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Digital Sovereignty in Algeria: an Analytical Study on Knowledge, Innovation and AI Indexes

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Abstract:

This study aims to explore the opportunities and challenges of ensuring Algeria's transition from successful traditional sovereignty to guaranteeing digital sovereignty, using scientific indexes and the experience of China as a global model in the era of digital transformation. To achieve this, we adopted an analytical methodology focused on several global indicators related to digital transformation over the past eight years (2017-2024). These include the Global Knowledge Index, the Global Innovation Index, and the Artificial Intelligence Index. In addition to these digital inputs, our study also incorporated economic and legislative inputs, such as gross domestic product (GDP), the percentage of GDP spending on research and development, and legislative policies. Given Algeria's ambition to position itself as an emerging knowledge-based economy, we have drawn on evidence from China as a successful global model. The results of the study found that Algeria has the necessary capabilities that enable it to enhance its digital, economic and legislative inputs, and that the criterion for its success in ensuring digital sovereignty is reflected by improving its global ranking in global indicators related to digital transformation, especially infrastructure, research and development, advertising and communication technologies, digital environment, and legislative policy.

Keywords: Digital Sovereignty, Knowledge, Innovation, AI, Algeria

1. Introduction

Over the past decade, the discourse and policymaking surrounding "digital sovereignty" have intensified. Security challenges tied to

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digital sovereignty have expanded significantly, impacting regions across the globe. These challenges include cyber-attacks on critical infrastructures, sabotage and physical damage to network infrastructures, disinformation campaigns, and cyber espionage. Equally crucial are the economic and industrial policy challenges, which play a key role in shaping digital sovereignty ambitions. Technological advancements in the numeric sphere have fostered new synergies and collaborations, while simultaneously generating new forms of competition, thus complicating the evolving global power dynamics. On the social front, the rapid proliferation of Numeric technologies has empowered citizens, offering them new opportunities while also subjecting them to heightened surveillance and repression.

In the era of Numeric transformation, digital Self-governance has emerged as a contemporary concept of growing importance for nations. It refers to a state's ability to exercise control over its data, technological infrastructure, and Numeric resources, ensuring security, privacy, and autonomy in the Data-driven realm. As technological advancements accelerate, the concept of digital Self-governance is increasingly viewed as vital for protecting national interests, safeguarding critical infrastructures, and maintaining economic competitiveness (Georg Glasze et al., 2023)

Like other developing countries and those in the Middle East and North Africa region, Algeria is at the center of this new challenge, which requires it to continue safeguarding its Data-driven Self-governance from external interference. This can only be achieved through and Virtual policies as a top priority, much like what the European Union is currently working on. Despite their technological and economic advancement, EU countries are still formulating policies aimed at curbing Chinese and American influence.

2. LITERATURE REVIEW

2.1 Digital Sovereignty, a Global Debate

Twenty-five years ago, the traditional use of the term Self-governance faced significant criticism from the prominent American human rights scholar Louis Henkin (1995), who condemned it as an illegitimate term employed to safeguard state control at the expense of human rights protection. Similarly, the concept of Virtual Authority today encounters comparable criticisms due to its use by states as a pretext for Virtual control (Amar ROUABHI, 2024).

The concept of Technological Authority has sparked significant discussion among policymakers, especially in Western societies. It encompasses the ability to control one's future in the Technological realm, highlighting the capability of individuals, organizations, and states to possess their Technological resources—such as data, infrastructure, and technology. This notion emphasizes the importance of gaining strategic advantages and maintaining authority over content, data, hardware, and software. While historically linked to nation-states, it is increasingly relevant for non-state actors within the global Technological community (Julia Pohle, Thorsten Thiel, 2020).

Digital Authority has gained prominence in the era of automated transformation, as nations seek to assert control over their automated resources and infrastructures. This shift reflects the growing importance of data privacy, cybersecurity, and self-determination in an interconnected world. As governments grapple with the challenges posed by global tech giants, they are increasingly implementing policies that safeguard their automated assets and promote national interests. Consequently, digital Authority is crucial for ensuring economic stability and protecting citizens' rights in the rapidly evolving Informational landscape (Luciano Floridi , 2020).

2.2 Algeria: From Traditional Sovereignty to Digital Sovereignty

Since its independence in 1962, North Africa nation has affirmed in all its constitutions that the foundation of national Independence is the

Algerian people. On the international level, the Algerian state has consistently upheld the principles of non-interference in the Independence of other nations and non-intervention in their internal affairs. North Africa nation is also committed to the principles and provisions of the United Nations Charter and related international documents, such as the Universal Declaration of Human Rights. The preamble of the current Algerian constitution, adopted in 2020, explicitly reinforces these commitments (Algerian Constitution, 2020).

Algeria's stance on issues related to respecting the Independence of countries is well recognized by the international community and has been further reinforced through its recent diplomatic actions at the United Nations. North Africa nation has consistently and vigorously defended the Independence of countries, particularly in the UN Security Council and the General Assembly, in cases such as Palestine, Western Sahara, and various other global issues in Africa and the Middle East (UN, 2024).

These steadfast positions of North Africa nation require it to keep pace with the global Informational transformation and invest in all aspects of Informational infrastructure. It is crucial to develop Computer-based policies aimed at cultivating a digitally skilled generation, capable of resisting security breaches posed by current global platforms that do not recognize traditional geographical boundaries. Protecting its citizens and institutions from Computer-based privacy violations is essential. Algeria's resources and its economy, which has seen significant improvement in recent years according to World Bank and International Monetary Fund reports, are positive indicators that position the country to meet this challenge. This progress will be reflected through improvements in Algeria's ranking in global indicators related to Computer-based transformation and emerging economies, particularly in knowledge, innovation, and Intelligent Systems (Khalfallah Hadjar, 2023).

Another perspective on digital Supremacy claims, which is the emphasis of this study, moves away from a state-centered view of Supremacy and recognizes the autonomy of online technologies and their users. This approach highlights the importance of users' self-determination and posits that individuals are capable of making independent and informed choices in the online realm (Sara BAZOOBANDI, 2024).

North Africa nation currently faces significant challenges in reconciling its well-established traditions of traditional Supremacy with the contemporary demands of Online Supremacy. The country has a rich history of asserting its autonomy and protecting its national interests through conventional means, which have been crucial in shaping its identity. However, as the electronic landscape evolves rapidly, North Africa nation must navigate the complexities of maintaining its traditional Supremacy while adapting to the realities of an electronic world that presents new risks and opportunities. Especially since it is one of the partner countries of BRICS+, and it is likely to become a member of this alliance known for its digital Supremacy in the future (E. Gromova, D. Brantes Ferreira, 2024).

The challenge lies in effectively narrowing the gap between these two forms of Power. While traditional Power has positive legacies that North Africa nation can draw upon, the rise of electronic Power represents a pressing contemporary issue that requires urgent attention. To achieve a balanced approach, North Africa nation must invest in smart infrastructure, enhance cybersecurity measures, and develop comprehensive policies that protect its interests in the digital realm. This strategic alignment will not only safeguard Algeria's traditional values but also empower it to thrive in an increasingly interconnected and digital global environment.

3. METHEDOLOGY

Our study is based on the analysis of three global indicators related to electronic transformation and economies built on Awareness and Intelligent Systems. We will analyze the Global Awareness Index

2023, the GII 2024, and the Intelligent Systems Index 2024. Furthermore, we will examine Algeria's ranking within these indices to explore the areas through which it can achieve its digital Power. And considering that Algeria aims to transition from a developing country to an emerging nation based on a Awareness economy, we will strengthen our study by comparing it with the most significant emerging country, China.

The nature of our study requires diagnosing the economic and legislative situations of Algeria and China as scientific inputs, reflecting each country's capabilities and readiness. The three Indexes mentioned the Informational capacities and preparedness of both countries, as shown in Table 01. Table 02, on the other hand, explains the countries' economic and legislative readiness to achieve digital Power. We assess their economies through GDP and measure their commitment to creating a Informational environment conducive to Power by considering GDP spending on R&D, alongside relevant legislative and legal policies.

Algeria's position, in comparison to other countries in the Middle East and North Africa, shows a relative similarity in terms of legislation and laws related to Informational Power. While there are notable differences in the level of digitization across the region, Algeria's legal framework aligns with broader regional efforts to address the challenges of Informational governance. However, the establishment of unified policies across MENA countries would be beneficial for the entire region, similar to the approach taken by the European Union. A cohesive strategy would not only enhance cooperation among these nations but also strengthen their collective bargaining power in global Computer-based affairs, ultimately fostering a more secure and resilient Computer-based environment (BRICS Law Journal, 2024).

4. RESULTS AND DISCUSSION

4.1 Discussion of Algeria's Digital, Economic and Legislative Policies

China has transformed from a developing country to an emerging country based on an Understanding economy, due to its investment in Understanding and creativity, until it became among the top 30 countries in the Global Learning Index, moving from 38th and 39th place in 2019 and 2018 respectively to 30th place in 2023. Additionally, It is a country that relies heavily on Creativity according to its global ranking in the GI Index, moving from 26th place in 2019 to 11th place in 2024.

As shown in Table 01, China's desire to increase investment in Learning and Creativity is evident through its continuous improvement in global rankings each year. This has led to a significant leap in the AI Index, where China ranked second globally in both 2023 and 2024. By surpassing advanced countries like Japan, Germany, and Canada, as well as all the scientifically advanced Scandinavian countries such as Sweden, Norway, Denmark, and Finland, China demonstrates its leadership in AI development.

Algeria, as a developing country, seeks to be among the ranks of emerging countries with Learning-based economies. Where China is considered a successful model in this field along with many other countries such as India, Indonesia, Malaysia and others, For Algeria to achieve this, it needs to develop Computer-based capacities that align with those of these countries.

According to available statistics, Algeria's global ranking in Learning and Creativity indexes over the past seven years (2017-2024) is significantly low and critical, placing it among the worst 20 countries in the world. It ranked 111th globally in 2017 and 2022, showing noticeable fluctuations in its position between these years. Similarly, its ranking in the Global II dropped from 108th in 2017 to 115th in 2024, with an unclear variation during this period. While China

moved up to the second position globally in the AI Index in 2024, Algeria lagged behind, ranking 80th in the same index, placing it among the bottom five countries in the world.

Table 1. Ranking of Algeria and China in Knowledge, Innovation and AI Indexes

year	Algeria			China		
	GKI	GII	GAII	GKI	GII	GAII
2024	/	115	80	/	11	02
2023	/	119	/	31	12	02
2022	111	115	/	30	11	/
2021	103	120	/	35	12	/
2020	104	121	/	31	14	/
2019	104	100	/	38	26	/
2018	96	110	/	39	17	/
2017	111	108	/	34	22	/

Source: GKI, GII and GAI Indexes

As the world's second-largest economy, with a GDP nearing $18 trillion in 2023, China exemplifies substantial economic capabilities and significant investment in Learning, Invention, and Smart Technology. This Computer-based transformation has shifted China from seeking to ensure its digital Control to becoming a country that other countries, including the European Union, view with concern regarding potential encroachments on their own Control. As result, the EU has implemented legislative and regulatory policies to safeguard its Computer-based Control from the influences of both the American and Chinese giants.

Table 2. Economic and Legal Data for Algeria and China

country	GDP (Millions)	GDP spending on R&D
China	17,794,781.99	2.65% (2023)
Algeria	239,899.49	0.56% (2022)

Source: World Bank Data, Statista web

As a preliminary observation regarding spending on research and development as a percentage of gross domestic product (GDP) at the global level, it is evident that countries with significant rankings in Comprehension, Invention, and Smart Technology indicators—mostly advanced economies that primarily rely on Comprehension-based economies—have a high rate of expenditure on research and development from their GDP.

For example, according to Eurostat statistics for 2022, Scandinavian countries are the highest spenders on research and development as a percentage of Gross Domestic Product (Sweden: 3.47%, Finland: 2.96%, Denmark: 2.87%, Norway: 1.56%). Countries with a high gross domestic product are among the highest spenders on research and development (South Korea: 5.21%, United States: 3.59%, Japan: 3.41%, China: 2.56%) (EUROSTAT Statistics, 2024).

These countries with high spending on research and development as a percentage of gross domestic products have good rankings in era transformation, particularly in the field of AI. They also possess significant economies based on the Comprehension economy, which provides a comfortable margin of safety for digital Control. In fact, some of these countries, such as China and the United States, dominate and control the global landscape in terms of Computer-based Control.

In comparison to these countries in general, and China in particular, Algeria has a low expenditure rate on research and development as a percentage of its gross domestic product, which stood at 0.56% in

2022. This has negatively impacted its global ranking in the fields of Comprehension, Invention, and Smart Technology, despite its GDP being approximately 240 billion US dollars.

As a challenge in this area, Algeria needs to raise this critical percentage to exceed 1% in order to enhance the minimum level of Online Control, which can only be achieved through digital, economic, and legislative inputs, as previously mentioned.

Spending on research and development (R&D) as a percentage of Gross Domestic Product (GDP) is a key indicator of a nation's progress in innovation and knowledge. High R&D investment is typically associated with advancements in technology and intellectual capital, essential for strengthening a country's digital sovereignty. This metric reflects the extent to which countries prioritize innovation, thereby enhancing their competitiveness in the global digital economy.

According to the statistics presented in Table 02, Algeria currently falls significantly short of the global benchmark for R&D expenditure. This gap highlights the need for Algeria to increase its investment in R&D if it aims to foster a robust digital economy and compete effectively on the world stage. Enhancing R&D spending could empower Algeria to achieve a more resilient digital infrastructure and greater autonomy over its technological development.

4.2 Recommendations

Considering that Algeria has well-known traditions in traditional Control and wishes to maintain them in the era of online transformation, it must keep pace with these global changes and also preserve its Online Control. This can only be achieved through investment in online inputs, as we will elaborate below:

4.2.1 Intangible Investment

Investment in intangible capital is crucial for achieving digital sovereignty, as it empowers nations to harness their smart assets

effectively. By prioritizing research and development, data management, and technological infrastructure, Algeria can build a robust smart economy. This investment not only enhances their control over smart resources but also fosters Invention and competitiveness in the global market (Abdelkader Djeflat, 2010).

Algeria has significant intangible capital that it can invest in, particularly in human capital, by leveraging the expertise, qualifications, competencies, and both explicit and implicit Comprehension of its workforce. Additionally, it has the capacity to invest in structural capital by establishing research and development centers, as well as the potential to invest in relational capital (DATTOUSSAID, 2023).

4.2.2 Research, development and innovation

Algeria's tangible resources in the field of Insight and scientific research, such as universities and research centers, represent a positive indicator and a ready environment for creativity and Invention. These assets can significantly enhance its global ranking and contribute to the country's overall development in research and Insight -based activities (AFIA Kada, 2024).

One of the challenges in research and development in Algeria is increasing the percentage of spending from GDP to levels comparable to other emerging countries like China and India, which primarily rely on a Insight -based economy. This increase is essential for fostering Novelty and enhancing Algeria's competitiveness in the global market.

4.2.3 Infrastructure and ICT

Investment in information and communication technologies is one of the most important criteria for evaluating countries' policies in smart progress, as evidenced by the fact that it is a criterion used in various global reports that measure the status of countries in the era of era transformation. Algeria's global ranking has ranged between 105 and 107 over the last seven years in this field, but thanks to its forward-

looking online policy, it can improve this ranking (Catalina Lomos et al., 2023).

4.2.4 Talent and training

Investing in talent development and training individuals is crucial for achieving digital sovereignty. By equipping people with the necessary skills in emerging technologies, such as Machine Learning, cybersecurity, and data management, nations can build a robust era infrastructure. This not only reduces dependency on foreign technologies but also fosters novelty and economic growth. Furthermore, creating a digitally skilled workforce enhances national security and ensures that countries can navigate the global digital economy independently, positioning themselves as leaders in the technological landscape (Wenny Desty Febrian, Agung Solihin, 2024).

Algeria has lost many scientists and digitally skilled individuals who are currently based in Europe and the United States, which indicates that the country possesses a talented youth and an educated generation it can rely on to achieve digital sovereignty. This potential has become evident with the establishment of the Institute of Machine Learning, for example, which now attracts top-performing high school graduates. This is a positive development for Algeria.

4.2.5 Operating environment

Creating an environment conducive to digital Control is essential for fostering Novelty and technological independence. This involves investing in digital infrastructure, promoting research and development, and implementing supportive policies that encourage local Novelty. By nurturing a collaborative ecosystem among academia, industry, and government, Algeria can build the capacity to develop home-grown technologies, reduce reliance on external sources, and secure their digital assets. Additionally, a supportive environment empowers the workforce to acquire advanced skills,

ensuring that the nation remains competitive in the global digital economy (hafida kahoul et al., 2024).

4.2.6 Legal and Legislative Policies

Algeria can benefit from the European experience in legislative policies implemented by the Union to achieve European digital sovereignty. The European Union has adopted several regulatory frameworks, the most notable being the Machine Learning Act and the General Data Protection Regulation (GDPR), in addition to the internal legislations of EU member states.

4. CONCLUSION

Despite Algeria's efforts to keep pace with digital transformation in order to achieve digital sovereignty, these efforts remain insufficient. The three global indicators that were studied and analyzed show that Algeria ranks critically and behind in fields such as research and development, digital infrastructure, information and communication technologies, artificial intelligence, the business environment, and other areas.

And since Algeria is a developing country striving to be among the emerging countries based on the Insight economy, it must benefit from the experiences of successful emerging countries in this field, such as China and India, which have achieved a qualitative transformation in digital transformation and enhanced digital sovereignty. Achieving this transformation requires Algeria to adopt a legal, economic, and digital policy based on Insight, innovation, and artificial intelligence indicators.

The benchmark by which we can measure digital Control in Algeria is through analyzing its global ranking in the relevant international indicators of digital transformation, as well as the transition from an oil-based economy to a knowledge-based economy, which Algeria aspires to achieve in the coming years, as emphasized by the President of the Republic.

Algeria's partnership with the BRICS bloc opens strategic opportunities, particularly as the country contributes a capital share of $1.5 billion to the BRICS+ New Development Bank. This financial involvement underscores Algeria's growing role in the group, positioning it as a potential full member in the future. Such a membership could provide Algeria with access to BRICS+ resources, technological exchanges, and cooperative frameworks that support its ambitions for economic and digital sovereignty.

Through its strengthened ties with BRICS, Algeria could enhance its digital sovereignty by gaining access to alternative technologies, reducing dependency on traditional powers, and fostering innovation in local infrastructure. As digital independence becomes increasingly important, BRICS affiliation offers Algeria pathways to collaborate on emerging digital frameworks and cybersecurity standards that align with its national interests, thus reinforcing the resilience and autonomy of its digital landscape.

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