymakers to focus on innovation and entrepreneurship to facilitate continuous development. Both , entrepreneurship and artificial intelligence (AI) play a pivotal role in shaping Algeria's future economic trajectory Together, these forces contribute to a more resilient and knowledge-based economy, positioning Algeria to better place by welcoming innovation, nurturing a culture of startups, and effectively employing AI initiatives, Algeria has the potential to lessen its reliance on oil, generate stable job opportunities, and establish itself as a frontrunner in the digital evolution of the Arab region. Despite existing obstacles, proactive strategies, investment in skill development, and the embrace of technology can lead to sustainable economic stability and growth. As Algeria progresses through the fourth industrial revolution, the incorporation of entrepreneurship and AI will be crucial for creating a vibrant, knowledge-driven economy that benefits all aspects of society.

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