Institute of Natural and Life Sciences

Production Végétale / Semestre 6 / Section A

Chapter II:

agricultural and agri-food policies

Agricultural and agri-food policies are government-led frameworks governing food production, safety, trade, and sustainability.

I. Agrarian reforms in Algeria

Algeria has undergone comprehensive agricultural reforms to achieve food security, beginning with self-management and the agrarian revolution (1971), and progressing to restructuring and agricultural investments. Currently (2026), the focus is on supporting production, modernizing desert agriculture, and encouraging investment, leading to increased production and price stability.

Agricultural policy in Algeria has undergone two main phases during the half-century since independence, both linked to the economic reforms the country has experienced. These reforms all aimed to develop and improve the agricultural sector. However, not all of them were successful, but they did underscore the importance of agriculture to the national economy and the significant challenges it still faces. These phases are summarized below.

1. Meaning Agrarian reform:

Agrarian reform is a set of legislative and executive measures taken by the state to change the structure of agricultural land ownership and tenure, with the aim of eliminating feudalism, distributing land more equitably among small farmers, and improving agricultural productivity and social justice. This includes setting a maximum limit on private ownership and seizing surplus land for redistribution.

2. Objectives of agricultural reform

The goals of agricultural reform can be summarized in several key objectives, varying in importance from one country to another, and centered around making the agricultural sector capable of:

2.1. Meeting the nutritional needs of the population in the required quantity and quality: Achieving this goal is considered one of the priorities of

agricultural reform policies in developing countries, most of which suffer from low levels of nutrition and poor quality of food. Therefore, the increased demand for natural resources has a distinct economic characteristic in these countries due to the high rate of population growth on the one hand, and the high elasticity of internal demand on the other hand, which makes every increase in income characterized by an increase in demand for food resources. It can be noted here that the shortage of food supplies and the high prices have been behind many social disturbances in many countries.

2.2. Providing raw materials for agriculture: Many processing industries for canning and pasta production depend on raw materials of agricultural origin, and therefore their continuation and development depend on the continuation and development of the production of agricultural raw materials in the required quantities and specifications.

2.3. Job creation: Here we distinguish between two approaches according to the stages of economic and social development that the society has undergone. In the early stages of the development process, recovery programs in the agricultural sector are required to create new job positions to absorb the unemployed rural workforce that the emerging industries in cities cannot absorb. Reports from the Food and Agriculture Organization of the United Nations (FAO) indicate that there are still untapped employment opportunities in many developing countries within the agricultural sector, especially if irrigation projects, soil conservation, and other components of modern agriculture are launched, which require more work due to the adoption of intensive crop rotations.

2.4. Creating an economic surplus that can be accumulated: The economic history of developed countries confirms that the economic surplus achieved in the agricultural sector is behind the launch of their economic development.

2.5. Opening Markets for Industrial Products: Reforming and developing the agricultural sector will open up broad markets for industrial products for two reasons:

First, developing the agricultural sector necessitates the use of more inputs and equipment, such as machinery, fertilizers, and pesticides, all of which are industrial products.

Second, agricultural development is generally accompanied by an increase in farmers' incomes, enabling them to increase their demand for industrial products, including consumer goods and durable goods that were previously beyond their purchasing power.

3. Historical stages of agricultural reforms

The agricultural sector has undergone numerous transformations aimed at improving its condition, increasing agricultural production, raising per capita output, increasing its contribution to the gross domestic product, and ultimately improving the standard of living of the population. Among the most important of these transformations were the following:

- **Self-Management (1964-1971)**

The situation created by the sudden and mass departure of the settlers in the aftermath of independence led the state to focus its attention on these wealthiest investments in the country. The priority given to the self-managed sector was recognized as an economic necessity due to the significant capital it represented, and as a historical obligation based on equality and social justice towards the former workers of the settlers and their families.

- **The Agrarian Revolution (1971–1979)**

The Agrarian Revolution reinforced the socialist orientation of the agricultural economy by nationalizing the largest private holdings belonging to nationalists.

It also nationalized uncultivated lands and adopted a collective management model that was imposed on investors benefiting from redistribution, as well as the state's organization of the supply chains for inputs, production processing, and marketing. This period was also marked by the establishment or strengthening of a large number of new bodies for research, information, and agricultural extension, as well as the development of basic infrastructure and facilities in rural areas.

- **Initial Reforms of the Agricultural Economy (1979-1999)**

During this period, a number of reforms were gradually implemented. These included the first experiments in market liberalization, followed by the restructuring of socialist farms, which were transformed into collective and individual agricultural holdings, while the right of perpetual usufruct was

introduced (Law 87-19). Furthermore, some of the lands nationalized during the agrarian revolution were returned to their former owners (Land Orientation Law of 1990), and the cooperative system that emerged from the agrarian revolution was reorganized.

- **The Stabilization, Reconciliation, and Emergency Action Phase (2000-2008)**

Following the gradual return of security to the country, coinciding with the recovery of public finances, Algeria launched the National Agricultural Development Plan (2000-2004). This plan operated within a new framework that encouraged private initiative, even though its main tools and procedures remained subject to administrative regulations. Support was directed towards agricultural investments to increase production and productivity, and to accelerate the agricultural sector's contribution to meeting the country's food needs. Significant efforts within the budget allowed for increased imports of agricultural equipment, and the relevant technical and administrative bodies continued their work in providing guidance and extension services, adapting them to the new and diverse demands of producers.

- **The Agricultural and Rural Renewal Phase (2009-2014)**

This phase highlights a new governance model for the agricultural sector and rural regions, centered around three fundamental and integrated pillars:

A. Rural Renewal: This program focuses on the social aspects of rural life, targeting families in areas characterized by difficult living conditions (mountains, plains, deserts). The program aims to achieve harmonious and sustainable development for rural regions within an economic and social framework.

B. Agricultural Renewal: This program focuses on the economic dimension of the agricultural sector and its profitability to ensure the country's food security. It encourages the intensification and modernization of production on farms and their integration into a "branch" approach to align the numerous agricultural investment support initiatives undertaken in the sector with the goal of creating added value along the entire value chain from production to consumption. This aims to integrate stakeholders and modernize branches for sustainable, internal, and sustained growth in agricultural production.

Approximately ten branches of widely consumed products were identified as priorities: cereals, pulses, milk, red and white meat, potatoes, processing tomatoes, olive and date palm cultivation, and seeds.

C. Human Capacity Building and Technical Assistance Program: This pillar addresses the difficulties faced by stakeholders in integrating into the implementation of this new policy, particularly due to the new roles and the separation of different organizational structures. This program aims to:

- ✓ Modernize agricultural management methods.
- ✓ Invest in agricultural research, training, and extension services to encourage the development and rapid adoption of new technologies in production settings.
- ✓ Strengthen the material and human resources of all institutions and bodies responsible for supporting producers and operators in the sector.
- ✓ Enhance seed certification and technical oversight.

Agriculture in Algeria has undergone a long transition from "directed socialism" to "economic liberalization," with reforms, particularly after 2000, demonstrably positive impacts on agricultural output. However, achieving complete self-sufficiency requires deeper reforms focused on reclaiming desert land, managing water resources, and modernizing technologies.

II. Rural, agricultural and sustainable development in arid zones

Sustainable rural agricultural development in arid regions depends on managing scarce water resources, diversifying crops to enhance resilience to climate change, and adopting agroecological technologies to ensure food security and protect the environment. Effective strategies include modernizing irrigation systems, combating desertification, and supporting smallholder farmers.

1.1. Rural development

Rural development refers to the integrated process aimed at improving the quality of life and living conditions of rural populations through the development of economic, social, and service sectors. This ensures higher income levels, the provision of basic services, and a reduction in migration to cities.

Rural development is considered a gateway to achieving social justice by reducing poverty, narrowing regional disparities, and ensuring the sustainability of natural resources.

1.2. Challenges Facing Rural Development

• Insufficient investment in rural areas.

• Increasing migration from rural to urban areas.

• Degradation of natural resources due to overexploitation.

• Lack of modern technology and weak infrastructure.

• Limited participation of women in some rural communities.

2.1. The concept of sustainable development

The report issued by the Human Resources Institute included twenty comprehensive definitions of sustainable development, covering social, environmental, economic and technological aspects, which are:

- **Social aspect:** This refers to efforts to stabilize population growth and improve the level of health and education services, with a particular focus on rural areas.
- **The environmental aspect:** This refers to the use of natural resources such as agricultural land and water resources. The United Nations Development Programme defines sustainable development in this context as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.
- **The economic aspect:** Sustainable development means utilizing available resources to improve living standards, in addition to reducing energy and resource consumption.
- **The technological aspect:** This means transitioning society to an era of clean industries that rely on environmentally friendly technologies, thereby reducing emissions of polluting gases that contribute to global warming and ozone layer depletion.

The World Commission on Environment and Sustainable Development and the Brundtland Report of 1987 defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

2.2. Dimensions of Sustainable Development

Sustainable development is influenced by the economic, social, and environmental dimensions, which interact to shape sustainable development.

- **The Economic Dimension:** A set of objectives has been identified to achieve sustainable development in its economic dimension:

- Promoting sustainability in water use by increasing its efficiency and reducing waste.

- Increasing per capita national income.

- The economic dimension is considered fundamental to achieving sustainable development, as it involves promoting sustainable investment and developing economic activities that minimize negative environmental impact, in addition to focusing on the production of environmentally friendly goods and services.

- **The social dimension:** Achieving sustainable development in the social dimension requires setting a set of goals, including:

- Providing healthcare and education to members of society.

- Achieving equity in the distribution of wealth and national income.

- **The environmental dimension:** The environmental dimension is achieved through:

- Combating desertification.

- Raising awareness among individuals about existing environmental challenges.

- The contribution of the green economy to achieving sustainable development.

3.1. Definition of sustainable agricultural development

Sustainable agricultural development is a set of policies and procedures that are introduced to change the structure and framework of the agricultural sector, leading to the optimal use of agricultural resources and an increase in agricultural production and productivity, with the aim of raising the rate of increase in national income and achieving a high standard of living for members of society across different generations without harming the environment.

In 1988, the Food and Agriculture Organization of the United Nations (FAO) defined sustainable agricultural development as the management and maintenance of natural resources in such a way that institutions and technologies ensure current and future human requirements, and work to conserve land, water, plant and animal genetic resources, and are technically and economically acceptable to society. It also adds that it is development that contributes to improving resource efficiency and enhancing resilience, and ensuring social equity (the social responsibility of agriculture and food systems), with the aim of ensuring food security and nutrition for all, now and in the future.

3.2. Principles of Sustainable Agricultural Development:

The 1992 Rio Earth Summit Final Papers included the following principles for sustainable agricultural development:

• Human beings are at the heart of the concerns for a healthy and productive life in harmony with nature, through respect for present and future generations.

• Countries acting in good faith have the sovereign right to exploit their resources without interfering in the affairs of other countries, and must immediately report any unsafe conditions or potentially harmful activities.

• Environmental protection is an integral and inseparable part of sustainable development, which aims to protect and restore the health and integrity of the Earth's ecosystem.

• Sustainable development is contingent upon combating poverty and reducing disparities in living standards, and the interests and needs of all countries, especially the most vulnerable, must be taken into account.

• Unsustainable production and consumption patterns must be eliminated in favor of sustainable ones, the spread of which should be supported.

• All citizens should have access to information and participate in decision-making. Sustainable development must benefit from the active participation of all social groups, especially women, youth, and local communities.

3. 3. sustainable agricultural development goals

The key objectives of sustainable agricultural development can be summarized as follows:

- **Ensuring food security and nutrition:** Eliminating hunger and malnutrition by increasing crop productivity and ensuring food availability.
- **Protecting and regenerating environmental resources:** Improving soil quality, conserving water, protecting biodiversity, and minimizing negative environmental impacts.
- **Transitioning towards economic sustainability:** Enhancing resource efficiency and increasing farmers' incomes to ensure the continuity of agricultural activity.
- **Adapting to climate change:** Implementing resilient agricultural practices that enhance resilience to climate change and mitigate its impacts.
- **Social justice and rural development:** Improving working conditions in the agricultural sector, raising the standard of living for rural residents, and reducing poverty.
- **Enhancing the efficiency of food systems:** Adopting sustainable production methods that promote diversity and use local resources responsibly.

Sustainable agricultural and rural development enables sustainable production and environmental protection, delivering tangible benefits to forests, wildlife, water, and soil, while minimizing negative impacts on agriculture and maintaining or increasing production. Furthermore, the focus on sustainability has had a strong influence on the emergence of international governmental mechanisms related to biosafety and biodiversity.

III. technological progress in agriculture

Technological advancements have revolutionized agriculture, or what is known as smart agriculture, transforming it into a precise and sustainable sector using artificial intelligence, drones, and the Internet of Things. These technologies aim to increase productivity and improve crop quality while reducing the consumption of resources such as water and energy.

Historically, agriculture has relied on traditional methods that can be slow and inefficient. However, technological innovations have encouraged a shift from these methods to more advanced techniques. These include precision agriculture, the use of drones for crop monitoring, and smart irrigation systems.

These tools improve resource management and reduce waste, ultimately leading to increased agricultural yields.

1. The Concept Agricultural technology

Agricultural technology is essential for addressing economic and environmental challenges. By applying modern agricultural technologies, countries can enhance food security and increase their competitiveness both domestically and internationally. Innovation in this sector not only contributes to increased productivity but also helps reduce the environmental impact of traditional farming practices.

Agricultural technology is defined as the application of scientific, engineering, and digital technologies to enhance agricultural productivity, efficiency, and sustainability. It encompasses everything from traditional machinery to modern artificial intelligence, the Internet of Things, and biotechnology, all designed to improve crop yields and livestock management.

2. Agricultural Technology Methods

Agricultural technologies can be divided into five main groups: mechanical technology, biotechnology, chemical technology, infrastructure technology, and organizational technology.

2.1. Mechanical Technology: Mechanical technology involves replacing human or animal labor with machinery. Agricultural mechanical technology is a type of technology that saves labor or intensifies capital. There is a long history of developing agricultural mechanical technology methods and their role in reducing costs, increasing productivity, and decreasing the time required for various agricultural operations. Agricultural mechanical technology methods include soil preparation, seeding, drilling, and harrowing machines, fertilizer spreaders, pesticide sprayers, harvesters, and threshers, in addition to irrigation equipment, both traditional and modern.

2.2. Biotechnology: This type of technology involves developing new varieties and strains in the plant and animal fields that are characterized by high productivity and resistance to diseases and pests. This is achieved through hybridization or the use of genetic engineering, in addition to plant tissue culture or the use of biological control methods as an alternative to chemical pesticides that are harmful to the environment, humans, and animals when they exceed a

certain limit. The broad meaning of agricultural biotechnology encompasses the use of living organisms in production, the modification of agricultural products, or the development of microorganisms for specific uses. Biotechnology methods include developing improved varieties of different crops and enhancing animal breeds to increase their productivity in meat, dairy, and eggs. Agricultural biotechnology is considered a land-saving technology because it leads to increased yield per unit of land.

2.3. Chemical technology: Chemical technology includes techniques that use the energy resulting from reactions between chemical elements. Chemical technology is represented in chemical pesticides, growth regulators, agricultural fertilizers and fertilizers. The use of chemical technological methods aims to address shortcomings in agricultural lands and compensate for any deficiencies that appear in them. Chemical technology methods are also important in resisting diseases and pests that affect crops.

2.4. Infrastructure technology: This includes modern methods related to irrigation and covered drainage equipment and soil fertility preservation programs through land improvement by deep subsoil plowing, and cleaning of canals and drains, in addition to the infrastructure related to all marketing transactions in the post-harvest stage, whether in relation to the storage of agricultural products, which are characterized by their high susceptibility to spoilage, as well as means of transport and infrastructure for preparing agricultural products for export, in addition to the infrastructure for agricultural information.

2.5. Organizational technology: It is considered a necessary condition for the success and application of all other agricultural technological methods, as a result of the fact that these methods require a suitable organizational framework for their application and achieve balance in the aspects related to their application economically and socially. That is, systems technology works to employ and use data in a way that achieves maximum benefit from all types of previous technology. That is, organizational technology aims to prepare the appropriate environment to absorb different types of technology, given the material, organizational, legal and cultural changes required for the conditions surrounding the technological change so that it can be absorbed.

3. Modern innovations in the world of agriculture

1. Artificial Intelligence in Agriculture

- **Agricultural Data Analysis**

In the world of modern agriculture, artificial intelligence plays a significant role in agricultural data analysis. Big data extracted from sensors and agricultural equipment gives farmers accurate insights into soil health, moisture levels, and crop needs. This data helps in making informed decisions to improve production efficiency and reduce waste.

- **Crop Forecasting**

Crop forecasting has become more accurate thanks to artificial intelligence. Through smart farming systems that rely on satellite imagery and weather data, farmers can obtain precise forecasts about planting and harvesting times. These forecasts help improve productivity and reduce losses caused by unpredictable weather conditions.

- **Efficient Resource Management**

With increasing pressure on natural resources, artificial intelligence (AI) is emerging to help manage resources efficiently. AI technologies can be used to determine the optimal amounts of water and fertilizer needed for each crop, contributing to reduced costs and increased productivity.

2. Vertical farming: The solution for limited spaces

Vertical farming is a modern agricultural technique that aims to increase agricultural production in limited spaces. This technique relies on growing crops in multiple layers, allowing for better use of available space, especially in urban areas.

2.1. Vertical Farming Techniques

- **Farming Towers:** These rely on constructing vertical structures with multiple layers for growing crops.
- **Hydroponics:** This uses water instead of soil to grow plants, conserving resources and reducing the need for large areas.
- **Artificial Lighting:** This compensates for the lack of sunlight by using LED lights to promote plant growth.

2.2. Benefits of Vertical Farming

- **Increased Productivity:** Vertical farming allows for growing more crops in a smaller area.
- **Reduced Water Consumption:** Hydroponic farming techniques help to significantly conserve water.
- **Utilizing Urban Spaces:** Buildings and rooftops in cities can be used for farming.

3. Agricultural Robots: The Next Revolution

3.1. Types of Agricultural Robots

Agricultural robots come in many forms, each designed to perform specific tasks in the fields. There are robots for planting, others for harvesting, and some for spraying and fertilizing. These robots help reduce human effort and increase the precision of agricultural operations. Among these robots is the Escarda Compact Duo, which uses smart laser technology to eliminate weeds.

3.2. Robot Applications in the Fields

Robots are used in the fields to perform many tasks, such as planting seeds, harvesting crops, and even monitoring plant health. These robots are capable of operating in harsh conditions and are unaffected by environmental factors like heat or humidity. Thanks to cameras and advanced sensors, they can accurately analyze soil and plant conditions.

3.3. Technical Challenges Despite the significant benefits offered by agricultural robots, they face several technical challenges. These include high development and maintenance costs, as well as the need for advanced infrastructure to support their operations. Furthermore, integration with existing farm systems requires specialized training for farmers to ensure the optimal use of these technologies.

4. Renewable Energy in Agriculture

Renewable energy has become an important part of modern agriculture. It offers sustainable solutions for power generation and reduces reliance on fossil fuels. Using renewable energy sources contributes to improving the efficiency of agricultural processes and reducing operating costs.

4.1. Using Solar Energy

- Solar panels are used to generate the electricity needed to power agricultural equipment.

- Solar thermal energy can be used for soil sterilization and water desalination.

- Photovoltaic solar energy is used to power refrigeration units for preserving produce.

4.2. Bioenergy on Farms

- Converting agricultural waste into bioenergy can be an important energy source.

- Biogas produced from anaerobic digestion is used to power electricity generators.

- Bioenergy can also be used to heat greenhouses, reducing the consumption of traditional fuels.

4.3. Energy-saving technologies

- Using smart irrigation technologies to reduce water and energy consumption.

- Improving the energy efficiency of agricultural machinery through modern technologies.

- Developing energy management systems to monitor and optimize energy consumption on farms.

4. Agricultural technology challenges

- **High cost:** Adopting modern technologies such as sensors and drones requires a high initial investment. Despite the long-term benefits, the cost can be a barrier for small farmers.
- **Need for advanced skills:** Smart agriculture requires advanced skills in using technology and analyzing data, which can be challenging in some areas lacking sufficient expertise or training.
- **Disparities in access to technology:** Farmers in remote or developing areas may face difficulties accessing these modern technologies due to a lack of infrastructure or resources.

Ultimately, agricultural technology is not just new tools and techniques; it's a completely new approach to farming. With the challenges facing traditional

agriculture, such as water scarcity and increasing food demand, these innovations offer smart and sustainable solutions. From artificial intelligence to gene editing, the rules of the game are changing in the agricultural field. As development continues, it will be exciting to see how these technologies will contribute to improving agricultural productivity and ensuring food security in the future. Therefore, we must be ready to embrace these changes to achieve a better agricultural future.

IV. Presentation of Algerian agriculture

Agriculture in Algeria is a strategic economic pillar, contributing 10% to the GDP and providing employment for more than 2.6 million people (approximately 24% of the workforce). The country has adopted an ambitious strategy to achieve self-sufficiency, particularly in cereals and strategic products, focusing on modernizing machinery and supporting desert agriculture.

Algeria's agricultural sector experienced significant growth in 2023, with agricultural production valued at approximately $35 billion, contributing 14.7% to the GDP. The government focused on the Sahara Desert as a strategic hub for grain production, targeting over 400,000 hectares of land to enhance food security and reduce imports.

1. Key Features of Algerian Agriculture (2025-2026):

- **Agricultural Census:** More than 1.1 million agricultural holdings were registered in a comprehensive data update process.
- **Real Estate Investment:** The state is making privately owned agricultural land available for reclamation under concession agreements, and digital platforms are being activated for acquiring agricultural land.
- **Support and Mechanization:** The Agrodrive company is being activated to promote agricultural mechanization and provide more than 1,100 harvesting machines for the 2026 season.
- **Desert Agriculture:** The focus is on supporting investors in the southern regions to achieve self-sufficiency.

2. Desert Agriculture…A Cornerstone of Food Security

- **Expanding Agricultural Areas:** The desert has become a hub for the production of grains, fodder, and industrial crops (such as sugar and oil).

- **Modern Technologies:** Adopting center-pivot irrigation and solar energy to reduce production costs and improve water efficiency.
- **Investment Models:** Encouraging large-scale investments (both domestic and foreign) in the southern states.

3. The Reality of Agriculture in the Algerian Sahara

Various programs and initiatives implemented in the Saharan agricultural sector have had a significant positive impact on improving the sector's performance. This has been achieved through expanding cultivated land, attracting private investors, establishing factories and warehouses, developing and maintaining agricultural equipment, and improving infrastructure such as agricultural electricity and road construction. As a result, agricultural production has developed across various sectors. Furthermore, the support programs established by the Algerian government for Saharan agriculture, particularly land reclamation, concession, and modern irrigation systems, have contributed to increased production capacity and transformed the Sahara into an agricultural market whose influence extends from the heart of the desert to the Algerian coast, relying on the strength and quality of its produce, and the quality of its goods, the Algerian government must provide more support, especially regarding efforts to attract settlement to the south, focusing on the quality of seeds and fertilizers, providing the necessary agricultural technology, particularly high-quality farming equipment, developing irrigation mechanisms, and expanding the use of alternative and renewable energies.

4. The Algerian Experience in Desert Agriculture (The Great South)

Algeria is considered one of the leading countries that are relying on its desert to achieve food security through:

- **Cultivation of strategic crops:** Large-scale cultivation of wheat, corn, and barley in regions such as Ghardaia, El Oued, and Adrar, with very encouraging results.

- **Quinoa cultivation:** Successful trials introducing the desert quinoa plant, which enhances food diversity.

- **Industrial agriculture:** Large-scale projects for sugar beet production and the development of desert agriculture (potatoes, vegetables) using modern irrigation techniques and sustainability studies.

- **Smart integration:** Adopting foreign and local partnerships for technology transfer and developing the management of large agricultural projects.

- **Sugar beet:** It is being presented as a strategic option to reduce the import bill and achieve sovereignty in the field of sugar.

5. The "Green Desert" Strategy and Industrial Agriculture (2026):

Expansion of Areas: Irrigated agricultural land in the desert has expanded to over 359,000 hectares, representing approximately 3% of the total irrigated area nationally.

Strategic Crops: Trials have successfully cultivated strategic crops such as wheat, corn, sugar beets, and soybeans in commercial quantities.

Desert Agriculture: Successes have focused on grain and fodder cultivation, livestock breeding, and dairy production using modern technologies.

6. Challenges

Despite its successes, Algerian agriculture faces challenges, most notably:

- **The absence of rational methods in land reclamation:**

Algeria has made considerable efforts in land reclamation projects, but these have not yielded the desired results, negatively impacting agricultural production due to the following factors:

- The frequent lack of clearly defined land reclamation objectives.

- The incomplete and incomplete phases of reclamation.

- The poor selection of some reclamation areas.

- The failure to adhere to the technical requirements for agriculture in reclaimed projects.

- **Weak Livestock Production:**

Like other Arab countries, Algeria has made considerable efforts to develop its livestock sector, but has failed to achieve the desired goals due to:

- The infertility of grazing lands and their susceptibility to drought.

- The lack of scientific methods in animal husbandry within pastoral communities and the absence of a comprehensive system for improving genetic breeds in agriculture.

- The incompleteness of livestock production policies.

In conclusion, it can be said that the future of agriculture in Algeria lies in moving towards sustainable agriculture, exploiting the enormous potential in the south (desert agriculture), and promoting investment in modern irrigation and service technologies, in order to achieve the goals of self-sufficiency and liberation from food dependency.

V. Agriculture in the arid zones of Algeria

Agriculture in the arid (desert) regions of Algeria has undergone a radical transformation, becoming a significant international agricultural center. State investments have contributed to turning the desert into vast green spaces that produce strategic crops, thus enhancing food security and achieving self-sufficiency through oasis farming and modern technologies.

Arid and semi-arid regions (desert and steppe) constitute more than 90% of Algeria's total area. Despite the harsh climate, these regions have become a "strategic reserve" for food security, transforming into leading agricultural hubs for cereal, date, and vegetable production through investment and technology.

1. Agricultural Potential in Arid Regions

- **Groundwater Resources:** Primarily reliant on groundwater (fossil water) found in the major desert basins.
- **Vast Lands:** Large areas of arable land, particularly in the southeastern regions (El Oued, Ouargla, Biskra) and the southwestern regions (Adrar, Timimoun).
- **Climatic Conditions:** High temperatures allow for early crop production, providing a competitive advantage.

2. Aspects of Agriculture in Arid Regions:

- **Oasis (Desert) Agriculture:** This represents an integrated ecosystem that relies on date palms as a canopy, providing shade. Vegetables, fruits, and fodder are grown beneath the palms, thus stabilizing the population and ensuring food production.

- **Modern and Smart Irrigation:** The use of drip irrigation and smart irrigation systems delivers water directly to plant roots, reducing waste and increasing the efficiency of scarce water resources.

- **Cultivating resilient crops:** Focus on crops such as sorghum, millet, alfalfa, and olives, in addition to legumes.

- **Water and soil conservation techniques:** Use small pits (zai) to collect rainwater and mitigate drought, especially in the Sahel region of Africa.

- **Using greenhouses:** Growing vegetables such as tomatoes, peppers, and cucumbers in greenhouses to control temperature and humidity.

- **Water desalination and reuse:** Expanding the use of treated wastewater and desalinated groundwater for irrigation.

3. Pillars of Desert Agriculture (National Strategy)

The state is working to intensify production through several mechanisms:

- ✓ **Pioneering Desert Agriculture:** Developing intensive agriculture (cereals, dates, fruit trees) to reduce imports.
- ✓ **Land Reclamation:** Horizontal expansion by granting land for agricultural investment to investors and young people.
- ✓ **Modernization and Technology:** Adopting smart irrigation technologies (sprinkler and drip irrigation) to rationalize water consumption, and using advanced machinery.

4. Major crops produced:

- **Dates:** Algeria holds a prominent global position, particularly with the Deglet Nour variety.
- **Cereals:** Wheat and barley are cultivated extensively (strategic agriculture).
- **Vegetables and early produce:** Potatoes, tomatoes, and garlic are produced out of season in the southern regions.
- **Forage crops:** Used to support livestock farming.

5. Challenges and Obstacles

- **Water Scarcity:** Risks associated with the excessive depletion of non-renewable groundwater.

- **Salinity:** Soil salinization resulting from unplanned irrigation, impacting soil fertility.
- **Desertification and Sand Encroachment:** The ongoing need for windbreaks and green barriers.
- **Lack of Logistical Infrastructure:** The need for storage (cold storage) and transportation to connect production with consumers in the north.

6. Future Prospects and Solutions

*** Seawater Desalination:** A move towards integrating desalination for agricultural purposes in some coastal areas.

*** Scientific Research:** Developing plant varieties resistant to salt and drought.

*** Solar Energy:** Using clean energy to power water pumps, thus reducing production costs.

Investing in arid agriculture in Algeria is not an option, but an absolute necessity for achieving food sovereignty. Sustainable success depends on balancing increased production with the protection of water resources through rational use and modern technologies.

VI. agricultural policies in Algeria

Agricultural policies in Algeria have undergone structural development since independence, moving from self-management and the agrarian revolution (1970s) to a market economy and supportive reforms (since the 1990s). These policies primarily aim to achieve food security, promote rural development, and increase productivity, with a modern focus on private investment, smart agriculture, and expanding irrigated areas to address resource scarcity.

1. What is agricultural policy?

- **Definition of politics:**

It is a general process in which different and conflicting forces and groups interact; it is the phenomenon of distributing values among individuals and citizens within every political organization.

- **Definition of Agriculture:**

It is a set of activities aimed at transforming the natural environment for the benefit of plant and animal production and for the benefit of individuals.

- **Definition of agricultural policy**

It is defined as a form of economic policy that focuses on the agricultural sector in order to achieve a specific goal or sectoral objective.

It was also defined as part of the state's general policy, which is a set of procedures and laws that the state puts in place according to a specific agricultural development plan, with the aim of achieving two main goals: achieving satisfaction for society with agricultural goods and achieving profit for agricultural producers.

2. Objectives of agricultural policy

- **Achieving productive efficiency**

This goal encompasses all current agricultural resources necessary for developing agricultural productivity. It also includes the objective of increasing the monetary value of agricultural exports, given its paramount importance in providing the foreign currency needed to finance economic and social development programs.

- **Increasing the volume of agricultural exports**

One of the goals of agricultural policy is to increase the quantity of agricultural goods and crops exported abroad. This is reflected in the availability of foreign currency needed to support and finance economic and social development programs. This requires studying the forces of supply and demand in global markets for agricultural products, as well as knowing the countries exporting these products and the extent of competition between national and foreign agricultural products, and then focusing on producing those crops that have a comparative export advantage.

- **Distributive justice**

Income distribution justice is a social objective of agricultural policy. Income distribution justice means trying to limit the widening gaps between incomes and living standards and setting limits on the individual's standard of living. Distributive justice also means the optimal distribution of society's economic resources among the various branches of economic activity. This is achieved when the value of the output of the factors of production (labor, capital, and land) is equal in all axes of economic activity.

3. Types of Agricultural Policy

The policies implemented to address the agricultural question, despite some minor differences, can be classified into three groups:

- **Agricultural guidance policies**

Are clearly prevalent among capitalist countries (Western Europe). Agricultural guidance policies combine the principles of economic freedom and government intervention. Agricultural guidance policies were launched with a primary goal of improving the efficiency of agricultural activity. Governments only intervened if intervention was necessary to serve this goal. These policies yielded economic results by increasing the economic surplus in agriculture, and thus creating the necessary preconditions for achieving the industrial revolution.

- **Agrarian reform policies**

Were implemented in most developing countries in Asia, Africa, Latin America, and some other European countries, such as Spain and Italy. The fundamental principles of most of these reform policies were:

***** Setting a maximum limit on land ownership and confiscating any excess, with or without compensation.

***** Distributing confiscated land to landless farmers.

***** Imposing specific obligations on beneficiaries of agrarian reform.

The economic aim of agricultural reforms is generally to transcend old production relations and encourage capitalist agricultural exploitation methods in order to increase the efficiency of agricultural activity and to create a kind of balance in investment between agriculture and industry, based on the premise that limiting agricultural land ownership will compel many investors to invest in industrial sectors.

- **Revolutionary Agricultural Policies**

First and foremost, it should be noted that reform and revolution are two methods of social change, differing in time and place, as well as in their ideological dimension. While reform implies repairing and modifying what already exists, revolution signifies total and comprehensive change, meaning a radical rejection of all prevailing forms and structures. The policies of revolution

were implemented by states that adopted a socialist orientation, based on returning land ownership to the people and placing it at the disposal of the peasants to work for their own benefit and the benefit of the entire population. However, these policies largely failed due to the prioritization of political considerations over economic necessities, among other factors.

4. Pillars of Modern Agricultural Policy

- **Technological and Digital Transformation:** Utilizing precision agriculture, smart irrigation systems, and greenhouses to maximize production and minimize resource consumption.

- **Environmental Sustainability:** Adopting organic farming, conserving natural resources, and combating desertification.

- **Food Security and Sovereignty:** Working towards self-sufficiency through increased production and improved productivity.

- **Structural and Legislative Development:** Registering land ownership and developing agricultural research and extension institutions.

- **Connecting Farmers to Markets:** Developing value chains, supporting marketing, and transitioning to market-driven agriculture.

- **Financing and Investment:** Providing accessible loans, encouraging public and private investment, and developing rural areas.

Agricultural policy is not merely legislation, but a strategic vision that requires integration between developing water resources, supporting agricultural investment, and adopting modern technology to ensure food security, achieve self-sufficiency, and reduce dependence on foreign food sources, especially in light of current climatic and economic challenges. It also aims to transform agriculture from a mere subsistence activity into a strong economic sector that contributes to the national product.

5. Implications of agricultural policies

The contents of these policies fall under the following sub-frameworks:

1. Agricultural production policy

This refers to policies aimed at regulating agricultural production processes and patterns. It focuses on implementing measures to ensure an increase in

agricultural production levels and improved productivity, achieving a growth rate in agricultural output that exceeds the population growth rate. This is done within the context of available natural resources (land and water), human resources (physical and intellectual capital), and technology (available machinery and equipment). These policies include the following sub-policies:

- ✓ **Land tenure policy:** This is the policy that deals with organizing agricultural land tenures and regulating the relationship between the tenurers. There are two main types of tenure: the private exploitation pattern, in which the tenurer is responsible for his tenure, manages it, and receives its returns; and the second pattern is the cooperative pattern, which means combining tenures and managing them in a cooperative manner, so that the returns are distributed according to the contribution and work of the tenurers.
- ✓ **Land Use Policy:** This policy concerns the classification and allocation of land for rangelands, forests, and agricultural crops. It also focuses on crop intensification, meaning increasing the number of times the land is cultivated within the same time period, and distributing cultivated areas between rain-fed and irrigated land.
- ✓ **Water Use Policy:** This policy concerns the conservation, development, and rational use of water resources, as well as their distribution among various productive sectors.
- ✓ **Labor force policy:** This policy addresses many aspects, perhaps the most important of which are those related to agricultural mechanization, training, and agricultural extension, which are closely linked to increased production and productivity. It also considers other aspects such as wages, income distribution, and internal and external migration, which determine areas of attraction and repulsion for labor.

2. Agricultural pricing policy

Is one of the most important branches of agricultural economic policy due to its significant role in improving the performance of the agricultural sector and creating various balances within it. It refers to the set of procedures and laws that shape the price structure at the production, consumption, and distribution levels, thus affecting the standard of living of citizens. This policy also enables the determination of the average per capita consumption of food commodities and the prevailing level of self-sufficiency in the country. Furthermore, prices play a crucial role in inflation and unemployment rates, as well as the net return

from foreign trade. Therefore, it is important to present the key components of this policy:

- **Pricing policy:** Pricing is determined at the level of inputs, outputs, and production requirements, and at the wholesale and retail price levels. This determination will not have an effect without the existence of support policies.
- **Support policies:** This support may be direct, covering all or some agricultural inputs and outputs, and affecting the entire agricultural sector. It may also be indirect, such as eliminating or reducing customs duties imposed on most agricultural inputs. Furthermore, products may be subsidized by setting a minimum production level that the government purchases at a low price. This price serves to protect producers and prevent negative impacts on their agricultural income.
- **Financial subsidy policy:** This involves countries providing financial subsidies to farmers so that they can use modern machinery that improves the level of agricultural production.
- **Incentive pricing policy:** This policy aims to encourage farmers to expand the cultivation of certain crops by setting a purchase price for the crop whose production is to be encouraged at a price higher than the wholesale price.
- **Price controls:** This policy aims to provide essential agricultural commodities at prices that are fair to both producers and consumers. These prices are set at the retail level for essential goods such as bread, dairy products, and legumes.
- **Income tax policy:** This policy involves customs exemptions on imported agricultural inputs or production supplies and imported staple foodstuffs, which supports prices, in addition to exempting farmers from income tax on their agricultural income.

3. Agricultural Marketing Policy

Agricultural marketing encompasses all activities related to the processing, storage, and transportation of agricultural products to local or foreign consumers. It therefore contributes significantly to adding value to the economy and creating job opportunities. It is considered a positive indicator reflecting the stage of development a country's economy is undergoing. Despite its crucial importance, marketing has not received the necessary attention when

formulating agricultural development plans. Instead, the focus has primarily been on production and pricing policies, based on the assumption that increased production, for example, will improve the nutritional status of individuals and that the market will automatically develop in line with increased production. This is a misconception, as scientific and empirical evidence indicates that the absence of efficient marketing will severely hinder production and rural development.

Policies in the field of agricultural marketing are varied and include the following:

- **Quality Policy:** This policy deals with the specifications and standards of agricultural products, production inputs, and marketing services, aiming to facilitate transactions between producers, intermediaries, and consumers, and to protect their interests.
- **Marketing Functions Organization Policy:** This policy focuses on organizing the various marketing functions: exchange (buying and selling), physical (manufacturing, transportation, and storage), and facilitative (calibration, packaging, marketing information, and risk management).
- **Market regulation policy:** This aims to protect the market from all forms of monopoly and any conduct that violates the principles of perfect competition, while maintaining the freedom and transparency of market competition.
- **Domestic trade policy:** This focuses on regulating the movement of goods and services within the local market, whether between traders, between marketing facilities, or between different regions.
- **Foreign trade policy:** It deals with the import and export of agricultural products in accordance with the principles of international trade and protection through quantitative and non-quantitative restrictions recognized at the level of international trade (customs tariffs, export subsidies, etc.).

4. Agricultural structural policy

This refers to policies designed to encourage changes in the size or organization of small enterprises and to mitigate the difficulties arising from these changes, or to find alternative means of preserving social benefits without harming individuals' livelihoods. If these changes occur slowly and over a long period,

structural policies are not necessary. However, if these changes occur rapidly and drastically, and impact individuals' living standards, then intervention through structural policies becomes essential.

The drastic changes in agriculture are due to several factors, including: the transition from traditional to modern agriculture; technological changes that alter the input/output system of an existing or new agricultural system; changes in agricultural ownership patterns or crop composition; changes in water resources; and environmental changes.

5. Agricultural Support Services Policy

Agricultural activities, whether plant or animal, at all stages require support to ensure the success of these activities, particularly in the areas of investment and production. This support is typically provided by relevant government agencies and institutions due to its vital importance and public benefit. This support takes many forms: research, extension, and training; financing; plant and animal health protection; land reclamation and environmental protection; provision of production inputs (fertilizers, seeds, mechanization); marketing assistance, etc. The policies of agricultural research and extension, as well as agricultural financing and credit, are given particular attention in detail.

VII. Innovations and social dynamics in arid environments

Arid environments present unique challenges, demanding special innovation and the development of social dynamics from their inhabitants. With the advent of modern climate change, the need to integrate traditional knowledge with modern technology for sustainability has become increasingly apparent.

Arid environments cover more than one-third of the world’s land area and represent the most common habitat on Earth after the oceans. Aridity poses a threat to the environment, as well as the economy, security, development, food security, and social life around the world. The causes of increased aridity are complex and are thought to be both natural and man-made. Factors such as climate change, population growth, soil erosion, inappropriate irrigation, wrong farming, soil, water, and groundwater contamination, urbanization, deforestation, improper water management, desertification of arid and semiarid zones appear as causes of drought.

1. The concept of arid environments

- **Meaning Environment**

Ricardos defined it as: the set of surrounding natural factors that affect the life of an organism, or that determine the life system of a group of organisms in a particular place and constitute an interconnected ecosystem.

- **Meaning arid environments**

Arid environments are characterized by enormous diversity in their landforms, soils, fauna, vegetation, water balance, and human activities. Because of this diversity, a practical definition of an arid environment is not possible. However, the common element among all arid regions is aridity.

2. Innovations in Arid Environments

Innovations focus on the intelligent use of limited resources:

- **Sustainable Agriculture:** This includes precision farming techniques, organic farming, and integrated water resource management to minimize waste.
- **Energy Solutions:** Utilizing geothermal and solar energy as renewable sources in harsh desert regions.
- **Environmental Technology:** Developing innovations aimed at stabilizing sand dunes and combating desertification, such as the Arab Green Belt project.
- **Water Resource Management:** Water recycling and modern irrigation techniques to overcome water scarcity.

3. Social Dynamics in Arid Environments

Social systems in these regions are shaped in response to environmental harshness:

- **Traditional Knowledge:** Reliance on heritage practices for protecting and managing natural resources.

- **Community Adaptation:** Education and awareness of the role of the environment promote the adoption of sustainable practices by farmers and communities.

- **Scientific Research and Application:** Crstra Biskra - the Scientific and Technical Research Center on Arid Regions - in Biskra, Algeria, contributes to

finding practical solutions to environmental problems and raising scientific awareness.

- **Social Innovation:** Encouraging environmental innovations as a means to achieve sustainable development, particularly in industrial enterprises.

4. Integrated Approaches and Future Directions

*** System-Level Thinking:** Experts argue that future progress requires moving beyond isolated, small-scale innovations toward, what ResearchGate calls "coherent, system-level frameworks" that integrate ecological, agricultural, and social needs.

*** Knowledge Integration:** There is an increased focus on combining scientific knowledge with traditional, locally-adapted practices to create more sustainable agricultural systems.

*** Resilience Planning:** Effective, long-term resilience strategies in arid zones are increasingly focusing on the "water–energy–food–ecosystem" nexus to ensure that technological advancements are not only profitable but also sustainable.

The future of arid environments depends on the ability to transform environmental challenges into opportunities for social and technological innovation, ensuring the continuation and flourishing of life in these regions.