

Intellectual Property and Food Security: Opportunities and Challenges

الملكية الفكرية والأمن الغذائي: فرص وتحديات

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Abstract:

Intellectual property is considered a critical driver of innovation and creativity and a key factor for achieving sustainable development. Indeed, it has become indispensable across vital sectors in addressing the challenges the world faces today. In the agricultural field, as an example, sustainable farming now directly relies on protected innovations and technologies. This is done so to mitigate the pressing issues this sector endures such as soil degradation, water scarcity, climate fluctuations, declining food quality, and the risk of food insecurity.

Achieving food security requires sustainable agricultural productivity. Ensuring this sustainability necessitates reliance on innovations and inventions that are protected by intellectual property laws.

However, the widespread proliferation of intellectual property in this sector may give rise to other risks and challenges. The most significant one is the dominance of large corporations over agricultural production and their control over the majority of the world's seeds, as they hold legally protected patents.

Keywords: Intellectual property; Agricultural development; Food security, sustainable development, Innovation and food

ملخص:

أصبحت الملكية الفكرية، باعتبارها محفزا حاسما للابتكار والابداع ومفتاحا ضروريا لتحقيق أهداف التنمية المستدامة، تفرض نفسها في كافة القطاعات الحيوية للتصدي لكل التحديات الحالية على غرار المجال الزراعي، حيث باتت الزراعة المستدامة تعتمد بشكل مباشر على الابتكارات والتكنولوجيات المحمية للتخفيف من حدة المشاكل التي يعاني منها هذا القطاع من تدهور التربة وقلة المياه والتقلبات المناخية لاسيما انخفاض جودة الأغذية وخطر انعدام الامن الغذائي، فتحقيق الامن الغذائي يستلزم توافر انتاجية زراعية مستدامة وضمنان هذه الأخيرة يستلزم الاعتماد على ابتكارات واختراعات محمية بموجب قوانين الملكية الفكرية

غير أن الانتشار الواسع النطاق على الملكية الفكرية في هذا القطاع قد يولد تحديات ومخاطر أخرى أهمها سيطرة الشركات الكبرى على الإنتاج الزراعي والتحكم في معظم بذور العالم باعتبارها صاحبة براءات الاختراع المحمية قانونا.

الكلمات المفتاحية: الملكية الفكرية؛ التنمية الزراعية؛ الأمن الغذائي؛ التنمية المستدامة، الابتكار والغذاء

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Introduction:

Since the dawn of humanity on Earth, individuals have been diligently working to ensure their sustenance for survival. The pursuit of satisfying bodily requirements and meeting nutritional needs is instinctual, implying that seeking to fulfill these needs is a fundamental, innate matter. With the evolution of human life, there has been an increasing focus on everything that addresses nutritional requirements, including agriculture and the production of various types of food, whether animal or plant-based.

It is evident that food security has become one of the most important and complex issues facing the Arab world and the entire globe. This is due to its direct impact on political, economic, and social situations, as well as the developmental decisions associated with it. The complexity of this issue increases with the escalating global food crisis, stemming from the Arab countries' reliance on food imports in a global market characterized by significant fluctuations. In the face of the continuous increase in population, there is a need for a parallel increase in food production to narrow the food gap, Arab countries often resort to importing food to bridge this gap. However, this reliance on imports is accompanied by trade deficits. Hence, the importance of the issue of food security in the Arab world is highlighted, with agricultural development and food security being top priorities for Arab leaders. These concerns are part of the common Arab action agenda in light of contemporary economic and environmental changes at both the regional and international levels. Therefore, all Arab efforts are currently directed towards addressing the challenges hindering the path of agricultural development and food security in the Arab world. The focus is on exploring avenues and mechanisms to address this phenomenon in the short, medium, and long term.

Sustainable agricultural productivity is a fundamental factor that effectively contributes to achieving food security. Agricultural research serves as the fertile ground for both agricultural productivity and food security. In this context, intellectual property plays a crucial role through patents or plant breeders who aim to develop this sector. The inclusion of intellectual property rights provides legal security and, consequently, food security.

Thus, the following questions arise, how can we reconcile food security with intellectual property rights, and how can intellectual property rights extend to the agricultural sector in a way that promotes sustainable agriculture and, consequently, ensures food security?

To address this problematic, we adhere to the following plan:

I: The Reality of Food Security and Agricultural Development in the Arab World

A)- Understanding the Concept of Food Security

B)- Challenges of Sustainable Arab Agricultural Development

II: The Role of Intellectual Property in Strengthening Sustainable Agricultural Development and Achieving Food Security

A)- The right to food and principles of intellectual property protection

B)- Intellectual Property as an incentive for Achieving Food Security

I: The Reality of Food Security and Agricultural Development in the Arab World

Agricultural development is considered one of the most vital sectors and a fundamental pillar upon which economic and social development relies in most countries. It serves as a primary source of food and raw materials, playing a significant role in providing various industrial resources. Additionally, it attracts a substantial portion of the workforce. It is impossible to discuss food security without addressing agricultural development, as they are interdependent and represent two sides of the same coin.

A)- Understanding the Concept of Food Security

Food security is considered one of the inherent concepts in human life, emerging since the beginning of human existence and evolving with time. It is a concept grounded in legal and rights-based frameworks, relying on several pillars that we will delve into below.

1: Definition of Food Security

Many international organizations and centers, led by the FAO¹, the World Bank and the International Food Policy Research Institute, conducted studies on global food demand and supply. These studies included many topics, the most important of which are food security, natural and environmental resources, forests, fish, and others. The studies also covered forecasts of demand and supply of plant and animal commodities to analyze Food demand, production, supply and demand.²

The right to food is recognized as one of the fundamental human rights. It was acknowledged in the Universal Declaration of Human Rights in 1948. There was global concern at that time regarding the provision of essential food resources, the stability of food prices, and ensuring the continuous supply of food. This led to the convening of the World Food Conference in 1947.

The term "food security" has undergone numerous changes and additions, culminating in a comprehensive definition agreed upon during the 1996 World Food Summit. According to this definition, food security is "the condition in which there is reliable access to a sufficient quantity of affordable, nutritious food."³

The right to food is an individual right, whether exercised alone or in association with others. In other words, every person has the material and economic means at all times to access adequate, culturally acceptable, and nutritionally suitable food. This food should be produced and consumed sustainably to secure its access to future generations. Individuals can ensure access to food through:

- Achieving income through employment or self-employment.
- Benefiting from social transformations.
- Producing food for those who can access land and other productive resources.

Through these ways, every individual should obtain a meal that includes a balanced mix of essential nutrients for both mental and physical growth. It should support the development and evolution of physical activity, and these nutrients should align with human physiological needs at all stages of life, taking into account gender and occupation.⁴

According to the Committee on World Food Security (CFS), food security is defined as: "the physical, economic, and social access by all people, at all times, to sufficient, safe, and nutritious food to meet their dietary needs for an active and healthy life."

The Food and Agriculture Organization (FAO) defines food security as: "The provision of food to all members of the community in the required quantity and quality to meet their needs continuously for a healthy and active life. "This definition differs from the traditional concept of food security, which is linked to achieving self-sufficiency by relying on a country's resources and capabilities to produce its food needs locally. In other words, it involves producing food within a single country to meet or exceed local demand.

The U.S. Department of Agriculture defines food security as: "The availability of adequate food at all times for active and healthy living for all individuals. "Conversely, it defines food insecurity as: "limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways."

Food security is closely related to another concept, known as food sovereignty, which means: "the right of peoples to define their agricultural policies that respond to their food needs and cultural

priorities." Some distinguish between two levels of food security: absolute and relative. The absolute level involves producing food within a single country to meet or exceed local demand, synonymous with complete self-sufficiency and also referred to as self-sufficient food security. The relative level refers to the ability of a country or a group of countries to provide goods and food items either entirely or partially. In other words, it signifies the capacity of a nation or a coalition of nations to meet the basic food needs of their societies, either fully or partially, and to ensure a regular supply of at least those essential requirements.

In light of the trade exchange between countries and the latter's tendency towards specializing in the production of goods over others according to the comparative advantage they possess, a new concept of food security has emerged that relates to the gap between the quantity and value of imported materials and the quantity and value of exported materials. The smaller this gap is, the better the country's situation is,⁵ and accordingly. Food insecurity constitutes a multifaceted problem whose causes range from the inability to produce food due to lack of resources, the inability to import the missing food due to lack of resources, and unfairness in the distribution of food for internal reasons.

2: Pillars of Food Security

Food security is based on four essential pillars, which are:

2.1 -Availability of Food:

It refers to the presence of sufficient and consistent quantities of food. This can be achieved through local food production, imports from external sources as well as food assistance.

2.2- Access Opportunities:

The ability to access such foods through sustainable methods that do not conflict with the enjoyment of other human rights. This implies having sufficient income to facilitate access to proper food or the presence of other resources ensuring this food. The United Nations Committee on Economic, Social, and Cultural Rights has indicated that the causes of hunger and malnutrition are often not solely due to a scarcity of food but may be attributed to the inability to access available food because of poverty, disasters, or wars. The U.S. Department of Agriculture further added that access to food should be socially acceptable without resorting to emergency food supplies, theft, or engaging in other illegal or inappropriate activities to obtain food.

2.3- Utilization:

It refers to all the processes associated with using these foods, including storage, care, transportation, cooking, and preparation, as well as food diversity, as the desired outcome is only achieved when it is diverse, encompassing all required nutritional elements. To achieve food security, the consumed food must be safe and meet individuals' physical needs adequately.

2.4- Stability of Supplies:

This means ensuring an adequate food supply at all times, where food should not be interrupted or its quantities reduced during emergencies such as wars, political unrest, natural disasters, or other factors.

B)- Challenges of Sustainable Arab Agricultural Development

Arab agricultural development, based on the principles of economic, social, and environmental sustainability, faces numerous challenges. These challenges include issues related to climate change

(the first subsection), as well as those associated with technology and innovation (the second subsection), and those related to policies and adopted strategies (the third subsection).

1: Climate Change

In recent years, Arab countries have been experiencing the phenomenon of climate change, which poses a real and serious threat to both global and Arab food security. Indeed, climate change is expected to have severe negative impacts in the long term on the key economic sectors in the Arab region. As a matter of fact, most Arab countries face dry climatic conditions and a severe shortage of water.

This has led these countries to rely on cultivating drylands using traditional methods in the agricultural and food production process. At a time when the world needs to increase food supply by 70 percent from current levels by 2050 to meet the needs of over 9 billion people, the challenging phenomenon of climate change stands as a significant obstacle to achieving this goal.

Climate change significantly and directly affects food security, with both positive and negative correlations. It results from greenhouse gas emissions, leading to an increase in carbon dioxide emissions, rising temperatures, and an intensification of climate and weather fluctuations. Moreover, climate change causes shifts in the foundations of the food system, including food production, storage, transportation, marketing, and livestock practices. All of these factors impact the ability to provide and access food for all segments of society and in all locations within the region. Additionally, climate change affects the sustainability of access to food and food consumption.

The phenomenon of change in the axes of food security results in a transformation of the food consumption system. This includes reducing the proportions of locally produced food, such as decreasing the production of grains used as animal feed and other commodities. Consequently, this leads to alterations in food consumption patterns and changes in the quality of consumed food. All of these factors have the potential to impact human health.⁶

Severe drought has contributed to a rise in famine rates and undermined the achievement of food security, leading to a loss of sustainable livelihoods. In the near future, a noticeable decrease in crop yields, up to 30 percent, is expected if there is a temperature increase ranging between 1.5 to 2.5 degrees Celsius. Moreover, the decline could reach 60 percent if the temperature rises by 3 to 4 degrees Celsius. This situation will result in a higher sea level, and if it persists, some coastal areas worldwide are projected to face erosion by the year 2050 due to submersion, potentially reaching up to 25 years into the future by 2100.

Algeria is considered one of the most vulnerable countries to climate risks. Coastal regions are at risk of submersion due to rising sea levels, coupled with the possibility of facing significant drought and reduced rainfall rates by the year 2050. According to estimates from some experts, rainfall levels in Egypt, North African countries, Saudi Arabia, Jordan, and Syria may decrease by 20 to 25 percent. This would clearly pose a substantial threat to food security in these countries. Besides, the decline in freshwater quantities in Algeria, Bahrain, Sudan, Tunisia, Morocco, Jordan, Syria, and the United Arab Emirates will have significant negative effects on food production and increase the risks of malnutrition.

Overall, climate change has negative effects on sustainable economic development opportunities. It can impact the supply of essential services such as energy, water, and food, along with related sectors like industry, agriculture, and transportation. In this way, it will inevitably affect the realization of the United Nations' Sustainable Development Goals for 2030, particularly the first, second, eighth, twelfth, and thirteenth goals.⁷

2: Limited Dependence on Technologies

Agricultural advisory services, technology transfer and research institutions are the cornerstone for uncovering the potential of agriculture in the Arab region. This is contingent upon having adequate support and financial resources to overcome various deficiencies and shortcomings in this field.

However, statistics indicate that the contribution of Arab researchers to efforts aimed at developing applied agricultural technologies at the end of the millennium did not exceed 0.3 percent, compared to the 30 percent observed in the developed world. Consequently, it is noteworthy that the Arab region faces genuine challenges in developing the necessary mechanisms for research advancement. Among these challenges, we can mention:

- Underutilization of the available research and technical workforce in most agricultural research institutions.
- Insufficient financial allocations to support agricultural research institutions and technology transfer.
- Limited involvement of the private sector in agricultural research.

Challenges in accessing scientific knowledge from advanced countries or utilizing advanced technology, often resulting in a weak flow of technology due to the absence of inadequacy of coordination between research institutions and agricultural services. There is also a lack of producer involvement in decision-making processes related to technology development.⁸

Not to mention that Arab countries encounter substantial shortcomings, particularly concerning technology, geographic information, remote sensing, early warning systems, and policies that encourage production and international agricultural trade. Furthermore, there is a disparity between university education and the current as well as future requirements of graduates. University curricula still tend to be traditional and lack stimulation for innovation, creativity, and the entrepreneurial aspects needed to inspire graduates to contemplate initiating their own businesses.

In addition, Arab countries witness shortcomings in the volume and procedures of exchange programs between them and qualified foreign institutions in related fields. There is a scarcity of facilities and programs for training producers, and a significant shortage of financial resources allocated for training and capacity-building to address the challenges of the shortage of qualified academics, administrators, and managers. This is exacerbated by the brain drain, as qualified individuals are enticed and attracted by better job opportunities outside the Arab region.

3: Lack of policies and strategies

Arab agriculture faces significant challenges that have escalated in the present time due to political disruptions in the Arab region and the scarcity of comprehensive Arab legislation and policies sufficient for achieving sustainable agricultural development. The majority of Arab policies have adopted an approach lacking full integration of production, marketing, and subsidiary services. At the same time, external interventions or countries providing technical and/or financial assistance may hinder the process of developing local policies. Sometimes, the performance of policy-making

institutions is hampered due to global economic and environmental fluctuations, lacking the necessary flexibility to cope with these changes.

4: Deterioration of self-sufficiency

Self-sufficiency means meeting food needs by producing it locally. The degree of self-sufficiency measures the ratio of local production to what is available for total consumption, whether it is produced locally or imported from outside the country. Therefore, it measures the degree of self-reliance, and when it equals one hundred percent, we say that self-sufficiency has been achieved. This happens when local production equals what is available for consumption, while lack of self-sufficiency occurs when what is available for consumption exceeds local production. It is also called food deficit or food gap, and this is what has afflicted Arab economies despite the reforms they have undertaken in all relevant fields to reduce this gap.

He defined food self-sufficiency as “the ability of a community to achieve complete reliance on itself and on its own resources and capabilities in producing all its food needs locally.”⁹ The deterioration of Arab self-sufficiency rates in general constitutes a real danger and a major challenge to food security, which constitutes one of the basic pillars of Arab national security from an economic perspective, as the growing food gap and the deterioration of self-sufficiency rates in the Arab world led to saying that food security is still just a dream that has not been achieved. After which it requires the Arab countries as a whole to join efforts and take a set of unified and integrated procedures and measures that work to achieve the desired agricultural development, while we note the lack of political will among Arab countries to achieve this goal in order to get out of their economic, political and social crises.

It should be noted in this regard that food security, which means the ability of society to secure its consumer needs for basic food commodities locally, is not achieving self-sufficiency, which means producing all basic food needs locally, but rather it goes beyond securing sources of obtaining food locally or internationally.¹⁰

In addition to the aforementioned issues, there are related challenges that pose significant obstacles for Arab countries, including:¹¹

- Absence of a cultural economic awareness in food and its conservation, with Arab countries facing significant issues of food loss and waste, as seen in Algeria where large quantities of bread are wasted.
- Social justice and empowerment of women and youth in marginalized rural communities.
- Adaptability and resilience.
- Trade integration (Technical Barriers to Trade - TBT, Sanitary and Phytosanitary Measures - SPS).
- Interconnection of water, energy, and food.

In this regard, it is worth noting that small-scale farmers constitute the majority of people experiencing poverty and chronic hunger in developing countries. Most of them reside in Africa and Asia, managing around 80% of agricultural land. The challenges faced by these farmers include a lack of access to knowledge, skills, inputs, and credit. They also lack opportunities to access markets and benefit from essential infrastructure. Moreover, they live and work in marginalized lands exposed to the risks of droughts, floods, storms, pests, and irregular rainfall.

II: The Role of Intellectual Property in Strengthening Sustainable Agricultural Development and Achieving Food Security

The legislations of many countries have shifted towards excluding plants and animals from the scope of protection provided by patents, considering them the main sources of food. The protection granted by intellectual property laws to the rights holders, in its various forms, includes awarding them exclusive rights. These exclusive rights, being inherently monopolistic, hinder access to and raise the prices of food when granted in relation to it.¹²

However, this situation did not persist due to the pressures exerted by giant corporations seeking to enhance the protection of intellectual property rights. Their goal was to secure more protection for their innovations and inventions, aiming to strengthen their grip and control over various technology fields, including food and agriculture technology. This demand was voiced during the eighth round of the Multilateral Trade Negotiations held from 1986 to 1993 under the auspices of the GATT (Uruguay Round).

The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)¹³ responded to this, obliging World Trade Organization (WTO) member states to provide a high level of protection for inventions in various technology fields without discrimination. It also mandated effective protection for new plant varieties.¹⁴

A)- The right to food and principles of intellectual property protection

The right to food is considered one of the fundamental human rights recognized by international treaties, agreements, and the constitutions of many countries worldwide. Consequently, an action plan has been adopted to secure food for various populations, and most countries have strived to achieve this objective.

1: Before the establishment of the World Trade Organization

To prevent monopolies on food and ensure its availability without restrictions or discriminatory practices, the laws of most countries excluded animals and plants from patent protection. This exclusion also applied to all living organisms in their various forms, including microorganisms.¹⁵

Indeed, the patent laws of most countries did not address the patentability of microorganisms.¹⁶ However, French judicial decisions recognized the patent protection of certain biotechnological processes, such as fermentation, considering them as new¹⁷ applications of known industrial methods. Similarly, since the second half of the twentieth century, U.S. judicial decisions have affirmed the patentability of products utilizing microorganisms in their production.

The European Patent Convention explicitly states that European patents shall not be granted for plant or animal varieties and also for biological processes for the production of plants and animals in most cases. However, this provision does not apply to microbiological processes and the products obtained through these processes.¹⁸ This legislative approach has been followed by European countries that are signatories to the Munich Convention.¹⁹

As for the legislation in developing countries, prior to the implementation of the TRIPS Agreement, it did not provide any protection for new plant varieties, either through patents or any specific legal system. The explanatory memorandum of the Egyptian Law of Patents, Designs, and Industrial Models No. 132 of 1949, which was canceled, clarified in the commentary on Article 1 of the law, which establishes the conditions for granting a patent, that plants are not considered inventions eligible for protection under the law.

Furthermore, before the enactment of this law, mixed courts had decided to exclude crops from patent protection. The courts ruled that the production of cotton seeds does not fall under the

protection granted to inventions. This exclusion from protection was likely aimed at avoiding the potential harm that monopolizing these materials could cause to society.

Accordingly, comparative legislations have not been concerned with providing legal protection for innovative plant varieties until recently, following the revolution brought about by biotechnology in the field of agricultural production. This revolution led to massive investments in creating new plants with unique and distinctive characteristics, such as increased production abundance, harvest timing, drought resistance, pest resistance, and more. Besides, large multinational companies emerged, controlling seed production.

The combination of all these factors has led major countries to ensure adequate and strong protection for new plant varieties at the international level. The principle of excluding living organisms from the scope of patent protection has not prevented advanced nations from establishing specific systems to provide a certain type of protection for innovative new plant varieties.

Many European countries have sought to establish a legal system to provide international protection for new plant varieties. The efforts made by these countries in this regard resulted in the signing of an international agreement in this field on December 2, 1961. This agreement is known as the International Convention for the Protection of New Varieties of Plants. It formed an international union comprising the parties to the agreement. It is known in French as "Union Pour la Protection des Obtention Végétales." It is commonly referred to as UPOV.²⁰

2: Protecting innovations in the field of food and agriculture through patents after the TRIPS Agreement

The TRIPS Agreement obligated its member states to allow the possibility of obtaining patents for inventions, whether they are products or industrial processes in all technological fields. This requirement compelled all member states to protect all inventions through patents, provided that they are new, involve an inventive step, and are capable of industrial application.

The Agreement also obligated member countries not to differentiate between inventions concerning the grant of patents or the enjoyment of property rights based on the place of invention, the technological field to which it belongs and whether the product is exported or is locally produced.²¹ This means that the Agreement recognized the principle of national treatment, prohibiting discrimination between national and foreigner. Furthermore, the non-discrimination principle extended not only to the equal opportunity to obtain a patent but extended to the enjoyment of patent property rights as well.

The TRIPS Agreement mandated WTO member countries to enable the possibility of obtaining patents for all inventions, whether the invention is directed towards a product or an industrial process in all fields of technology.

An exception to the principle of patentability in all fields of technology was allowed under the TRIPS Agreement, according to Article 2/27, 3, exempting three categories of inventions from patent protection, as an example, Plants and animals, unlike microorganisms and microbiological processes.²²

As such, member countries may exclude patent protection for animals and plants, whether bred or produced by traditional natural methods or modified genetically through genetic engineering. They are also allowed to exclude parts of animals and plants, including cells, components, organs, and tissues, from patent protection.

According to the provision of Article 27, paragraph 3(b) of the agreement, the exception does not cover microorganisms and non-biological processes used in plant and animal production. This

includes methods that do not rely on natural means in the production of plants and animals, thus, natural methods in the production of plants and animals are excluded from protection through patents, such as fertilization, pollination, and hybridization methods.

The exception does not extend to precise biological methods in the production of plants and animals. To conclude, the UPOV Agreement has compelled WTO member states to protect plant varieties through patents or through a specialized system or a system that combines both. This obligation persists, despite the allowance for these states to exclude plants and animals from patentability.

Thus, new plant varieties have become one of the important topics in intellectual property, and have received the attention of most legislators, such as the Algerian legislator, due to his great desire to join the World Trade Organization on the one hand, and the role of these plant varieties in ensuring food security for peoples on the other hand, and this is what led to the issuance of Law 05-03 relating to seeds, seedlings and plant possession, with the aim of protecting plant varieties,²³ which he defined as: "Every planting, clone, water strain, original or hybrid, and in some cases an original of an original or selected nature that is cultivated, or is capable of doing so, and that is of benefit and distinct. Consistent and stable."²⁴

B)- Intellectual Property as an incentive for Achieving Food Security

Food security has become a major challenge in the Arab region and globally. The importance of food security has increased in all societies after the COVID-19 pandemic disrupted the path to achieving sustainable development goals, causing an increase in the number of individuals suffering from chronic hunger, affecting nearly a billion people. It is expected that the demand for food will increase by 70% by 2050. Accordingly, agricultural productivity is a crucial factor that effectively contributes to achieving global food security. Conversely, agricultural research plays a fundamental role in developing fertile land for agricultural productivity and global food security. In this context, intellectual property, through patents and plant breeder's rights, plays a significant role. Yet, strict measures to protect agricultural intellectual property may give rise to concerns and risks to food security, as will be explained below.

1: Innovation as a Key Tool for Agricultural Productivity and Food Security

Any development strategy to achieve food security takes sustainable agricultural development as its goal and determining this goal stems from knowledge of the reasons leading to the emergence of the food security problem and the desire to find a radical and permanent solution to it. The goal of the food security strategy is to strengthen efforts to modernize Arab agriculture and develop its productive and competitive capacity. Developing and preserving natural resources and preserving the environment to ensure the achievement of the goals of the current generation and future generations within an integrated framework that achieves the interests of all Arab countries.²⁵ Intellectual property in the agricultural sector plays a fundamental role, as it contributes significantly to improving and modernizing agriculture through patents.

The United Nations, represented by Francis Gurry, the Director General of the World Intellectual Property Organization, emphasized, during the publication of the annual Global Innovation Index, that innovation is a key tool for development.²⁶ Gurry highlighted that innovation can provide a solution to the increasing pressure on global food resources, making it an essential instrument to address the significant and serious challenges facing the world as a whole.

Innovation in the agricultural and food sectors is instrumental in meeting the global food needs and mitigating the continuous increase in poverty and hunger resulting from the powerful impact of climate change on agricultural productivity and food shortages, Not to mention, intellectual property in the field of agriculture is one of the most important subjects regulated by the law,

especially in terms of protecting plant varieties, as it serves as a key driver for improving food security management and agricultural biodiversity.

The inclusion of intellectual property rights in the agricultural sector provides legal security that encourages investment, ensuring an increase in the number of investors in this field. It also motivates researchers and innovators. The application of intellectual property rules can lead to the development of new crop varieties that can be exported to international markets, generating financial and food-related benefits simultaneously. Countries aim to facilitate the exchange of genetic resources when strict intellectual property protection measures are in place.

Intellectual property plays a significant role in agriculture through patents or plant breeder's rights for technological achievements in the field of genetic engineering.²⁷ Researchers, for example, aim to develop seeds with improved quality and specific traits, providing farmers with distinctive varieties that are suitable for climatic conditions. Producing varieties that adapt to adverse climate conditions positively impacts farmers' income and contributes to the production of high-quality varieties.

Supporters of strong protection for agricultural intellectual property rights emphasize that it helps drive the innovation process. Major companies in the field advocate for effective protection of intellectual property rights in agriculture. In this context, Monsanto argues that patents are essential for financing new innovations in agriculture. These innovations can involve significant daily expenditures, sometimes reaching millions of dollars, in research and development. For every \$10 a farmer spends on seeds, Monsanto claims to reinvest \$1 in research and development. According to the company, such investments lead to innovations that provide crops with increased heat resistance.

Therefore, agricultural research is a key driver for improving agricultural productivity, and it has been proven to have long-term effects on crops, reaching its peak with the Green Revolution. Studies and experiments have shown that genetically enhanced crops have had a significant positive impact on reducing poverty, achieving agricultural growth, and protecting the environment.

The Consultative Group on International Agricultural Research (CGIAR) is considered the main vehicle for agricultural research in the public sector. It aims at promoting agricultural productivity and production among poor farmers in the developing world. CGIAR manages intellectual property issues on a case-by-case basis. In addition, the International Treaty on Plant Genetic Resources for Food and Agriculture and the Nagoya Protocol of the Convention on Biological Diversity govern the international standard for intellectual property in the agricultural sector.

2: The Risks of Intellectual Property on Food Security

Despite emphasizing the role of intellectual property in achieving productivity and food security, ensuring strict and widespread protection of intellectual property rights in the agricultural sector can lead to negative effects and risks on food security. The proliferation of intellectual property for food varieties may soon dominate everything we consume, especially with the spread of lab-engineered foods.

For several years, intellectual property rights have exerted control over the direction of the production of many foods that we consume daily. Control over agricultural production has largely settled into the hands of a few large companies that now dominate markets and the world's food through technologically produced foods, such as lab-grown meats or plant-based meat alternatives. The latter is expected to see increased demand in the coming years.

Since genetically modified foods entered mainstream diets, companies such as Monsanto, Bayer, DowDuPont (now known as Corteva Agriscience), and Syngenta have secured patents for extensive

areas of high-yield crop varieties. As a result, these companies exert control over a significant portion of the world's seed supply. With ownership of these seed varieties, these companies possess the authority to dictate how farmers use their seeds, prohibit them from trading them, and constrain their ability to replant without a formal agreement, in which they hold the upper hand and maintain control.

As a matter of fact, numerous major companies pursue farmers on the grounds of violating intellectual property rules. For instance, in 2019, PepsiCo filed a well-known lawsuit against several Indian farmers for cultivating a variety of potatoes for which it held a patent, specifically designed for use in the production of "Lay's" potato chips. Initially seeking \$143,000 in compensation for the alleged infringement, the situation was eventually settled by the company. Court rulings have also been issued in Egypt against farmers in Alexandria, Cairo, and Tanta due to the cultivation of a grape variety protected by intellectual property and commercially known as "Sugraone."

According to the presented information, it appears that food security is threatened due to a serious problem related to the "monopoly structure of a few supplying inputs," with companies like Bayer, Monsanto, and DuPont controlling around 50% of the global seed market. The size of this sector is expected to reach 90 billion by 2024, according to a United Nations report.

According to the presented information, it appears that food security is threatened due to a serious problem related to the "monopoly structure of a few supplying inputs," with companies like Bayer, Monsanto, and DuPont controlling around 50% of the global seed market. The size of this sector is expected to reach 90 billion by 2024, according to a United Nations report, while seeds are the first link in the food chain, they represent the guarantee of the continuation and renewal of life. For the farmer, they are not just a source of plants and food in the future, but rather a cultural stock. In addition, seeds constitute the basic symbol of food security.²⁸

These concerns will become more pronounced in the next generation through technologically supported food. Some companies have started producing low-carbon animal protein using actual animal tissue stem cells, promising a more sustainable future for food production. This is a positive step in reducing emissions caused by the global food industry. However, counteracting these initiatives, there is an aggressive rush to obtain patents that provide them with a massive competitive advantage in future food systems.

The reliance of people on laboratories for their food will be accompanied by the emergence of new billionaires who control that industry. We find ourselves subject to the control of a few companies that have obtained patents to meet our nutritional needs, leaving us with few legal alternatives to rely on.

If developing countries wish to introduce genetically modified crop technologies and use them in their agricultural systems, they must recognize the intellectual property rights of the companies developing these modified crops.²⁹

Conclusion

In light of contemporary challenges, food security has become a real concern for all nations worldwide. Many countries are struggling to increase agricultural production at the rate needed to meet growing food demand because of various reasons including poverty, demographic growth and other factors. This has prompted an urgent effort to find suitable solutions, both short-term and long-term, to address the looming threat of food shortages.

Intellectual property has become one of the central issues for countries facing food insecurity, due to the positive impact it can have on agriculture and food production.

The main findings of this study are as follows:

- Intellectual property plays a crucial and effective role in the agricultural sector through patents and plant breeders' rights, particularly in relation to technological advances in genetic engineering.

The inclusion of intellectual property rights in agriculture ensures food security by encouraging researchers and innovators to develop new innovations in this field. This is done with the assurance of protection for their rights, as well as fostering both domestic and foreign investment.

- The strict and widespread protection of intellectual property rights in the agricultural sector has led to emerging risks to food security, as these rights allow a small number of large companies to control a significant portion of the food supply, thereby dominating markets and influencing the food consumed by the global population.

Recommendations:

- The necessity of establishing a well-structured legal system that protects innovations in the fields of food and agriculture through patents, ensuring a balance between the interests of innovators and the public interest.
- Efforts should be made to develop and preserve natural resources and protect the environment.
- Launching urgent development initiatives and projects to achieve sustainable development goals as part of an Arab agricultural development strategy.
- Enhancing efforts to modernize national and Arab agriculture and develop its productive capacity and competitiveness.

¹-FAO is an abbreviation for the Food and Agriculture Organization, which is a specialized organization affiliated with the United Nations that leads international efforts to eradicate hunger in The world, this organization was established on October 16, 1945 in Canada, and its members number 194 countries, in addition to the European Union (member organization) and also the Faroe Islands and Tokelau (managing members)

²- Nokos Alekandrtos, « the outlook for word-food and agriculture to year 2010 paper presented at: population and food in the early twenty-first century, edited by Nurul Islam (Washington, dc: international food policy research institute1 1995.

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⁵ - صبحي القاسم، الأمن الغذائي العربي، حاضره مستقبله، مؤسسة عبد الحميد شومان، عمان 1993، ص 173.

⁶ - شريف فياض، دورية متخصصة في شؤون الدولة تصدر عن مؤسسة الأهرام، 2022/11/06.

⁷-The United Nations adopts new global goals to achieve sustainable development for humanity and the planet by 2030, on 9/25/2015 193 members of the United Nations General Assembly officially adopted the Sustainable Development Agenda and a set of bold global goals:
un.org/sustainabledevelopment/ar/2015/09.

The Sustainable Development Goals are a plan to achieve a better, more sustainable future. These goals address the global challenges we face, including challenges related to poverty, inequality, climate, environmental degradation, prosperity, peace, and justice. There are 17 goals. The first goal relates to the eradication of poverty, and the second goal is Zero hunger, the eighth goal is decent work and economic growth, the twelfth goal is responsible consumption and production, and the thirteenth goal is climate action.

⁸ - إبراهيم ادم أحمد الدخيري، استراتيجية التنمية الزراعية العربية المستدامة، جامعة الدول العربية، المنظمة العربية للتنمية الزراعية، 2030/2020، ص 31.

⁹ - بن عبيد فريد، مطاي عبد القادر، صلاح محمد، الامن الغذائي في الوطن العربي، دراسة تحليلية ونظرة استشرافية للحلول مقال منشور بمجلة الحقوق والعلوم الإنسانية، العدد الاقتصادي -34(1)، جامعة زيان عاشور بالجلفة، ص 145.

¹⁰ - سعيد عبد الخالق، الامن القومي العربي من منظور اقتصادي، شؤون عربية، جامعة الدول العربية، عدد 85، 1996، ص 21.

¹¹ - إبراهيم ادم أحمد الدخيري، استراتيجية التنمية الزراعية العربية المستدامة، جامعة الدول العربية، المنظمة العربية للتنمية الزراعية، 2030/2020، ص 32.

¹² - حسام الدين عبد الغني الصغير، حماية الملكية الفكرية وتحديات العولمة، تامين الغذاء، كلية الحقوق، جامعة حلوان، مصر ص 2.

¹³ - The Agreement on Trade-Related Aspects of Intellectual Property Rights, known as the TRIPS Agreement, which emanates from the General Agreement The Tariffs and Trade Agreement (GATT), an international agreement administered by the World Trade Organization (WTO), which sets minimum standards for laws relating to many forms of intellectual property, as applicable to WTO members, was negotiated at the end of the Uruguay Round of the Agreement on Tariffs and Trade in 1994.

¹⁴ - The number of member states in the World Trade Organization has reached 159, and they are all committed to the provisions of the TRIPS Agreement and must Amending its legislation in accordance with its texts, and among these countries there are 12 Arab countries: Bahrain, Egypt, Kuwait, Qatar, Tunisia, Morocco, the Emirates, Mauritania, Jordan, Saudi Arabia, the Sultanate of Oman, and Djibouti.

¹⁵ - Microorganisms mean those organisms that are extremely small and cannot be seen with the naked eye, and include bacteria and fungi. Algae, single-celled organisms, and viruses, they are widely used in many industries, especially the food and pharmaceutical industries.

¹⁶ - For example, the French patent law issued in 1968 did not address the issue of the patentability of microorganisms.

¹⁷ - حسام عبد الغني الصغير، المرجع السابق، ص 5

¹⁸ -Article 53 of the European Patent Convention, Munich Convention 1973...

The European Patent Treaty (EPC) is an international treaty established under the European Patent Convention of 1973, and entered into force in 1977. The agreement, through the institution of the European Patent Office (EPO), establishes an independent law to provide patent protection in its member states.

¹⁹ - In 1978, Article 7 of the French Patent Law issued in 1968 was amended, and paragraph (c) was decided from the same article that the exception relating to mostly biological species of animals for the production of plants and animals from patentability does not apply to precise biological methods and products obtained using these methods, Law No. 68-742, issued on July 13, 1978, Article 5.

²⁰ - Several subsequent amendments were made to the International Convention for the Protection of New Varieties of Plants (UPOV Convention). Respectively: November 10, 1972, October 23, 1978, and finally on March 19, 1991. This last amendment entered into force on April 24, 1998.

²¹ -Article 27/1 of the TRIPS Agreement

²² -Article 27, paragraph 1, of the TRIPS Agreement

²³ - Law No. 05-03, dated February 6, 2005, relating to seeds, seedlings, and the protection of plant tenure, Official Gazette No. 11, Dated 09 February 2005.

²⁴ - Article 3, paragraph 3, of Law No. 05-03.

²⁵ - Robert Bardowin (1985), *Le développement agricole en Afrique tropical*, édition Cujas.

²⁶ - This was on: June 15, 2017. P 125

²⁷ - الملكية الفكرية لتعزيز الابتكار في المنطقة العربية، الأمم المتحدة، الاسكوا، بيروت، 2019، ص 23.

²⁸ - قانداتا شيفاء، حقوق الملكية الفكرية، حماية ام نهج، دار المريخ للنشر، طبعة 2001، ص 125.

²⁹ - محمود الاشرم، التنوع الحيوي والتنمية المستدامة والغذاء عالميا وعربيا، مركز دراسات الوحدة العربية 2010، ص 112.

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