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The Challenges of Achieving Food Security in Algeria in Light of Comparative Advantage

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Abstract:

This study addresses food security in Algeria from the perspective of comparative advantage. It focuses on the tension between efficiency-based specialization and the need to maintain a certain level of food sovereignty. It draws on a descriptive and analytical approach, linking the theoretical framework to the realities of the agricultural sector through indicators, such as: production, water use, productivity, and cereal imports. The findings suggest that full self-sufficiency remains difficult due to structural and environmental limits, particularly water scarcity, rising costs, and climate pressures, which reduce the competitiveness of some local production. At the same time, heavy reliance on international markets is not without risk. In this context, the study leans toward a "selective self-sufficiency" approach, combining targeted domestic production with specialization and a measured use of trade, while stressing the role of technology in improving efficiency and supporting long-term food security.

Keywords: food security, comparative advantage, Algeria, self-sufficiency, water resources, international trade.

JEL Classification Codes: Q18, Q17, Q15, O13.

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Introduction:

Agricultural self-sufficiency is considered a central issue in the economic policies of many countries, especially those exposed to continuous fluctuations in global markets, along with disruptions in supply chains and rising food prices. The importance of this issue has grown in recent years due to successive global crises (both health-related and geopolitical) which have revealed the limits of excessive reliance on imports. In this context, several countries, including Algeria, have started to reconsider their development models, with a stronger focus on reinforcing domestic agricultural production capacity. However, this direction raises a deeper theoretical and economic issue. Classical economic theory, particularly the theory of comparative advantage developed by David Ricardo, suggests that economic efficiency is not achieved through full self-sufficiency, but rather through specialization in goods that a country can produce at a relatively lower cost, combined with participation in international trade. From this perspective, attempting to produce all goods locally, regardless of cost, may lead to inefficient resource allocation and higher overall economic costs.

From this perspective, there is an apparent contradiction between the logic of economic efficiency, as emphasized by comparative advantage theory, and the requirements of food security, which tend to push countries toward greater self-sufficiency. This tension is especially visible in Algeria, where several natural and structural limits are present. The most important include water scarcity, the spread of semi-arid zones, and the impact of climate change on agricultural output, particularly irregular rainfall and rising temperatures. All of this makes the local production of some strategic crops relatively costly compared to countries with more favorable natural conditions.

1. Research problem:

This raises a key question about how realistic it is to aim for full agricultural self-sufficiency in Algeria under current conditions, and whether it is even the most appropriate objective. Should priority be given to strict economic efficiency and deeper integration into international trade through specialization? Or do food security considerations make it necessary to accept higher costs in exchange for a minimum level of strategic autonomy?

Answering this question is not straightforward. It requires a more balanced reading of the issue, one that does not rely only on market logic, but also takes into account sovereignty concerns, as well as environmental and social constraints that shape agricultural policy in the Algerian context.

2. Sub-questions of the study:

Based on the main research problem, a set of sub-questions can be formulated to help structure the analysis of the topic:

1) What is meant by the theory of comparative advantage, and what are the limits of its application in the agricultural sector?
2) What is food security, and what are its main dimensions and indicators?
3) What is the current situation of the agricultural sector in Algeria in light of environmental challenges, particularly water scarcity and climate change?
4) How do these challenges affect the economic efficiency of agricultural production in Algeria?
5) To what extent is the pursuit of agricultural self-sufficiency compatible with the principle of comparative advantage?
6) What are the implications of reliance on imports, especially for strategic commodities such as wheat, for food security?
7) How can a balance be achieved between self-sufficiency and international trade in Algeria?
8) What policies and strategies can ensure food security under conditions of limited resources?

3. Research hypotheses:

This study is based on the following main hypotheses:

1) full agricultural self-sufficiency in Algeria cannot be achieved efficiently under conditions of limited water resources and climate change.
2) the application of the principle of comparative advantage contributes to a more efficient allocation of agricultural resources in Algeria, through specialization in goods with higher relative efficiency.
3) food security in Algeria can be achieved without full self-sufficiency, by adopting an integrated model that combines domestic production with international trade.
4) investment in agricultural technology and improved water-use efficiency plays a key role in reducing the production gap and strengthening food security.

4. Significance of the study:

This study is significant for several reasons:

- First, it contributes to the economic literature on the relationship between comparative advantage and food security, particularly in the context of countries with limited resources.
- Second, it offers an analytical framework that may assist decision-makers in Algeria in formulating more efficient and sustainable agricultural policies.
- Third, it sheds light on possible ways to balance economic efficiency with food security requirements, thereby helping to reduce resource misallocation and waste.
- Finally, it addresses the issue of food sovereignty in a context of global volatility, while it also clarifies the limits of relying heavily on international markets.

5. Objectives of the study:

This study aims to achieve the following objectives:

1) To analyze the theoretical relationship between comparative advantage and food security.

2) To assess the current situation of the agricultural sector in Algeria in light of environmental and economic challenges.

3) To examine the feasibility of achieving agricultural self-sufficiency in Algeria.

4) To highlight the limitations of applying the theory of comparative advantage in a strategic sector such as food.

5) To propose an integrated model that balances domestic production and international trade.

6) To provide recommendations for improving production efficiency and strengthening food security.

6. Methodology of the study:

This study adopts a descriptive-analytical approach, combining both theoretical and applied analysis to better understand the issue of food security in Algeria in light of the theory of comparative advantage. On the theoretical level, it reviews and analyses the key concepts related to comparative advantage and food security. On the applied level, it examines the situation of the agricultural sector in Algeria using a set of economic and environmental indicators, including agricultural production, water resource consumption, agricultural productivity, and food import levels, particularly cereals.

A comparative analysis is also used to highlight the differences between the cost of local production and the cost of imports, in order to assess economic efficiency. The study relies on statistical data and

reports issued by national and international organizations, in addition to graphical representations to illustrate the evolution of variables such as rainfall and agricultural productivity. Finally, an inferential approach is used to derive an integrated model that balances domestic production and international trade, with the aim of achieving food security in Algeria.

7. Structure of the study:

- **First:** Theoretical framework of comparative advantage and food security
- **Second:** The agricultural sector in Algeria
- **Third:** Self-sufficiency between economic necessity and strategic considerations
- **Fourth:** Towards an integrated approach between self-sufficiency and international trade

8. Literature review:

The topic of food security and its relationship with comparative advantage has received increasing attention in economic literature, particularly in developing countries facing constraints in natural resources. In this context, the study by Jeddou (2018) examined international trade theories, from comparative advantage to competitive advantage. It highlighted the limitations of classical models in explaining recent changes in international trade, which opens the discussion on the applicability of these theories to strategic sectors such as agriculture. Regarding food security in Algeria, the study by Khettaf and Mehlab (2024) analyzed key food security indicators and concluded that Algeria still records relatively low levels of food security, despite governmental efforts. This situation is mainly attributed to the fragility of food systems and weak sustainability. Similarly, the study by Rabbahi and Kermia (2024) reached comparable conclusions, emphasizing continued dependence on imports and the difficulty of achieving full self-sufficiency in the presence of structural constraints. From an agricultural sector perspective, the study by Bechta and Bormasana (2020) showed that efforts aimed at developing agriculture within the framework of economic diversification have not achieved the expected results. The agricultural sector still contributes only marginally to overall economic growth, despite the existence of significant potential. In the same line, the study by Omrani et al. (2025) found that agricultural exports in Algeria are influenced by several factors, including agricultural output and exchange rate movements, in addition to structural constraints such as weak infrastructure and water scarcity.

Regarding environmental factors, Bouarab and Fathallah (2022) demonstrated a significant impact of climate change on agricultural production. In particular, increases in temperature and variations in rainfall levels lead to lower agricultural productivity, which reflects the sector's vulnerability to climate fluctuations. Similarly, the study by El Mahi (2024) highlighted that the agricultural sector in Algeria consumes large quantities of water resources, with increasing depletion of groundwater reserves, raising serious concerns about long-term sustainability.

Within the framework of comparative advantage in the Algerian economy, the study by Bejaoui (2020) concluded that Algeria does possess relative potential in certain sectors, particularly agriculture and light industries. However, the exploitation of these advantages remains below expectations, mainly due to institutional and structural imbalances.

A review of the existing literature shows a general agreement on the presence of structural and environmental challenges that hinder the achievement of food security in Algeria, as well as on the limited feasibility of full self-sufficiency under current conditions. Nevertheless, most studies tend to address the issue from separate angles, whether environmental, economic, or trade-related. In contrast, this study attempts to provide an integrated analysis that connects comparative advantage theory with food security requirements, with the aim of proposing a balanced model that combines economic efficiency with strategic considerations.

Firstly. The theoretical framework of comparative advantage and food security

The theory of comparative advantage is based on the idea that countries gain more from specializing in the production of goods they can produce at a lower relative cost compared to others, and then exchanging them through international trade. In this sense, economic efficiency is not achieved through full self-sufficiency, but rather through specialization and the international division of labor. Historically, the starting point was the theory of absolute advantage developed by Adam Smith. However, this approach had an important limitation: it assumed that each country has an absolute advantage in producing at least one good. This makes it difficult to explain situations where one country is more efficient in producing both goods, while the other has no absolute advantage in either. In such a case, the question arises: would the first country produce and export both goods, leaving the second with no role in trade? It was precisely this gap that the theory

of comparative advantage addressed later. It showed that absolute advantage is only a special case within a broader and more general framework based on relative costs, rather than absolute productivity.

1- The theory of comparative advantage

1-1 Presentation of the theory

According to David Ricardo, the founder of this theory, countries gain from trade if they specialize in producing goods with relatively lower production costs, and import goods with relatively higher production costs (Guillechon & Kawecki, 2009, p. 5) . A country may be more efficient than another country in producing both goods; however, it can still maximize its gains by specializing in and exporting the good in which it has a comparative advantage. That is, the good in which the absolute productivity difference between the two countries is greater, and leaving the production of the other good, in which this difference is smaller, even if it is less efficient in it, to the other country, which in turn benefits from specializing in it (Yousri, 2007, P.24).

The comparison under the theory of comparative advantage is not made between the cost levels of the same product in the two countries, but rather between the relative costs of the two products within each country (Lafay, 2006, p. 174). Therefore, it is not necessary to have an absolute advantage in order to obtain a comparative advantage; a higher relative superiority is sufficient. The principle of the theory can be summarized as follows:

If we denote the production costs of goods (1) and (2) in country A as Q1 and Q2, and in country B as Q1′, and Q2′, then if the following condition is satisfied:

$$\frac{Q1}{Q2} < \frac{Q1'}{Q2'}$$

Then the production cost of good (1) is relatively lower in country A, while good (2) is relatively cheaper in country B. Accordingly, country A specializes in producing and exporting good (1), in exchange for importing good (2) from country B (Bekri, 2012, P.7-8).

1-2 assumptions of the theory

Ricardo's theory is based on the following assumptions (Djedou, 2018, P.522-523):

1. The existence of two countries and two goods, with exchange taking the form of barter.
2. The model is based on the labor theory of value, meaning that labor is the only factor of production .
3. Constant production costs.

4. No variation in factors of production (only one factor exists, which is labor).
5. Differences in technology or production techniques between countries.
6. Identical tastes and consumption patterns in both countries.
7. Perfect mobility of labor within each country and no mobility between countries.
8. Full employment of production factors (no unemployment).
9. Perfect competition in markets.
10. Absence of trade barriers (taxes, tariffs, subsidies).
11. Absence of transport costs.

1-3- Evaluation of the theory of comparative advantage:

Although the theory of comparative advantage is considered one of the most important principles in economics, it has been subject to several criticisms, the most important of which are:

1. It relies on a simplified assumption that is far from reality (two countries and two goods).
2. It assumes that trade takes place through barter, while ignoring the role of money (Daoud & al., 2002, P.41).
3. It is unable to determine international exchange rates with precision.
4. It is based on the labour theory of value, which faces several practical difficulties, including (Djedou, 2018, P.524):

- Considering labour as the only factor of production.
- Assuming a constant proportion in the use of labour.
- Assuming homogeneity of labour despite differences in skills and qualifications.

This led the economist Gottfried Haberler in (1936) to introduce the concept of opportunity cost, according to which the cost of producing a good is measured by what must be given up in terms of the production of another good (Hanison et al., 2004, p. 279).

5. Assuming constant returns to scale, which does not reflect reality (since increasing or decreasing returns may exist).
6. Ignoring the demand side and changes in consumer preferences.
7. Neglecting transport costs and customs duties.
8. Assuming full employment, which is unrealistic in the presence of unemployment.
9. Assuming complete specialization, whereas in reality specialization is often partial (Elkouez, 2009, P.3).
10. Failing to explain the sources of comparative advantage or the reasons behind productivity differences between countries.

11. Moreover, recent global crises have shown the limitations of relying entirely on comparative advantage, especially in strategic goods such as food.

In this context, the theory of comparative advantage can be considered a fundamental analytical framework for understanding the strategic choices facing Algeria in its pursuit of agricultural self-sufficiency, particularly under conditions of limited natural resources and environmental challenges.

2- The concept of food security and its dimensions:

Food security is one of the key concepts in development and economic literature, and it has gained increasing attention in recent years, especially with the rise of food crises and climate-related pressures. The Food and Agriculture Organization (FAO) defines food security as a situation in which all individuals, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life.

In practical terms, this concept is usually broken down into four main dimensions. The first is availability, which refers to the presence of food through domestic production or imports. The second is access, meaning people's ability to obtain food economically and socially. The third is stability, which relates to the continuity of supply over time, especially in the face of shocks. The fourth is utilization, which concerns how food is used by the body and its link to health and nutrition.

Food security is therefore not limited to self-sufficiency. It is more about ensuring a stable and reliable food system, whether through local production or international trade. This is where economic logic, such as efficiency and comparative advantage, intersects with strategic concerns linked to food sovereignty. In this sense, food security becomes a complex issue that cannot be reduced to one dimension, but rather requires a balanced view that takes economic, environmental, and social factors into account.

2-1- The concept of food security:

According to the Arab Organization for Agricultural Development, food security is understood as a situation in which a country produces as much of its food needs as possible, in appropriate quantities and at economically reasonable costs, while taking into account its comparative advantage in food production. At the same time, its products should be able to compete with foreign goods in international markets. It also implies that the country should have agricultural and/or industrial exports that generate the foreign currency needed to import food items that cannot be efficiently produced domestically. In addition, food

security requires that all citizens have access to sufficient and adequate-quality food. Finally, it includes maintaining a strategic food reserve sufficient for at least three months to cope with exceptional situations, such as natural disasters or political and military instability (Hasanin, 2007).

According to the Arab Organization for Agricultural Development, the concept of food security is based on three main elements. The first is the availability of food in sufficient quantity and required quality to ensure healthy living. The second is the continuity of this availability, meaning that food must remain accessible or be regularly supplied throughout the year at a minimum level. The third element is economic access, which refers to the existence of adequate purchasing power that allows individuals to obtain sufficient food at all times. Food security is not limited to producing or securing basic food needs only. It also extends to ensuring the availability of the necessary inputs and means required to sustain this production and guarantee long-term access to food resources (Mezari, 2018).

According to the Food and Agriculture Organization, food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences, allowing them to lead active and healthy lives. In this sense, food security refers to the ability of individuals and societies to consistently obtain adequate food that matches both their nutritional requirements and their food preferences, in a way that supports their health and daily functioning (Toufik, 2009).

Food security refers to the ability of individuals within a society to have continuous access, at all times, to sufficient food that meets their activity levels and health needs. This definition reflects a set of underlying factors, most notably the efficiency of food production, the availability of supporting resources, and the presence of institutional systems that facilitate agricultural production and distribution. The concern with food availability and sufficiency can be historically linked to the work of Thomas Robert Malthus, who drew attention to the relationship between population growth and food resources, and the potential imbalance that may arise between them over time (Toufik,1998).

Food security is considered as a relatively modern concept that emerged in the 1970s. Its use became particularly widespread in developing countries, which were experiencing significant shortages in production levels and food stock availability. Food security is closely linked to the prevailing conditions within each society. This means that

its meaning and scope may vary depending on economic, social, and environmental circumstances. As a result, several definitions of food security exist. This reflects the different perspectives adopted by scholars and institutions in their approach to the issue (Mourad, 2010, P.45).

These definitions can be summarized as follows: food security refers to a situation in which all members of society, at all times, have access to sufficient, safe, and nutritious food that meets their health and living needs. This depends on the availability of food in adequate quantities and quality, the continuity of its supply, and the ability of individuals to access it physically and economically. It also involves a partial or full reliance on domestic production supported by efficient production means and appropriate institutional frameworks, in order to ensure food stability even under exceptional circumstances.

2-2- Dimensions of food security:

Food security is commonly understood through four main dimensions:

- Physical availability of food: this dimension refers to the "supply side" of food security. It depends on the level of food production, stock levels, and net trade in food products.
- Physical and economic access to food: an adequate supply of food at national or international level does not, by itself, guarantee food security at the household level. For this reason, policy attention has increasingly focused on income, expenditure, markets, and prices as key factors in ensuring access to food.
- Utilization of food: this refers to how effectively the human body makes use of the nutrients contained in food. It depends on adequate intake of energy and nutrients, good care and feeding practices, food preparation methods, dietary diversity, and intra-household food distribution. Together with proper biological use of food, this determines the nutritional status of individuals.
- Stability over time of the three previous dimensions: even if food intake is sufficient today, a person is still considered food insecure if access to food is not stable over time. Climate shocks, political instability, unemployment, and rising food prices can all threaten this stability and negatively affect food security.

In order to achieve food security objectives, all four dimensions must be ensured simultaneously.

2-3 indicators of food security and its determinants

2-3-1 indicators of food security (dimensions of measurement):

Food security is usually measured through four main dimensions used by international organizations. The first is food availability, which relates to how much food is produced domestically, the level of food stocks, and the degree of self-sufficiency a country can achieve. The second dimension is access to food. This is less about production and more about whether people can actually obtain food in practice. It depends mainly on income levels, food prices, and how well transport and distribution systems function. The third dimension is food utilization, which focuses on what people actually eat and how the body benefits from it. It includes dietary quality and diversity, but also broader conditions such as access to clean water and adequate sanitation. The fourth dimension is stability. Here the concern is not only whether food is available or accessible today, but whether this situation remains consistent over time, especially when faced with shocks like economic crises or climate events (Khettaf, 2024, P.87-88).

2-3-2 factors affecting food security

Food security is influenced by a set of interconnected factors that may either support or hinder its achievement. From an economic perspective, poverty, unemployment, and low income levels are among the main constraints limiting people's ability to access food. On the demographic level, rapid population growth increases pressure on food demand, especially when it is not matched by a corresponding expansion in resources and production capacity. Political and security conditions also play a crucial role, as conflicts and instability often disrupt food production systems and supply chains. Environmental and natural factors are equally important. Events such as droughts, floods, and climate change have a direct impact on agricultural output and productivity. In addition, technological and agricultural constraints (such as limited use of modern technologies and insufficient investment in the agricultural sector) continue to hinder productivity improvements and, consequently, food security.

3- Theoretical link between comparative advantage and food security:

From a conceptual point of view, food security cannot be reduced to the volume of domestic production alone. The FAO framework defines food security through four interconnected dimensions: availability, access, utilization, and stability. It further clarifies that food availability is determined not only by domestic production, but also by stocks and net trade flows. In this sense, a country may still be considered food

secure even if it relies partially on international trade, provided that it has the capacity to finance imports, manage storage, diversify suppliers, and protect vulnerable groups from price volatility. Within this framework, the FAO makes a clear distinction between self-sufficiency and self-reliance. Self-sufficiency refers to producing all food domestically, while self-reliance refers to ensuring food availability through a combination of domestic production and imports. Accordingly, food security does not necessarily require limiting imports; rather, it requires an efficient agricultural sector and the ability to generate foreign exchange to import goods that are not efficiently produced domestically according to comparative advantage. This distinction is particularly relevant for Algeria, as it shifts the debate away from the objective of "eliminating imports" toward a more realistic goal: reducing strategic vulnerability at the lowest possible economic and water cost (FAO ،2008).

From an international trade perspective, the International Monetary Fund explains comparative advantage in a way that goes beyond the simple idea of producing what a country is "best" at in absolute terms. The focus is rather on relative efficiency, what a country can produce at a lower opportunity cost compared to other possible activities. When specialization follows this logic, it tends to improve overall welfare, since it allows a more efficient use of labor and capital and gives access to a wider range of technologies and inputs. In agriculture, this idea becomes more complex in the Algerian context, where water has become a binding constraint, often more critical than land. This means that evaluating comparative advantage purely through prices or productivity can be misleading. A more relevant approach would integrate water scarcity into the analysis, treating it as a key factor in determining what is truly efficient to produce locally. Seen from this angle, comparative advantage and food security in Algeria are not opposing logics. The tension only appears when one of them is applied in an extreme form. Excessive reliance on imports without safeguards such as storage capacity, supplier diversification, or social protection increases exposure to external shocks. On the other hand, pursuing full self-sufficiency in crops that are water-intensive and poorly suited to local conditions leads to rising costs and pressure on already limited resources (IMF, n.d.).

A more realistic strategy lies somewhere in between. It involves producing locally where conditions are favourable, specialising in products where efficiency gains are possible, and relying on imports for goods that are too costly in water and economic terms to produce

domestically. This is essentially what can be described as selective self-sufficiency.

Secondly. The state of the agricultural sector in Algeria

The agricultural sector in Algeria faces a number of structural challenges, among which water scarcity stands out as one of the most pressing.

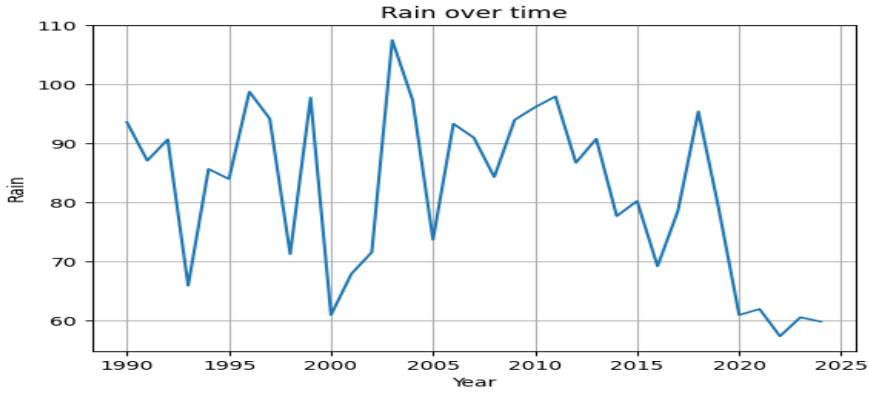
1- Water scarcity and the growing reliance on irrigation:

Water availability has become a central constraint for agriculture in Algeria. The country is increasingly affected by water stress, mainly due to limited and irregular rainfall, combined with rising demand from other economic sectors. Under these conditions, irrigation is no longer optional but has become necessary to maintain agricultural activity and secure even modest levels of production. However, this growing dependence on irrigation comes at a cost. It tends to increase production expenses, whether through the energy required to pump water or the significant investments needed for infrastructure such as dams, distribution networks, and irrigation systems. At the same time, it raises concerns about how efficiently water is being used, which explains the growing interest in more controlled techniques like drip irrigation as a way to limit waste while maintaining productivity. In practice, agriculture remains the largest user of water in Algeria, accounting for roughly 65% to 70% of total annual consumption in recent estimates (2023-2025). This reflects the nature of the sector, which relies heavily on irrigation to compensate for both the scarcity and irregularity of rainfall. Algerian agriculture also relies heavily on groundwater, which represents around 65% to 70% of the total water used for irrigation, particularly in desert and semi-arid areas. The remaining share is mainly supplied by surface water stored in dams. This strong dependence on groundwater is not without consequences, as it places increasing pressure on these reserves and raises concerns about their long-term sustainability.

In response to these constraints, Algeria has taken steps to improve water resource management. One of the notable directions has been the gradual use of treated wastewater in agriculture. By 2025, its use is estimated to have reached between 15 and 20 million cubic meters per year, with ongoing efforts to expand treatment facilities and improve reuse networks in order to increase this volume. Despite these initiatives, water resources remain under growing strain. Declining rainfall, more frequent drought periods, and rising demand continue to intensify

pressure on available supplies. This situation often leads to increased extraction of groundwater, accelerating its depletion and, in turn, affecting the sustainability of agricultural activity. Ultimately, this represents a significant constraint on efforts to strengthen food security.

Figure N°01: Evolution of rainfall in Algeria during the period (1990-2024)



Source: Prepared by the researcher based on various statistical data.

Looking at rainfall trends over the period (1990–2024), what stands out is not just fluctuation, but how pronounced it has become. Rainfall levels do not follow a stable pattern; instead, they shift between relatively wet years and periods of clear drought. Figure (1) suggests that these variations have become sharper in recent years, with a slight overall decline, which aligns with broader climate change patterns. This instability helps explain why the agricultural system in Algeria remains vulnerable, especially for rain-fed crops that rely heavily on regular precipitation. When rainfall becomes unpredictable, agricultural output becomes equally uncertain, often resulting in uneven yields and reduced reliability over time. From an economic angle, the consequences are quite direct. To offset irregular rainfall, farmers increasingly depend on irrigation, which raises production costs and intensifies pressure on water resources, particularly groundwater reserves. In this way, water variability does not only affect production levels; it also has implications for food security, especially in terms of ensuring consistent availability and stability. For this reason, rainfall variability should not be treated as a purely climatic issue. It is, in fact, a structural factor that is reshaping agricultural practices in Algeria. This makes it necessary to move toward more adaptive strategies, such as: improving water-use efficiency, expanding modern irrigation methods, and gradually shifting production toward crops that are better suited to local climatic conditions.

Other pressures add to this situation. Energy costs (especially fuel for machinery and transport) have been rising, and labour has become more expensive as well. At the same time, many input costs remain volatile, which makes it harder for farmers to plan production with any real precision. Even though agriculture in Algeria has recorded solid output, its contribution to GDP has exceeded roughly 35 billion USD in recent years (Algeria Invest, n.d.). These figures mask a cost problem on the ground. Higher production costs tend to squeeze profit margins, and this is felt most by small farmers, for whom reduced returns can threaten the viability of their activity.

These cost pressures also show up in the domestic market. Higher production costs often translate into higher food prices, which weigh on consumers and make local products less competitive compared to imports. In some cases, this reinforces reliance on imported goods to fill supply gaps, adding strain to the trade balance. Despite these constraints, public authorities continue to support the sector through incentive-based policies aimed at encouraging investment and improving productivity, with the broader objective of strengthening its contribution to food security.

These rising costs are also reflected in domestic market prices. As production becomes more expensive, agricultural products tend to be sold at higher prices, which increases the burden on consumers and reduces the competitiveness of local goods compared to imports. In some cases, this situation reinforces reliance on imported food to cover supply gaps, adding further pressure on the trade balance. Despite these constraints, public authorities continue to support the agricultural sector through incentive-based policies designed to encourage investment and improve productivity, with the aim of strengthening its role in achieving food security.

3- The impact of climate and water changes on agricultural production:

In recent years, Algeria has been increasingly affected by climate-related changes, particularly through irregular rainfall patterns and rising temperatures. These shifts have a direct impact on crop yields and make agricultural production less predictable and more exposed to risk. Changes in water availability (driven by declining rainfall and more frequent droughts) have clear consequences for agricultural productivity, especially for rain-fed crops. Higher temperatures further intensify the problem by increasing evaporation rates, which reduces the effectiveness of already limited water resources.

One of the most visible outcomes is the decline in crop yields. When water becomes scarce or irregular, plant growth is directly affected, especially during critical stages of the production cycle. At the same time, the growing reliance on groundwater to compensate for surface water shortages accelerates its depletion, raising concerns about long-term sustainability.

Rainfall variability also contributes to unstable agricultural output, as production levels fluctuate from one season to another, affecting both quantity and quality. In addition, climate pressures can degrade soil conditions, particularly through increased salinity, which further limits the ability of crops to adapt and grow under harsh environmental conditions.

To address these challenges, Algeria has adopted several strategies aimed at improving the sustainability of the agricultural sector. These include expanding the use of modern irrigation techniques, such as drip irrigation, to enhance water-use efficiency, as well as investing in water infrastructure through dam construction and better mobilization of surface resources. Efforts have also been made to promote more integrated approaches to water resource management.

Like many countries, Algeria is increasingly experiencing the effects of climate change, which have moved beyond abstract discussion to become part of everyday reality. These changes are visible in shifting weather patterns, rising temperatures, and the gradual degradation of ecosystems, all of which have direct implications for both livelihoods and the broader economy. Algeria is particularly exposed to these pressures, given its geographical location and the predominance of arid and semi-arid environments. In recent years, climate patterns have become less predictable, with noticeable increases in temperature and longer, more frequent periods of drought, especially in inland regions. These developments carry significant consequences for both water resources and agricultural activity. Since agriculture remains a key source of income in many rural areas, any disruption in climatic conditions directly affects production capacity and, by extension, local livelihoods.

One of the most immediate effects is the growing scarcity of water. Already a limited resource, water availability in Algeria depends largely on groundwater and seasonal rainfall. With declining precipitation and higher evaporation rates, water reserves are under increasing pressure. In addition, prolonged droughts (particularly in the southern and western parts of the country) have contributed to the deterioration of agricultural

land and a reduction in vegetative cover, further increasing the risk of desertification.

4- The impact of these challenges on economic efficiency (in light of comparative advantage):

Under conditions of water scarcity, rising production costs, and increasing climate pressures, the cost of producing certain agricultural goods locally (especially those that are water-intensive or climate-sensitive) tends to exceed their cost on international markets. In such cases, resources are not allocated in the most efficient way, and overall economic efficiency declines.

This observation is consistent with the logic of comparative advantage, which suggests that countries gain more when they specialize in goods they can produce at relatively lower cost, and import those that are less efficient to produce domestically. From this perspective, attempting to produce all agricultural goods locally, regardless of their cost, may lead to misallocation of resources and higher aggregate costs. However, applying this reasoning in the Algerian context is not straightforward. Food security considerations (particularly for strategic products such as cereals) introduce an additional layer of complexity. Concerns related to supply disruptions and price volatility in global markets make it necessary to maintain a certain level of domestic production, even when it is not the most cost-efficient option. The issue, therefore, is less about choosing between efficiency and self-sufficiency, and more about finding a workable balance between the two. This requires flexible agricultural policies that take into account both economic logic and the country's structural and environmental constraints. In practice, some locally produced goods may remain more costly than imports, which places them at odds with the strict application of comparative advantage.

Thirdly. Self-sufficiency between economic necessity and strategic considerations

While the logic of comparative advantage highlights the benefits of international specialization, the pursuit of agricultural self-sufficiency in Algeria cannot be understood purely in economic terms. It is also shaped by practical and strategic concerns. Recent global disruptions (particularly those affecting supply chains and food prices) have shown how fragile excessive dependence on external markets can be, especially for essential goods. In this context, products such as cereals (notably wheat) and milk illustrate the dilemma quite clearly. Producing them

locally is often costly, given water constraints and high input costs. Yet relying entirely on imports exposes the country to price volatility and potential supply restrictions. For this reason, Algeria tends to maintain a minimum level of domestic production, even when it is not the most efficient option economically. At the same time, pushing too far toward full self-sufficiency can create its own inefficiencies. Directing resources toward goods that are expensive to produce locally (such as water-intensive crops) may lead to higher overall costs and place additional strain on already scarce resources. Wheat is a good example here: its production requires significant water inputs, while it can often be imported more cheaply from countries with more favorable conditions.

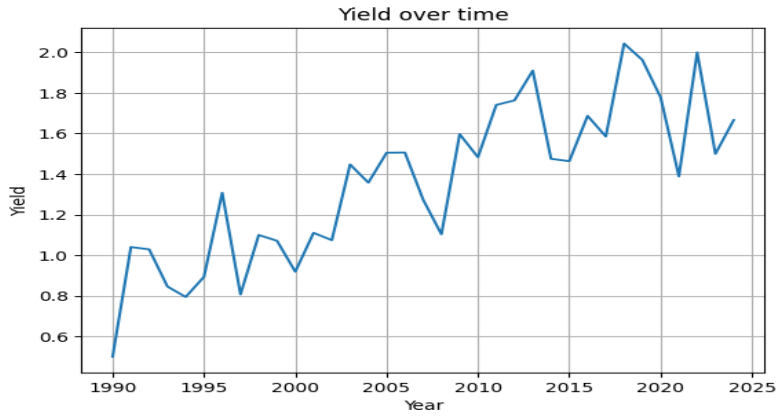
In practice, the challenge is not to choose one approach over the other, but to strike a workable balance. This implies a more selective strategy, based on three complementary directions:

- Maintaining domestic production of key strategic goods such as wheat and milk.
- Strengthening output in products where Algeria has a relative advantage, such as dates and certain vegetables.
- Using international trade to cover remaining needs in a cost-effective way.

Wheat, in particular, highlights the limits of local production under existing constraints. Algeria continues to rely heavily on imports, which have been estimated at around 8 to 9.5 million tons annually over the period (2023-2025) (World Grain, 2025), with projections of approximately 9.2 million tons for the (2025-2026) season. These figures point to a clear gap between domestic production and consumption, as local output covers only about one-third of demand.

From the perspective of comparative advantage, this reliance is largely explained by the relatively high cost of producing wheat domestically, especially under conditions of water scarcity and irregular rainfall. However, this dependence also raises strategic concerns related to global price fluctuations and supply risks, which is why maintaining a baseline level of domestic production remains a key policy objective in ensuring food security.

Figure N°02: Trends in agricultural crop productivity in Algeria (1990-2024)



Source: prepared by the researcher based on various statistical data.

An analysis of crop productivity trends over the period (1990-2024) as shown in Figure (2), reveals noticeable fluctuations in output levels, despite an overall upward tendency. However, this improvement is not stable, as productivity varies significantly from one year to another. When this pattern is compared with rainfall developments, a clear link emerges between rainfall stability and agricultural performance. Years of drought or reduced precipitation are generally associated with lower productivity, while relatively wetter years tend to record better outcomes. This highlights the strong sensitivity of the agricultural sector in Algeria to climatic conditions, particularly given its partial dependence on natural rainfall. In this sense, the instability of productivity cannot be explained solely by technological or managerial limitations. It is closely connected to variations in water availability. This reinforces the need to further develop efficient irrigation systems and adopt production techniques that are more resilient to climate variability.

Fourthly. Towards an integrated approach between self-sufficiency and international trade

Building on the earlier discussion of comparative advantage, the current structure of Algerian agriculture, and the limitations of full self-sufficiency, a key policy implication emerges: Algeria should prioritize resilience rather than complete self-sufficiency. Within the framework of the Food and Agriculture Organization / Committee on World Food Security (Food and Agriculture Organization / Committee on World Food Security), food security is understood as more than domestic

production alone. It is also shaped by availability, access, utilization, and stability. In this regard, FAO guidance consistently stresses that effective food security strategies require a balance between domestic production and international trade, rather than reliance on a single pillar (Committee on World Food Security [CFS], n.d.).

1- From diagnosis to policy direction:

The economic logic behind this shift is well established. Comparative advantage argues that countries achieve higher welfare when they specialize in activities where their relative opportunity costs are lower, while relying on trade to obtain other goods more efficiently. The International Monetary Fund similarly highlights that trade contributes to higher living standards through specialization and improved resource allocation. At the same time, the Food and Agriculture Organization (Food and Agriculture Organization) emphasizes that agricultural trade plays an important role in balancing food deficits and surpluses across countries, improving availability, and supporting price stability. However, it also clearly underlines that trade alone is not sufficient to ensure food security. Domestic production capacity and rural incomes remain essential components of a stable and sustainable food system (IMF, n.d.).

This issue is particularly important for Algeria, because policy debates are often framed in a binary way between "producing everything locally" and "depending on imports." However, empirical evidence does not support either extreme. In fact, the OECD's 2025 report on supply chain resilience indicates that large-scale reshoring efforts could reduce global trade by more than 18% and lower global real GDP by over 5% (OECD, n.d.), without delivering sustained improvements in resilience. On the contrary, such policies may even reduce GDP volatility in more than half of the economies studied. In other words, resilience is not achieved by closing economies, but rather through diversification, stronger logistics systems, adaptability, and effective risk management.

From this perspective, and based on the previous discussion, Algeria's food security strategy should combine selective domestic production, strategic imports, productivity gains driven by technology, and broader policy reforms aimed at reducing waste and improving water-use efficiency. This approach is consistent with comparative advantage theory, as well as the FAO's multidimensional understanding of food security.

2- Sectors in which Algeria should strengthen production to enhance food security

Algeria's structural constraints provide an important starting point for identifying priority areas. Agriculture remains a significant sector, contributing about 14% of GDP in 2024 according to World Bank data. However, this economic role is accompanied by severe water scarcity pressures. The World Bank reports that internal renewable freshwater resources stand at only 247 m³ per capita (2022), reflecting a high level of water stress. Based on FAO/AQUASTAT-derived data, agriculture accounted for around 67.4% of total freshwater withdrawals in 2022. The World Bank further notes that rising temperatures, declining rainfall and recurring droughts are increasingly affecting agricultural output, food prices, and import dependence (World Bank, n.d.). These structural constraints are clearly reflected in the cereals balance. FAO estimates put Algeria's cereal production at around 4.2 million tons in 2025, while import needs for the 2025/2026 season reach approximately 14.6 million tons, about 8% higher than the five-year average. FAO projections also indicate that wheat will remain the main imported commodity, alongside maize imports of up to 5 million tons, largely driven by strong demand from the poultry feed sector.

USDA estimates similarly suggest wheat imports of around 9.2 million tons for the 2025/2026 season, following levels exceeding 9.5 million tons in 2023/2024 (FAO, n.d.). These figures provide clear empirical evidence of the structural difficulty and high cost of achieving full self-sufficiency in basic food commodities under current conditions. At the same time, Algeria shows stronger or emerging specialization potential in certain agro-food sectors better aligned with its agro-climatic conditions. In 2024, the country exported about USD 87.1 million worth of fresh and dried dates (26.48 million kg), with France and Morocco among the main destinations.

The World Intellectual Property Organization (highlights that ''*Deglet Nour''* dates from Tolga derive their quality and reputation from a specific geographical and human environment (WITS, n.d.), which is a clear example of a place-based comparative advantage that can support sustainable value-added agricultural trade. Olive oil represents another, although less developed, case. According to World Bank data, exports of virgin olive oil and related products reached only around USD 1.88 million in 2024. However, sector data from the International Olive Council show production increasing from 64,000 tons in 2023/2024 to 85,000 tons in 2024/2025 (WITS, n.d.), with further growth expected if current momentum continues. This gap between rising production and

weak export performance suggests that the constraint is not only agricultural output, but also processing capacity, marketing systems, certification, and market access. A similar situation applies to horticultural products. A sector study commissioned by the Dutch Ministry of Agriculture notes that Algeria has more than 500,000 hectares dedicated to vegetable production and over 21,000 hectares of greenhouse farming. At the same time, it stresses the weak technological base of the sector and its significant potential for modernization, explicitly linking productivity gains and better resource efficiency to technological upgrading and international cooperation.

Therefore, the strategic implications do not suggest that Algeria should abandon the production of staple crops. Rather, they point toward the need for a more diversified agricultural structure. Products such as dates already demonstrate a clearly established export capacity, while olive oil and greenhouse crops still show promising potential that remains underexploited. At the same time, cereals remain strategically important, but achieving full domestic self-sufficiency in these crops under current water constraints and production costs appears structurally difficult. This makes an undifferentiated self-sufficiency objective less realistic than a more selective production strategy. Such a conclusion is consistent with Algeria's water resource limitations, its continued reliance on cereal imports, and the current structure of its agro-food trade. In this sense, a selective production strategy appears more economically and environmentally viable than a uniform self-sufficiency model.

3- Areas where imports remain an economically rational option within an integrated production (trade model):

A practical Algerian approach can be understood as relying on two complementary tracks. The first consists of maintaining and strengthening domestic capacity in strategic staple crops, particularly wheat, barley, and related animal feed systems, in order to reduce full exposure to external shocks. The second involves directing scarce resources, especially water, technology, and logistics investment towards higher value-added agricultural value chains where Algeria has stronger competitive potential, such as dates, olive oil, and selected horticultural products. This approach is fully consistent with the Food and Agriculture position, which stresses that food security policy should balance domestic production and international trade, rather than treating them as substitutes. Within this framework, imports are not interpreted as a policy failure, but rather as a rational component of the system when goods are water-intensive, land-intensive, or structurally costly to

produce locally. The key issue is therefore not whether imports exist, but whether they are managed strategically or passively.

Given that FAO projections indicate Algeria's wheat supply will continue to rely mainly on the Black Sea region, and that USDA assessments point to an increasing role of Russian wheat in Algerian imports, the appropriate response is not to reject trade, but to reduce concentration risk through diversification of suppliers, improved stock management, and stronger logistics systems. In this context, strategic reserves become particularly important. According to USDA-related reporting, Algeria has launched a program to build 30 silos and 350 storage centers, increasing public grain storage capacity from about 5 million tons to nearly 9 million tons (USDA FAS, 2025)**.** The country is also expanding rail connections to grain storage facilities. While such infrastructure does not eliminate import dependence, it strengthens the stability pillar of food security by reducing vulnerability to shipping delays, procurement cycles, and sudden price shocks.

In this sense, the integrated model is neither a protectionist form of self-sufficiency nor a fully liberal market-based approach. Rather, it is a managed system in which Algeria maintains a domestic production base for strategically important food products, while covering structural deficits through diversified external suppliers, and investing more selectively in value chains where it can generate higher returns per hectare, per cubic meter of water, and per unit of public support. This rationale is consistent with the Food and Agriculture Organization framework on trade and food security, as well as with the evidence provided by the Organisation for Economic Co-operation and Development on resilience.

4- Technology and innovation as a key variable:

Technology plays a central role because it can partially offset the resource constraints that make full self-sufficiency highly costly. The Food and Agriculture Organization highlights that precision agriculture using sensors, GPS systems, satellites, and aerial imagery to generate site-specific information. This can significantly improve irrigation efficiency while minimizing environmental impacts. A similar direction is recommended by the World Bank for Algeria, which stresses the need to expand climate-resilient agriculture through modern irrigation systems, wastewater reuse, and the adoption of drought-resistant crops. These recommendations are not purely theoretical. The International Center for Agricultural Research in the Dry Areas reports that conservation agriculture and crop-livestock systems in Algeria reduced irrigation water use by around 30-40%, while increasing barley and

wheat yields by two to three times. In a broader regional programme focusing on wheat across several countries, ICARDA also found that improved varieties and agricultural packages increased wheat productivity by approximately 30%, alongside significant gains in annual production (ICARDA, n.d.).

These results are particularly relevant for Algeria. The key contribution of such technologies is not that they make all crops globally competitive, but that they narrow the productivity gap and increase output per unit of scarce water. In other words, innovation does not replace comparative advantage; it improves the efficiency of what can realistically be produced domestically under environmental constraints. This point is particularly important from an analytical perspective. Comparative advantage is not entirely fixed over time. The World Bank notes that Algeria experienced strong gains in agricultural productivity over the past two decades, particularly between 2008 and 2018, during the implementation of the National Agricultural Development Plan. This suggests that public investment, technology diffusion, and institutional support can actively reshape productive capacity, rather than merely reflect existing conditions. In other words, while Algeria cannot fundamentally alter its climate or hydrological constraints, it can improve productivity within those constraints.

In horticulture, the technological agenda becomes even clearer. A greenhouse-based study indicates that one of the key productivity shifts required in Algeria is the transition from traditional manual fertilization to semi-automated systems, combined with better control of irrigation and fertilizer application. Additional recommendations include substrate-based cultivation, reuse of treated wastewater, rainwater harvesting, improved water storage systems, and better climate control in greenhouses. The development of on-farm cold storage facilities is also highlighted as a way to reduce post-harvest losses and improve market efficiency.

These are not abstract proposals; they are practical interventions that directly enhance water productivity, product quality, and marketability.
Furthermore, Food and Agriculture Organization works on non-conventional water resources in the Maghreb adds another dimension. Reports show that Algeria and neighboring countries are increasingly adopting innovative approaches to wastewater reuse and treated effluent irrigation in agriculture, expanding the knowledge base on alternative water sources. In a country where groundwater is heavily exploited and increasingly stressed, these measures are not marginal options but essential components of long-term sustainability in irrigated agriculture.

5- Policy reforms required for the success of the model:

If the intended outcome is a selective, technology-driven balance between domestic production and international trade, then public policy needs to be reoriented around a limited set of strategic priorities: efficient water use, innovation, effective governance, and improved logistics. Evidence from Algeria itself indicates that such an approach is feasible. The World Bank finds that agricultural productivity increased significantly during the implementation of the National Agricultural Development Programme. This improvement was supported by substantial public investment, estimated at around 200-300 billion Algerian dinars annually, directed toward mechanisation, irrigation infrastructure, and rural development (World Bank, 2025). This experience offers an important lesson: productivity responds positively when public support is linked to productive assets and system-level capabilities, rather than being driven only by quantitative output targets. In this sense, policy effectiveness depends not simply on the scale of spending, but on the quality of allocation and its alignment with long-term structural efficiency goals.

5-1- Water governance reform:

The first and most urgent policy priority concerns water governance. Algeria cannot build its agricultural future on the continuous expansion of water extraction under conditions of increasing scarcity. Evidence from the International Center for Agricultural Research in the Dry Areas shows that irrigation water management in Algeria has historically relied on expanding supply and maintaining subsidies, even as scarcity has intensified. Studies on greenhouse agriculture further indicate that groundwater is used intensively, often beyond natural recharge rates. At the same time, the World Bank warns that declining rainfall and rising temperatures are aggravating long-term water stress. Taken together, these findings point to the need for a coherent policy package centered on regulated irrigation, stricter monitoring of groundwater aquifers, reuse of treated wastewater, and water-saving technologies. In addition, incentive structures should be redesigned to encourage the allocation of water toward higher-value and more productive uses, rather than low-efficiency consumption patterns.

5-2- Research, extension, and innovation diffusion:

The second major reform priority concerns agricultural research, extension services, and the dissemination of innovation. Cooperation between Algeria and the International Center for Agricultural Research in the Dry Areas (International Center for Agricultural Research in the Dry Areas) covers key areas such as cereals, legumes, integrated farming

systems, water management, and capacity building. ICARDA's soil, water, and agriculture programmes combine smart irrigation practices, drought-resistant crop varieties, crop rotation systems, and scalable extension mechanisms (ICARDA, 2025). This implies that research funding should not remain confined to laboratory-based activities. Instead, it should be expanded to include adaptive field trials, seed multiplication systems, digital extension services, farmer training programmes, and advisory structures capable of translating scientific innovations into large-scale agricultural practice.

5-3- Improving the targeting of public subsidies:

The third reform priority relates to improving the targeting of government subsidies. The World Bank's 2025 Algeria Economic Update recommends a gradual reform of subsidies in order to make them more efficient and better targeted. Similarly, the International Monetary Fund argues that subsidy reform can create fiscal space for more targeted transfers and increased investment in adaptation policies. In the agricultural sector, this implies a shift away from broad, untargeted support toward public spending with clearer and more measurable returns. Priority investments would include modern irrigation systems, certified seeds, drought-resistant genetic varieties, local mechanisation, soil testing services, digital irrigation advisory tools, and cold storage infrastructure. It also involves supporting quality-based value chains in sectors where Algeria has either a strategic production rationale or demonstrated competitive potential. This conclusion is consistent with the empirical evidence previously discussed on productivity performance, subsidy inefficiencies, and the need to redirect public finance toward adaptation-oriented investment.

4- Infrastructure and supply chain organization:

The fourth reform priority concerns infrastructure development and the organization of agricultural supply chains. In the cereal sector, ongoing programs related to grain silos and railway logistics are moving in a positive direction. However, in horticulture and export-oriented agriculture, the constraints remain more structural. A study on greenhouse agriculture indicates that farms often lack adequate cold storage facilities, with most produce being sold immediately in local markets. Supermarket distribution channels and export-oriented market structures remain limited, and value addition is still relatively low. The same report identifies improvements in cold-chain logistics, certification systems, post-harvest handling, processing capacity, and quality control as key determinants for reducing losses and enhancing export competitiveness. In other words, the challenge for Algeria is no longer

limited to increasing production. It increasingly involves improving storage, grading, certification, processing, and transportation systems in order to strengthen overall value chain performance. This leads to an important policy implication: agricultural policy should be assessed on a crop-by-crop and region-by-region basis, rather than relying on a single national self-sufficiency benchmark. Northern coastal zones, highlands, oasis systems, and greenhouse clusters do not face the same constraints, nor do they generate the same economic returns. A comparative advantage approach is only effective when it is spatially differentiated and grounded in reliable data on crop performance, water efficiency, logistics costs, and market access. The same greenhouse study also highlights the limited availability of sectoral data and the difficulty of making evidence-based decisions at the farm level, reinforcing the need for improved agricultural statistics and stronger monitoring systems.

Therefore, Algeria should not define food security as producing everything domestically, nor should it equate efficiency with simply importing the cheapest available goods. The workable middle path lies in an integrated strategy that maintains domestic capacity in strategic staple commodities, covers structural deficits through diversified external suppliers, and directs technology, finance, and logistics toward value chains in which Algeria can generate higher returns from its limited land and water resources. This includes, most notably, dates, and potentially olive oil and selected horticultural crops, provided that existing value-chain constraints are effectively addressed. This approach is also consistent with Algeria's broader development objective of economic diversification away from hydrocarbons. The World Bank highlights the country's continued reliance on hydrocarbon exports, while its productivity analyses emphasize that technology transfer, private investment, and improved performance in non-hydrocarbon sectors are essential for strengthening economic resilience. In this sense, an integrated food security strategy would not only enhance supply stability, but also contribute to building a more diversified, climate-aware, and economically rational agro-food system.

Conclusion:

In light of the findings of this study, it becomes clear that the issue of food security in Algeria cannot be reduced to the objective of full self-sufficiency. Rather, it should be understood within a more complex framework that balances economic efficiency with strategic considerations. The analysis shows that structural constraints, most notably: water scarcity, high production costs, and the impacts of climate

change significantly limit Algeria's ability to achieve complete self-sufficiency, particularly in water-intensive agricultural commodities such as cereals.

The study also indicates that while comparative advantage theory remains useful for improving resource allocation and enhancing efficiency, it cannot be applied in a rigid or absolute manner to a strategic sector such as food. Heavy reliance on international markets exposes the country to risks linked to price volatility and disruptions in global supply chains. Accordingly, the relationship between comparative advantage and food security in the Algerian case should be understood as one of conditional complementarity rather than opposition. Within this context, the most appropriate approach is a "selective self-sufficiency" model, based on a calibrated balance between domestic production and international trade. This involves maintaining a minimum level of domestic production for strategic food items, specializing in products where Algeria holds relative advantages, and relying on external markets to efficiently cover structural deficits. The study also highlights the central role of technology and innovation in improving productivity and narrowing the food gap, particularly under conditions of water scarcity.

Ultimately, achieving food security in Algeria does not require economic closure. It requires instead the development of a flexible and sustainable agricultural system capable of adapting to environmental and economic change, grounded in efficient water governance and a functional integration between domestic production and international trade, thereby strengthening the economy's resilience to external shocks and ensuring long-term food stability.

Recommendations:

Based on the findings of this study, a set of policy recommendations can be proposed as follows:

1- Adopt a selective self-sufficiency model by supporting domestic production of strategic commodities (such as wheat and milk), while specializing in products where Algeria holds a comparative advantage.

2- Improve water resource management through:

- Wider adoption of modern irrigation techniques (drip and smart irrigation systems)
- Enhanced reuse of treated wastewater
- Stricter monitoring of groundwater exploitation

3- Direct investment toward high-value agricultural value chains, particularly:
- Dates
- Olive oil
- Greenhouse and protected agriculture
4- Strengthen the role of agricultural technology by:
- Supporting research and development
- Promoting climate-smart and resilient farming systems
- Improving crop productivity through certified and improved seed varieties
5- Diversify food import sources to reduce exposure to international market risks, while:
- Establishing adequate strategic food reserves
- Upgrading storage and transport capacities
6- Reform agricultural subsidy policies to improve efficiency by:
- Targeting productivity rather than output volume alone
- Supporting small farmers and improving their competitiveness
7- Develop agricultural infrastructure and supply chains, particularly in:
- Cold storage systems
- Transportation networks
- Agricultural marketing systems
8- Adopt a spatially differentiated agricultural policy that takes into account regional specificities (north, highlands, south).

Ultimately, achieving food security in Algeria depends on moving from a narrow self-sufficiency paradigm toward a broader logic of efficiency and sustainability, based on smart agricultural policies that balance limited resources with global challenges.

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