

The Great Transformation of the Agri-Food Sector: A Transformation for Life and Well-Being

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Abstract: This analysis aims to explore the urgent need to drive a major transformation of the agri-food sector. With this, it is intended to contribute to defining strategies for the future of agri-food systems. In this sense, the dynamics and importance of the agri-food sector are examined. Scientific and technological developments in the sector are described below. Subsequently, the implications of the link between health and agri-food systems are discussed. Next, alternatives are proposed to recover, heal and improve agri-food systems and the planet. Finally, some strategies are formulated to begin the great transformation of the agri-food sector, a transformation for the life and well-being of all. With appropriate planning and management, the great transformation of the agri-food sector can be achieved and the demand for healthy, nutritious and safe foods can be met.

Keywords: food and health; health and well-being; technological change and innovation; science and technology; smart agri-food systems



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1. Introduction

The pandemic caused by SARS-CoV-2 transformed all aspects of our lives. In addition, the best way to resist, adapt and overcome health problems is by maintaining a healthy, balanced and culturally appropriate diet. The above is made evident in the close relationship that exists between food production, health and well-being [1]. On the other hand, the effects of vaccination against SARS-CoV-2 indicate that they present multiple health risks, since vaccination is associated with various potentially serious adverse events such as myocarditis [2]. That is to say that thinking only about vaccines and medicine is not the best way to face health problems if we continue with the current logic of food production (with the massive use of agrochemicals, hormones, antibiotics and preservatives, among other chemical molecules).

Addressing health problems requires comprehensive care methods (prevention, diagnosis, control and eradication). The most effective and efficient way to control modern health problems is through prevention. The best option is the transformation of agri-food systems to produce nutritious, balanced and safe diets (physically, chemically and biologically). It must be ensured that consumers have access to healthy, sustainable and culturally acceptable diets [3]. Unhealthy food is one of the leading causes of death in the world, and it is estimated that diet-related diseases have been responsible for 11 million premature deaths and 255 million illnesses [4].

Currently, enterprises are more concerned about extending the life of food than about its quality [5]. However, ultra-processed foods pose health risks, especially cardiometabolic diseases, mental disorders and finally premature deaths [6,7]. In addition, they have a high environmental cost and require enormous amounts of water and agrochemicals [8]. The consumption of modern foods involves consuming sweeteners such as aspartame, which is classified as potentially carcinogenic [9] and is an ingredient in more than 5000 food products [10].

In that sense, the hidden costs related to food are very high, amounting to USD 12.7 trillion of the gross domestic product in 2020 in terms of purchasing power parity, of

which 73% is associated with health, 20% with environmental costs and 4% with social costs [11]. It is possible to reverse these costs if diet is improved. Adopting healthy dietary patterns can increase life expectancy by 10 years [12]. Product labeling has shown potential as a public health tool [13]. However, this is an alternative that does not attack the real causes of the problems.

Consequently, the transcendence of the agri-food sector goes far beyond its economic importance; it is the only sector that allows life to be maintained and reproduced [1,14]. The food obtained from the agri-food sector is essential not only to sustain life but also for the optimal performance of all the functions of living beings. Of course, there are currently important advances in food production in laboratories or through quasi-artificial methods. However, they are still in their initial stages, and their contribution to the nutrition of humanity is practically nil. In addition, agri-food systems are the largest biome on the planet and the one that has the greatest impact on the elemental cycles of nitrogen, phosphorus, water and carbon [15]. The dynamics of agri-food systems have very strong implications for planetary stability. Furthermore, plant-based diets are a public health problem linked to planetary health [16,17].

Is another world and another future possible? Yes, a world for life and a future for all, and a world that cares for the environment and improves human relations, is possible [18]. Considering the social problems and needs, the aim of this analysis is to raise the urgent need to promote a major transformation of the agri-food sector, for which some technological alternatives and strategies for its implementation are proposed (Figure 1). This must be a sustainable transformation, with an ethic for life and to heal the planet. It has been almost a century since *The Great Transformation* was published, and it proposed reversing the dynamics of the economy, society and relationships with nature [19], but this has not been achieved. However, there is no other option given the current situation and future projections.

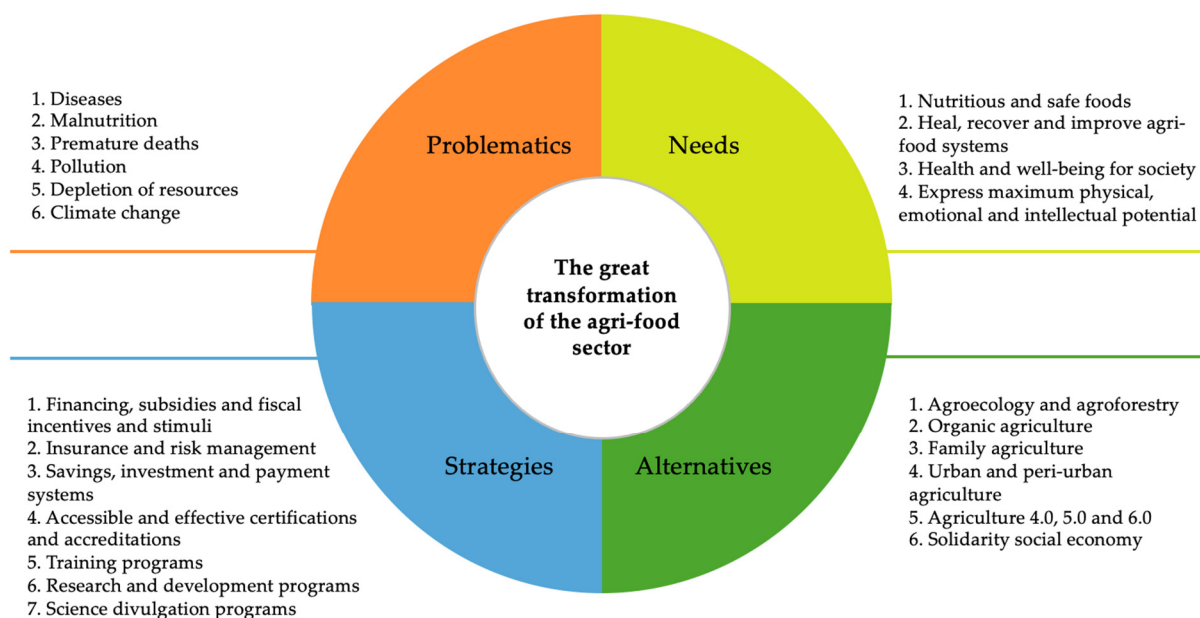


Figure 1. Problems, needs, alternatives and strategies to promote the great transformation of the agri-food sector.

It is worth mentioning that in order to carry out this analysis, two theoretical approaches were considered as main axes: (1) sustainability and its complexity, under the premise of balancing economic development and the environment, and (2) the agri-food systems approach, due to the interrelations and transformations that are generated by their actions in all their elements.

The structure of this work is as follows. In Section 2, an analysis of the importance of the agri-food sector and its current dynamics is presented. Section 3 includes a study of the development of science and technology in the agri-food sector. In Section 4, the analysis of the relationships between the agri-food sector and the health and well-being of the population in general is deepened. In Section 5, some alternatives are addressed to transform the logic and dynamics of the agri-food sector. In Section 6, some strategies are proposed to promote the great transformation of the agri-food sector. Finally, in Section 7, the conclusions and limitations of this work are presented, and some recommendations are made.

2. Dynamics and Importance of the Agri-Food Sector

The agri-food sector includes all activities related to the production, collection, storage, processing, distribution and marketing of food for human use and consumption [14], raw materials to produce energy, and essential non-food consumables such as medicines [1]. For some years now, the global agri-food sector has shown increasing specialization driven by demand and has been geared toward producing crops of high commercial value in national or international markets [20,21]. This logic responds to the neoclassical theory of international trade [22]. In this sense, for a country to enter, remain and grow in international markets, it is necessary to develop a strong comparative advantage and a high degree of specialization [23].

This process of agricultural intensification is not new; it began in at least the 1970s and has involved an almost total reconfiguration of production methods and systems, ownership and use of land and, above all, the logic of the social subjects involved [24]. It is a process that occurs recurrently over time, and it is now known as sustainable agricultural intensification with the central idea being the same: increase food production, but in a sustainable way [25,26]. However, the production model continues to make massive use of fossil fuels, agrochemicals, fertilizers and fresh water and drives the massive concentration of wealth [27].

With the above implied, over time, the transformation of agri-food systems at the global level has continued to respond to the interests and needs of populations outside the territories where they are located. There are several examples of the above. In Mexico, the production and success in international markets of red fruits has led to the emergence of global value chains, which have subordinated and displaced traditional agri-food systems [28]. In the case of Brazil, the growing demand from global markets exerts strong pressure on the livestock value chain, which has strong impacts on the environment and sustainability [29]. For example, in Indonesia, supermarket demand is causing people to abandon traditional markets and value chains [30]. In this economic dynamic, production systems are subordinated to market demands, and their negative externalities do not matter [20,21].

Currently, food comes almost entirely from agri-food systems; the problem with this is that the agri-food sector is subordinated to a global economic and scientific system with very clear interests and objectives. In this logic, food is seen only as a commodity, and the only objective of its production is to generate profits regardless of its physical, chemical and biological characteristics and the effects on health [1]. Today, the global agri-food system relies heavily on the use of agrochemicals and other chemical molecules to maintain an adequate level of food production. The problem is that the use of these chemicals generates strong negative externalities that affect the health of the population, the environment and all ecosystem services [31,32]. Technology is far from implying a sustainable transformation of the agri-food sector [33].

However, sustainable agri-food systems are essential to avoid social and ecological disasters, overcome the growth paradigm and redefine the interactions between humanity and nature [34]. One of the great transformation challenges for humanity is for agri-food systems to operate within planetary limits [15,35].

Furthermore, the agri-food sector is essential in meeting the Sustainable Development Goals of eradicating poverty in all its forms and ensuring zero hunger, which are among the main challenges facing humanity [36,37]. Ensuring sustainable agriculture, promoting sustainable economic growth, combating climate change [37], and improving nutrition, health, resource use, biodiversity, transformation, employment and livelihoods [38], among others, all depend on agri-food systems.

Finally, it is important to include regional and local perspectives in political debates about the directions that food system transformations should take [39]. Likewise, continuing with specialization, productive diversification and economic integration at different scales [40], and of course smart specialization [41–43], can thereby obtain smart agri-food systems.

3. Scientific and Technological Development of the Agri-Food Sector

The agri-food sector has shown great resilience and adaptation over time to the challenges that have arisen. The scientific and technological development of the sector and the adaptations of other sectors have allowed for constant modernization, and this has contributed to the fulfillment of its basic mission of producing sufficient food. One could even say that there has been a surplus. However, for some years now, it has been proposed that food should be safe and of good quality, and that the environment should be conserved [44]. In this sense, the agri-food sector has experienced important scientific and technological advances. At least six technological revolutions or scientific paradigms can be identified that have transformed the sector [45–47]. The first is Agriculture 1.0, which was characterized by the use of animal traction, intensive in labor, small plots with low levels of productivity and very low growth rates.

Agriculture 2.0, also known as the Green Revolution, consisted of the use of improved seeds, fertilizers, agrochemicals and specialized agricultural machinery. This allowed a significant increase in productivity, a reduction in labor and high growth rates [48,49]. The impact of the adoption of these technologies worldwide was impressive. This allowed the production of corn, wheat and rice to almost triple, with minimal variation in the planted area. Undoubtedly, thanks to the Green Revolution, many countries solved their food problems, and a major global food crisis was avoided.

Agriculture 3.0 arose from the need to control and manage inputs more efficiently and is known as precision agriculture. Its main feature is the use of Global Positioning Systems that provide reliable positioning and navigation and are used to direct vehicles remotely and to detect and control some activities such as pest control, diseases, weeds and fertilization [45]. Agriculture 4.0, also known as digital agriculture, involves the adoption and adaptation of digital technologies in all segments of the agri-food value chains, from production to the final consumer. It is based on the use of sensors to monitor and collect information, the Internet of Things, the use of drones, the massive and intelligent use of data, intelligent control devices and the automation of facilities [45,46,50].

Agriculture 5.0 is the second phase of application of digital agriculture [51,52] and involves highly interconnected and data-intensive computer technologies. It is oriented towards the use of robotic machines, incorporates artificial intelligence and autonomous systems for decision-making in real time and focuses on caring for the environment [48,51,53]. Finally, Agriculture 6.0 is not about technological gadgets, but about a break with previous technological systems. It aims to address global challenges such as climate change, resource depletion, pollution, sustainability and maintaining food production. It seeks to provide specific and highly specialized solutions to protect, restore and heal agroecosystems in order to increase the resilience of productive environments and make agri-food systems healthier [54,55].

Currently, we are in the transition towards Agriculture 4.0, 5.0 and 6.0, and great benefits are expected in all stages and processes of agri-food chains [56,57]. That is, it is expected that we will achieve greater efficiency in the use of resources and production inputs, improve the quality and safety and increase the quantity of agricultural products, and reduce the economic and environmental costs of the agri-food sector [58]. However, as is to be expected with the emergence of a new technology, there is great controversy

and uncertainty about the potential effects (positive and negative) of its adoption and about the political, economic, social and security implications [59,60]. This is mainly due to the technological barriers that exist, the technological capabilities and the scarce regulation of this type of technology, which could cause very different economic, social and environmental impacts in different regions [56,57].

It is worth mentioning that Agriculture 5.0 is the second phase of application and mastery of Agriculture 4.0. Agriculture 6.0, on the other hand, is no longer about technological artifacts. It is about a change in the way society, nature and technology interact and focuses on protecting, healing and recovering agroecosystems; that is, it is a kind of agri-food biorevolution. This includes regenerative agriculture, biotechnology, the circular economy and the bioeconomy, among others.

4. Relationship between Agri-Food Systems and Health

The lifespan of living organisms can be prolonged through genetic, dietary and pharmacological interventions [61]. In human beings, the total loss of resilience or absolute limit of life is between 120 and 150 years [61,62]. However, for *Homo sapiens* to express their maximum genetic potential, they require favorable conditions. Currently, we are far from being able to achieve this potential, and even life expectancy has decreased due to the effects of SARS-CoV-2 [63]. There are different opinions on the possible consequences, but there is a growing consensus in the scientific community about the environmental and health catastrophe that could result if the current model continues [64].

Transforming agri-food systems is urgent in order to improve life and the planet. To contribute to solving modern health problems, it is necessary to recover, heal and improve agri-food systems. The current dynamics of agri-food systems are causing serious environmental and health problems. The above is related to a strong distancing between the degree of evolution of the *Homo sapiens* genome and its biological environment. This has been caused by the migration from the countryside to the city, the change in habits, the gradual loss of biodiversity and food modernity [65].

It is true that the use of agrochemicals contributes substantially to maintaining and increasing agri-food productivity. However, agri-food systems make massive use of agrochemicals and other molecules for food production. As a result, agrochemical residues are being detected in practically all agri-food chains [66–68]. In addition, agri-food fraud is becoming more and more frequent, such as in the case of organic production [69]. It is true that it is difficult to abandon the use of agrochemicals immediately, as it would affect food production worldwide. More than 1000 agrochemicals are currently used for food production [70] and to control household pests [71]. However, these are highly toxic products, and their irrational use poses serious risks and consequences for the health of the population and the environment [71]. Some estimates indicate that around 385 million people worldwide become ill due to the use of agrochemicals, and approximately 11,000 deaths occur each year [72,73]. The most affected regions are Asia, Latin America and Africa, where population incomes are lower, sales have been increasing in recent years, and environmental and health regulations are very lax [73].

The harmful effects of agrochemicals on health have been identified for decades. However, scientific findings on these relationships are denied, minimized and/or marginalized [1]. For example, the environmental damage of DDT (dichlorodiphenyltrichloroethane) was documented in the 1950s [74]. Since 1990, human poisoning by agrochemicals has been seen as a public health problem [72]. The use of agrochemicals has increased throughout the world, and they have also been transformed; new ones have been created, and a huge generic sector has emerged. Furthermore, their lower effectiveness due to resistance to agrochemicals has also driven the intensification of their use [75]. Currently, there is no updated overview of agrochemical poisoning [72].

The long-term harmful effects of agrochemicals vary according to the type and level of exposure. However, there are those that directly affect the exposed individual, such as the impairment of hormonal development, sterility, aplastic anemia and various types of cancer

and disorders, and those observed in their offspring (affecting future generations), such as teratogenesis, mutagenesis and alterations in the immune system and/or the central nervous system [71,76,77]. Of course, people directly exposed to agrochemicals have a higher risk of developing all types of cancer, especially at certain stages of development [76]. Exposure to agrochemicals has been documented to be associated with an increase in the occurrence of neurological disorders that are increasingly affecting the population, such as Parkinson's and Alzheimer's [71,77]. In addition, they are related to chronic respiratory diseases, respiratory disorders and very severe lung diseases [71].

For example, for glyphosate, epidemiological evidence indicates strong correlations between its use and a multitude of cancers [78]. Likewise, prepubertal exposure to glyphosate modifies testosterone levels and testicular morphology. The same occurs in amphibians exposed to atrazine: males are completely demasculinized or feminized, and they have depressed testosterone, suppressed mating and spermatogenesis and decreased fertility [79]. In addition, this exposure is related to the appearance of malformations of the reproductive system, nervous system, musculoskeletal system and digestive system, among others [80–82].

On the other hand, the use of agrochemicals is also associated with some modern psychological and psychiatric problems. A correlation has been found between exposure to glyphosate, the herbicide with the highest global use, and biomarkers indicative of neurological impairment [83]. Early exposure to environmental chemicals is particularly a risk factor for neuropsychiatric disorders such as depression and anxiety [84]. This exposure also generates alterations in the profiles of the intestinal microbiota, which cause alterations in the gut–brain axis, a fundamental aspect of regulation of the central nervous system; these alterations are correlated with major depressive disorders, anxiety and psychiatric disorders [85,86].

On the other hand, chemical products called growth promoters (steroid hormones, synthetic anabolics and growth hormones, among others) are also used in the livestock sector. In this sense, the consumption of milk and dairy products in general has been identified as a risk factor for the occurrence of breast cancer [87]. It is also associated with other types of cancer, such as bladder and prostate cancer. It is worth mentioning that there is much controversy and debate regarding the ways in which studies are conducted and their findings [88,89]. In addition, in the consumption of animal protein, high levels of antibiotics are also consumed involuntarily, and for some years now a strong resistance has been generated by various organisms, which could cause serious problems in the future. Antibiotic resistance prolongs hospital stays, increases medical costs and mortality [90], and is considered one of the greatest health threats for the future.

In the livestock sector, growth promoters are used, and they always generate residues in food [91], the impact of which on the human body is unknown [92]. The impacts of these substances have not been clearly identified; however, effects similar to those that occur in experimental species would be expected [1]. For example, according to the World Health Organization, very low values in the case of hormones could generate physiological effects and generate important changes that have not yet been identified [92].

5. Alternatives for the Transformation of the Agri-Food Sector

Implementing the great transformation of the agri-food sector is an irrefutable urgency [93]. The agri-food sector must provide and guarantee safe, accessible and affordable diets [3]. To achieve this, it is necessary to create synergies between the agri-food sector and the rest of the sectors, thinking about inclusive livelihoods and sustainable ecosystems [40,94,95]. Of course, systemic changes are required [39]. The transformation of each country and region will be different depending on their technological trajectories [33]. The alternatives to heal, recover and improve agri-food systems are not new, and there is a solid knowledge base. Of course, it is necessary to understand the specific conditions of each region [34], which involves reconfiguring social, political, economic, environmental and health relationships. These alternative systems are described below:

1. *Agroecology and agroforestry.* These production systems integrate ecological food production processes and are an alternative food model with great potential. They are not only a technological proposal but also forms of organization of production and all the relationships that this implies [96–98]. They are traditional systems that can contribute to the solution of environmental problems in agriculture [99]. They present ecological sustainability, help reduce poverty and offer ecosystem services and multiple environmental benefits [100].
2. *Organic agriculture.* It is a production system in which its methods involve returning to the principles of harmony between food production and the environment. It focuses on minimizing the use of non-renewable inputs and not using synthetic fertilizers or agrochemicals. Organic agriculture is a global food production management system that encourages, facilitates and promotes the health of agroecosystems, biological diversity and maintains biological cycles. This is achieved by harmoniously applying agronomic, biological and mechanical methods [101]. It is currently increasing in surface area worldwide thanks to the growing awareness of consumers to consume healthier foods.
3. *Family farming.* This type of agriculture has the capacity to produce more than 80% of the globally calculated food that society requires to live well [102]. Small agri-food farms are an important source of food and income [40] and contribute to conserving and expanding species diversity and reducing food waste and losses [103]. Furthermore, small businesses currently generate more than 50% of jobs [104,105].
4. *Urban and peri-urban agriculture.* This type of agriculture is crucial for urban areas in terms of food supply, ecology, biodiversity, disaster mitigation and recreation [106]. These production systems are gaining popularity worldwide due to increasing urbanization and the need to produce food sustainably. Furthermore, due to their multifunctionality, they have a high value by providing social, economic and environmental collateral benefits [107]. They contribute to strengthening food security by providing local, nutritious, safe and fresh food and thereby reducing dependence on other regions. Currently, more than half of the world's population lives in cities, and to achieve sustainability it is necessary for these areas to produce at least part of their food.
5. *Agriculture 4.0, 5.0 and 6.0.* Digital innovations can positively contribute to the transition towards sustainability [108]. With these technologies, greenhouse gas emissions, food waste and malnutrition can be stopped [109]. These technological advances project benefits and positive impacts and are focused on sustainability, caring for the environment, managing and restoring ecosystems and making ecosystems healthier [48,54,55,110,111]. However, it is necessary to consider that electronic products have notable effects on the waste stream [112].
6. *Social solidarity economy.* Its objective is to generate a harmonious and sustainable economic system through which trade and fair exchange are sought in order to revalue agri-food products and achieve a dignified life. Its foundation and principles are the social relations of production and exchange based on cooperation, equity, non-exploitation of work, fair exchange, reciprocity, cooperative competition, association and recognition of the other as an equal, without giving up personal interests [113,114]. It seeks to create value at the individual level, to create well-being at the collective level, to conserve the environment and to reverse damage to agrosystems. Of course, the above implies developing new business models capable of creating value in a sustainable way [115].

It is worth mentioning that the proposed alternatives still have some limitations. More knowledge about their management and new technologies are required to achieve greater efficiency. In addition, in some cases their implementation is very expensive, and a large part of the population does not have access to them. In other cases, there are still problems with the scalability of production systems, mainly related to the availability of inputs and operating logistics.

6. Strategies for the Transformation of the Agri-Food Sector

Today more than ever there is a need to support the agri-food sector to increase the production of healthy, nutritious foods with less impact on the environment and health [116]. That is, unconventional strategies are needed. The challenges for the agri-food sector require designing public policies that affect a change in the supply and demand of food and the impacts on the environment and health [3,117]. Based on the above, it is necessary to modify public policies [94], design global agri-food policies and create a monitoring infrastructure [59].

The agri-food system requires deep, systematic change and a lot of cooperation and collaboration. To achieve this efficiently and effectively, it is necessary to combine a series of strategies in all communities, institutions and organizations [118], maintain long-term commitments and economic compensations, and resolve scientific, political and economic controversies [93]. Below, some strategies are described that can serve as inputs for the generation of new agri-food policies:

1. *Financing and fiscal stimuli.* An effective and inclusive transformation requires accessible and appropriate financing and incentives [119]. These strategies stimulate the adoption of sustainable technologies [120]. Tax incentives for green technologies have higher multiplier effects [121]. Financing and subsidies are effective in increasing productivity and economic performance [122]. Currently, there are tax payment and financing exemptions; however, they are not related to technologies. These strategies must be directly linked to the adoption of technologies. From the adoption of sustainable technology, the payment of taxes should be reduced, and/or vice versa, the same should occur with subsidies and financing (Figure 2).

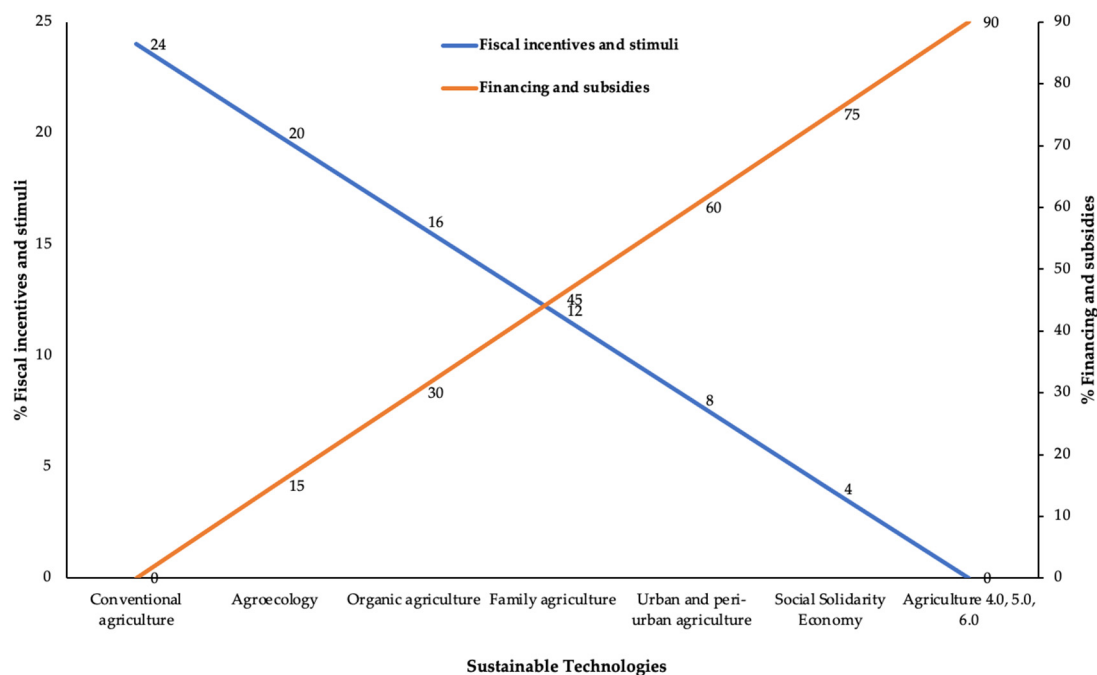


Figure 2. Financing scheme, subsidies, incentives and fiscal stimuli to promote sustainable agri-food technologies.

It is worth mentioning that there are similar taxes to discourage, for example, the consumption of tobacco and beverages with high sugar content. These instruments are incipient and must be evaluated based on the essential co-benefits of health and environmental conservation [121]. The aim is to gradually internalize negative externalities. In other words, product prices or production costs should reflect the social costs of food production. This has been proposed through Pigouvian taxes as an alternative to correct

the negative effects produced by pollution on the environment and/or on the health and well-being of citizens.

2. *Insurance and risk management.* Farmers face risks such as droughts, floods, pests and diseases, unstable prices and access to markets, among others [123]. It is expected that these risks will become more frequent and their impacts greater. Currently, there is agricultural insurance; however, its use is not widespread, and it only provides very basic coverage. It is necessary to be able to access insurance for types of technologies, crops and eventualities. Farmers are willing to pay for this insurance, of course, with the attributes they require [123]. In addition, we must promote the development of insurance with coverage of medical expenses for hospitalizations and medical specialties for the population working in the agri-food sector. The deficiency in these services means that in many cases workers are not attended to, and the health of the population deteriorates more and more, as does the capacity to produce food.

3. *Savings, investment and payment systems.* Financial inclusions allow access to credit to start or enhance a business, save for the future and access insurance schemes, among others [120]. For example, the use of digital payment systems facilitates access to financial services [124]. In the agri-food sector, these types of services are almost non-existent. Digital financial services would make it possible to manage income and cash flows and their relationship with the seasonality of production and planning, thereby reducing costs, theft and extortion. In addition, it is necessary to create formal systems for retirement savings and pensions for the population engaged in food production. Currently, there are no instruments of this type, which leaves them completely abandoned and in misery.

4. *Accessible and effective certifications and accreditations.* These instruments would make it possible to evaluate and monitor the great transformation of the agri-food sector. In addition, they are essential in improving food production and avoiding agri-food fraud [125,126], which represents a serious threat to the production and marketing of food [69] and violates the safety of consumers. Also, it is important to define regulations and sanctions that persuade the population to commit this type of crime. With appropriate regulations and sanctions, it would be possible to ensure that all food supply chains are transparent and free of food fraud [126]. Currently, such instruments are practically non-existent. It would be advisable to consider including agri-food fraud in criminal and administrative codes.

5. *Training.* Reality indicates that we are moving into the digital age. In this sense, it is essential to have training programs on digital technologies and platforms [120], training on sustainable technologies to successfully adopt and adapt them and training on finances to obtain returns from agribusiness. Management and training in agribusiness are essential for agri-food policies and strategies to be successful [127]. The correct administration and management of financial, human, natural and technological resources is essential for successful planning and financial strategies.

6. *Research and development.* Solving problems in a systemic and comprehensive way requires intensive use of knowledge. Therefore, investment in scientific research that is focused on sustainable agri-food technologies must be strengthened. Society demands better-quality products, greater supervision and regulation, sustainable practices and health-related attributes [58]. The current dynamics and problems require the strengthening of concrete actions in science, technology and innovation on these topics.

7. *Divulgence of science.* Infodisinformation is an increasingly serious problem, and society is experiencing a strong problem of scientific misinformation [128]. In this sense, it is necessary to generate divulgation programs on the relationship between agri-food systems and health. Scientific divulgation provides the population with useful knowledge with a prevention focus [129] and allows the genuine appropriation of knowledge [130]. The consumer has the right to be informed about the way food is produced and based on this to decide what to consume.

These proposals and strategies are based on a very simplified and summarized vision of the possible future of agri-food systems. In other words, there is immense complexity in the global agri-food sector. There are an infinite number of realities in each geographic region that

prevent an analysis of this type from considering its universe and its multi-determinism. Of course, there are common elements, problems, needs and realities that allow us to outline some guidelines that could be followed. In other words, this analysis invites us to continue working, improving and fine-tuning proposals and strategies with the aim of contributing to the design of a policy that configures a sustainable global agri-food system.

7. Conclusions

For *Homo sapiens* to be able to express their maximum genetic potential and adequate physical, emotional and intellectual development, it is necessary to promote the great transformation of the agri-food sector, which implies a profound transformation of the way food is produced, an intelligent transformation for life and well-being with a vision for the future, sustainability and ethics for life.

With an appropriate global agri-food policy, the demand for healthy, nutritious and safe foods could be met. To achieve this will require a lot of investment and long-term thinking. If the hidden costs of food production are considered, the great transformation of the agri-food sector is the best option.

With these strategies, the agri-food sector could be more attractive, especially for the younger population, because it would give them certainty about their future. Furthermore, it is advisable to integrate large work and research groups to continue working on these problems, to propose alternatives from different perspectives and to develop and implement unconventional strategies.

The limitations of these proposals are mainly related to the lack of evaluations and measurements of the positive and/or negative effects of implementing the strategies. This is mainly due to the lack of data to carry out analyses and possible projections. In this sense, it is advisable to continue dialoguing and discussing ways to improve the proposed strategies and, if possible, generate, share and analyze the effects.

The great transformation of the agri-food sector could have profound implications in various aspects. It would undoubtedly improve the quality of the environment and health conditions. However, given the complexity of the sector, it would imply transforming business models, markets and their regulation. In other words, it is not a simple process; it requires a lot of research, a lot of work, a lot of political will and a lot of resources.

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References

1. Vargas-Canales, J.M.; Orozco-Cirilo, S.; Estrada, S.; del Carpio-Ovando, P.S.; Camacho-Vera, J.H.; López-Carmona, D.; García-Melchor, N.; Rodríguez-Haros, B.; Valdés-Cobos, A.; Sánchez-Torres, Y.; et al. Science, Technology, Agri-Food Systems, Health, and Wellbeing: Logic, Dynamics, and Relationships. *Front. Sustain. Food Syst.* **2024**, *8*, 1–14. [\[CrossRef\]](#)
2. Barda, N.; Dagan, N.; Ben-Shlomo, Y.; Kepten, E.; Waxman, J.; Ohana, R.; Hernán, M.A.; Lipsitch, M.; Kohane, I.; Netzer, D.; et al. Safety of the BNT162b2 mRNA Covid-19 Vaccine in a Nationwide Setting. *N. Engl. J. Med.* **2021**, *385*, 1078–1090. [\[CrossRef\]](#)
3. Brouwer, I.D.; van Lier, M.J.; de Brauw, A.; Dominguez-Salas, P.; Herforth, A.; Kennedy, G.; Lachat, C.; Omosa, E.B.; Talsma, E.F.; Vandevijvere, S.; et al. Reverse Thinking: Taking a Healthy Diet Perspective towards Food Systems Transformations. *Food Secur.* **2021**, *13*, 1497–1523. [\[CrossRef\]](#)
4. Afshin, A.; Sur, P.J.; Fay, K.A.; Cornaby, L.; Ferrara, G.; Salama, J.S.; Mullany, E.C.; Abate, K.H.; Abbafati, C.; Abebe, Z.; et al. Health Effects of Dietary Risks in 195 Countries, 1990–2017: A Systematic Analysis for the Global Burden of Disease Study 2017. *Lancet* **2019**, *393*, 1958–1972. [\[CrossRef\]](#)

5. Liaudat, S. La Pandemia Está Directamente Relacionada al Sistema Alimentario Agroindustrial. *Cienc. Tecnol. Política* **2020**, *3*, 041. [\[CrossRef\]](#)
6. Lane, M.M.; Gamage, E.; Du, S.; Ashtree, D.N.; McGuinness, A.J.; Gauci, S.; Baker, P.; Lawrence, M.; Rebholz, C.M.; Srour, B.; et al. Ultra-Processed Food Exposure and Adverse Health Outcomes: Umbrella Review of Epidemiological Meta-Analyses. *BMJ* **2024**, *384*, e077310. [\[CrossRef\]](#) [\[PubMed\]](#)
7. Brambila-Paz, J.D.J.; Rojas-Rojas, M.M.; Martínez-Damián, M.Á.; Pérez-Cerecedo, V. Mortandad Por Enfermedades Modernas En Función Del Consumo de Productos Ultraprocesados: Caso México. *Agric. Soc. Desarro.* **2023**, *20*, 1–11. [\[CrossRef\]](#)
8. Vega Mejía, N.; Ponce Reyes, R.; Martinez, Y.; Carrasco, O.; Cerritos, R. Implications of the Western Diet for Agricultural Production, Health and Climate Change. *Front. Sustain. Food Syst.* **2018**, *2*, 1–5. [\[CrossRef\]](#)
9. Organización Mundial de la Salud (OMS). Se Publican Los Resultados de La Evaluación Del Riesgo y La Peligrosidad Del Aspartamo. *Comunicado de Prensa Conjunto, Ginebra*, 14 July 2023.
10. Landrigan, P.J.; Straif, K. Aspartame and Cancer—New Evidence for Causation. *Environ. Health* **2021**, *20*, 42. [\[CrossRef\]](#)
11. Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). *El Estado Mundial de La Agricultura y La Alimentación 2023. Revelar El Verdadero Costo de Los Alimentos Para Transformar Los Sistemas Agroalimentarios*; FAO: Roma, Italy, 2023; ISBN 978-92-5-138417-6.
12. Fadnes, L.T.; Celis-Morales, C.; Økland, J.-M.; Parra-Soto, S.; Livingstone, K.M.; Ho, F.K.; Pell, J.P.; Balakrishna, R.; Javadi Arjmand, E.; Johansson, K.A.; et al. Life Expectancy Can Increase by up to 10 Years Following Sustained Shifts towards Healthier Diets in the United Kingdom. *Nat. Food* **2023**, *4*, 961–965. [\[CrossRef\]](#)
13. Merz, B.; Temme, E.; Alexiou, H.; Beulens, J.W.J.; Buyken, A.E.; Bohn, T.; Ducrot, P.; Falquet, M.-N.; Solano, M.G.; Haidar, H.; et al. Nutri-Score 2023 Update. *Nat Food* **2024**, *5*, 102–110. [\[CrossRef\]](#) [\[PubMed\]](#)
14. Vargas-Canales, J.M.; García-Melchor, N.; Orozco-Cirilo, S.; Camacho-Vera, J.H. Los Siete Pecados Capitales Del Sector Agroalimentario En México y Cómo Revertirlos. *Agric. Soc. Desarro.* **2023**, *20*, 516–532. [\[CrossRef\]](#)
15. Rockström, J.; Edenhofer, O.; Gaertner, J.; DeClerck, F. Planet-Proofing the Global Food System. *Nat. Food* **2020**, *1*, 3–5. [\[CrossRef\]](#)
16. Kraak, V.I.; Aschemann-Witzel, J. The Future of Plant-Based Diets: Aligning Healthy Marketplace Choices with Equitable, Resilient, and Sustainable Food Systems. *Annu. Rev. Public. Health* **2024**, *45*, 253–275. [\[CrossRef\]](#)
17. Ramkumar, D.; Marty, A.; Ramkumar, J.; Rosencranz, H.; Vedantham, R.; Goldman, M.; Meyer, E.; Steinmetz, J.; Weckle, A.; Bloedorn, K.; et al. Food for Thought: Making the Case for Food Produced via Regenerative Agriculture in the Battle against Non-Communicable Chronic Diseases (NCDs). *One Health* **2024**, *18*, 100734. [\[CrossRef\]](#)
18. Hinkelammert, F.J.; Mora Jiménez, H.M. *Hacia Una Economía Para La Vida*; Primera, Ed.; Editorial Departamento Ecuménico de Investigaciones (DEI): San José, Costa Rica, 2005; ISBN 9977831483.
19. Polanyi, K. *La Gran Transformación. Crítica Del Liberalismo Económico*; Quipu Editorial: Madrid, España, 1947; ISBN 8477310475.
20. Vargas-Canales, J.M.; Carbajal-Flores, G.; Bustamante-Lara, T.I.; Camacho-Vera, J.H.; Fresnedo-Ramírez, J.; Palacios-Rangel, M.I.; Rodríguez-Haros, B. Impact of the Market on the Specialization and Competitiveness of Avocado Production in Mexico. *Int. J. Fruit. Sci.* **2020**, *20*, S1942–S1958. [\[CrossRef\]](#)
21. Vargas-Canales, J.M.; Bustamante-Lara, T.I.; Rodríguez-Haros, B. Especialización y Competitividad Del Sector Agrícola En México. *Braz. J. Bus.* **2022**, *4*, 1890–1905. [\[CrossRef\]](#)
22. Costinot, A.; Donaldson, D.; Vogel, J.; Werning, I. Comparative Advantage and Optimal Trade Policy. *Q. J. Econ.* **2015**, *130*, 659–702. [\[CrossRef\]](#)
23. Kang, M. Comparative Advantage and Strategic Specialization. *Rev. Int. Econ.* **2018**, *26*, 1–19. [\[CrossRef\]](#)
24. Gárgano, C. *El Campo Como Alternativa Infernal. Pasado y Presente de Una Matriz Productiva ¿sin Escapatoria?* Imago Mundi: Buenos Aires, Argentina, 2022; ISBN 978-950-793-384-4.
25. Garnett, T.; Appleby, M.C.; Balmford, A.; Bateman, I.J.; Benton, T.G.; Bloomer, P.; Burlingame, B.; Dawkins, M.; Dolan, L.; Fraser, D.; et al. Sustainable Intensification in Agriculture: Premises and Policies. *Science* **2013**, *341*, 33–34. [\[CrossRef\]](#)
26. Tilman, D.; Balzer, C.; Hill, J.; Befort, B.L. Global Food Demand and the Sustainable Intensification of Agriculture. *Proc. Natl. Acad. Sci. USA* **2011**, *108*, 20260–20264. [\[CrossRef\]](#) [\[PubMed\]](#)
27. Gárgano, C. Agroextractivism in Argentina Environmental Health, Scientific Agendas, and Socioecological Crisis. *Front. Public. Health* **2023**, *11*, 1304514. [\[CrossRef\]](#) [\[PubMed\]](#)
28. González-Ramírez, M.G.; Santoyo-Cortés, V.H.; Arana-Coronado, J.J.; Muñoz-Rodríguez, M. The Insertion of Mexico into the Global Value Chain of Berries. *World Dev. Perspect.* **2020**, *20*, 100240. [\[CrossRef\]](#)
29. Guéneau, S. Neoliberalism and the Emergence of Private Sustainability Initiatives: The Case of the Brazilian Cattle Value Chain. *Bus. Strategy Environ.* **2018**, *27*, 240–251. [\[CrossRef\]](#)
30. Vetter, T.; Nylandsted Larsen, M.; Bech Bruun, T. Supermarket-Led Development and the Neglect of Traditional Food Value Chains: Reflections on Indonesia's Agri-Food System Transformation. *Sustainability* **2019**, *11*, 498. [\[CrossRef\]](#)
31. Elizondo, C. Rumbo al Sistema Agroalimentario Que Necesitamos: GISAMAC. *La J. Campo* **2020**, 157.
32. Alliot, C.; Mc Adams-Marin, D.; Borniotto, D.; Baret, P.V. The Social Costs of Pesticide Use in France. *Front. Sustain. Food Syst.* **2022**, *6*, 1027583. [\[CrossRef\]](#)
33. Ambikapathi, R.; Schneider, K.R.; Davis, B.; Herrero, M.; Winters, P.; Fanzo, J.C. Global Food Systems Transitions Have Enabled Affordable Diets but Had Less Favourable Outcomes for Nutrition, Environmental Health, Inclusion and Equity. *Nat. Food* **2022**, *3*, 764–779. [\[CrossRef\]](#)

34. McGreevy, S.R.; Rupprecht, C.D.D.; Niles, D.; Wiek, A.; Carolan, M.; Kallis, G.; Kantamaturapoj, K.; Mangnus, A.; Jehlička, P.; Taherzadeh, O.; et al. Sustainable Agrifood Systems for a Post-Growth World. *Nat. Sustain.* **2022**, *5*, 1011–1017. [\[CrossRef\]](#)
35. Rockström, J.; Steffen, W.; Noone, K.; Persson, Å.; Chapin, F.S.I.; Lambin, E.; Lenton, T.M.; Scheffer, M.; Folke, C.; Schellnhuber, H.J.; et al. Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecol. Soc.* **2009**, *14*, art32. [\[CrossRef\]](#)
36. Dhahri, S.; Omri, A. Foreign Capital towards SDGs 1 & 2—Ending Poverty and Hunger: The Role of Agricultural Production. *Struct. Chang. Econ. Dyn.* **2020**, *53*, 208–221. [\[CrossRef\]](#)
37. Manzoor, S.; Fayaz, U.; Dar, A.H.; Dash, K.K.; Shams, R.; Bashir, I.; Pandey, V.K.; Abdi, G. Sustainable Development Goals through Reducing Food Loss and Food Waste: A Comprehensive Review. *Future Foods* **2024**, *9*, 100362. [\[CrossRef\]](#)
38. Hodson de Jaramillo, E.; Trigo, E.J.; Campos, R. The Role of Science, Technology and Innovation for Transforming Food Systems in Latin America and the Caribbean. In *Science and Innovations for Food Systems Transformation*; Springer International Publishing: Cham, Switzerland, 2023; pp. 737–749. ISBN 9783031157035.
39. Dengerink, J.; Dirks, F.; Likoko, E.; Guijt, J. One Size Doesn't Fit All: Regional Differences in Priorities for Food System Transformation. *Food Secur.* **2021**, *13*, 1455–1466. [\[CrossRef\]](#)
40. Giller, K.E.; Delaune, T.; Silva, J.V.; Descheemaeker, K.; van de Ven, G.; Schut, A.G.T.; van Wijk, M.; Hammond, J.; Hochman, Z.; Taulya, G.; et al. The Future of Farming: Who Will Produce Our Food? *Food Secur.* **2021**, *13*, 1073–1099. [\[CrossRef\]](#)
41. Pinto, H. Universities and Institutionalization of Regional Innovation Policy in Peripheral Regions: Insights from the Smart Specialization in Portugal. *Reg. Sci. Policy Pract.* **2023**, *16*, 12659. [\[CrossRef\]](#)
42. Balland, P.-A.; Boschma, R.; Crespo, J.; Rigby, D.L. Smart Specialization Policy in the European Union: Relatedness, Knowledge Complexity and Regional Diversification. *Reg. Stud.* **2019**, *53*, 1252–1268. [\[CrossRef\]](#)
43. Asheim, B.T. Smart Specialisation, Innovation Policy and Regional Innovation Systems: What about New Path Development in Less Innovative Regions? *Innov. Eur. J. Social. Sci. Res.* **2019**, *32*, 8–25. [\[CrossRef\]](#)
44. Hubert, B.; Rosegrant, M.; van Boekel, M.A.J.S.; Ortiz, R. The Future of Food: Scenarios for 2050. *Crop Sci* **2010**, *50*, 33–50. [\[CrossRef\]](#)
45. Kovács, I.; Husti, I. The Role of Digitalization in the Agricultural 4.0—How to Connect the Industry 4.0 to Agriculture? *Hung. Agric. Eng.* **2018**, *7410*, 38–42. [\[CrossRef\]](#)
46. Saiz-Rubio, V.; Rovira-Más, F. From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management. *Agronomy* **2020**, *10*, 207. [\[CrossRef\]](#)
47. Guzev, M.M.; Ledeneva, M.V.; Trukhlyaeva, A.A.; Mishura, N.A. Smart Technologies in Agriculture. In *Lecture Notes in Networks and Systems*; Springer International Publishing: Cham, Switzerland, 2021; Volume 155, pp. 1573–1584. ISBN 9783030591267.
48. Vargas-Canales, J.M.; Brambila-Paz, J.d.J.; Pérez-Cerecedo, V.; Rojas-Rojas, M.M.; López-Reyna, M.d.C.; Omaña-Silvestre, J.M. Trends in Science, Technology, and Innovation in the Agri-Food Sector. *Tapuya Lat. Am. Sci. Technol. Soc.* **2022**, *5*, 2115829. [\[CrossRef\]](#)
49. Zhai, Z.; Martínez, J.F.; Beltran, V.; Martínez, N.L. Decision Support Systems for Agriculture 4.0: Survey and Challenges. *Comput. Electron. Agric.* **2020**, *170*, 105256. [\[CrossRef\]](#)
50. Klerkx, L.; Rose, D. Dealing with the Game-Changing Technologies of Agriculture 4.0: How Do We Manage Diversity and Responsibility in Food System Transition Pathways? *Glob. Food Sec* **2020**, *24*, 100347. [\[CrossRef\]](#)
51. Ragazou, K.; Garefalakis, A.; Zafeiriou, E.; Passas, I. Agriculture 5.0: A New Strategic Management Mode for a Cut Cost and an Energy Efficient Agriculture Sector. *Energies* **2022**, *15*, 3113. [\[CrossRef\]](#)
52. Vargas-Canales, J.M. Technological Capabilities for the Adoption of New Technologies in the Agri-Food Sector of Mexico. *Agriculture* **2023**, *13*, 1177. [\[CrossRef\]](#)
53. Juwono, F.H.; Wong, W.K.; Verma, S.; Shekhawat, N.; Lease, B.A.; Apriono, C. Machine Learning for Weed-Plant Discrimination in Agriculture 5.0: An in-Depth Review. *Artif. Intell. Agric.* **2023**, *10*, 13–25. [\[CrossRef\]](#)
54. Neves, M.F.; Casagrande, B.P.; Cambaúva, V.; Teixeira, G.d.O.; Toledo, P.J.F. Agriculture 6.0: A New Proposal for the Future of Agribusiness. *Rev. Gestão Social. E Ambient.* **2023**, *17*, e04004. [\[CrossRef\]](#)
55. Schattman, R.E.; Rowland, D.L.; Kelemen, S.C. Sustainable and Regenerative Agriculture: Tools to Address Food Insecurity and Climate Change. *J. Soil. Water Conserv.* **2023**, *78*, 33A–38A. [\[CrossRef\]](#)
56. da Silva, F.; Barbedo, J.G.A.; da Silva, S.L.C.; Amaral, F.G. Proposal for a Framework to Manage the Barriers That Hinder the Development of Agriculture 4.0 in the Agricultural Production Chain. *Comput. Electron. Agric.* **2023**, *214*, 108281. [\[CrossRef\]](#)
57. da Silveira, F.; da Silva, S.L.C.; Machado, F.M.; Barbedo, J.G.A.; Amaral, F.G. Farmers' Perception of the Barriers That Hinder the Implementation of Agriculture 4.0. *Agric. Syst.* **2023**, *208*, 103656. [\[CrossRef\]](#)
58. Zhang, J.; Trautman, D.; Liu, Y.; Bi, C.; Chen, W.; Ou, L.; Goebel, R. Achieving the Rewards of Smart Agriculture. *Agronomy* **2024**, *14*, 452. [\[CrossRef\]](#)
59. Fielke, S.J.; Garrard, R.; Jakku, E.; Fleming, A.; Wiseman, L.; Taylor, B.M. Conceptualising the DAIS: Implications of the 'Digitalisation of Agricultural Innovation Systems' on Technology and Policy at Multiple Levels. *NJAS Wagening J. Life Sci.* **2019**, *90–91*, 1–11. [\[CrossRef\]](#)
60. Ingram, J.; Maye, D.; Bailye, C.; Barnes, A.; Bear, C.; Bell, M.; Cutress, D.; Davies, L.; de Boon, A.; Dinnie, L.; et al. What Are the Priority Research Questions for Digital Agriculture? *Land. Use Policy* **2022**, *114*, 105962. [\[CrossRef\]](#)
61. Podolskiy, D.I.; Avanesov, A.; Tyshkovskiy, A.; Porter, E.; Petrascheck, M.; Kaeberlein, M.; Gladyshev, V.N. The Landscape of Longevity across Phylogeny. *bioRxiv* **2020**. [\[CrossRef\]](#)

62. Pyrkov, T.V.; Avchaciov, K.; Tarkhov, A.E.; Menshikov, L.I.; Gudkov, A.V.; Fedichev, P.O. Longitudinal Analysis of Blood Markers Reveals Progressive Loss of Resilience and Predicts Human Lifespan Limit. *Nat. Commun.* **2021**, *12*, 2765. [\[CrossRef\]](#)
63. Schöley, J.; Aburto, J.M.; Kashnitsky, I.; Kniffka, M.S.; Zhang, L.; Jaadla, H.; Dowd, J.B.; Kashyap, R. Life Expectancy Changes since COVID-19. *Nat. Hum. Behav.* **2022**, *6*, 1649–1659. [\[CrossRef\]](#)
64. Comisión Económica para América Latina y el Caribe (CEPAL). Ciencia, Tecnología e Innovación En La Economía Digital. La Situación de América Latina y El Caribe. *Nac. Unidas Impr. En Santiago* **2016**, 96.
65. Román, S.; Ojeda-Granados, C.; Panduro, A. Genética y Evolución de La Alimentación de La Población En México. *Rev. Endocrinol. Nutr.* **2013**, *21*, 42–51.
66. Khazaal, S.; El Darra, N.; Kobeissi, A.; Jammoul, R.; Jammoul, A. Risk Assessment of Pesticide Residues from Foods of Plant Origin in Lebanon. *Food Chem.* **2022**, *374*, 131676. [\[CrossRef\]](#)
67. Rivas-Garcia, T.; Espinosa-Calderón, A.; Hernández-Vázquez, B.; Schwentesius-Rindermann, R. Overview of Environmental and Health Effects Related to Glyphosate Usage. *Sustainability* **2022**, *14*, 6868. [\[CrossRef\]](#)
68. Ambrus, Á.; Vársárhelyi, A.; Ripka, G.; Szemánné-Dobrik, H.; Szenczi-Cseh, J. Evaluation of the Results of Pesticide Residue Analysis in Food Sampled between 2017 and 2021. *Agrochemicals* **2023**, *2*, 409–435. [\[CrossRef\]](#)
69. Giannakas, K.; Yiannaka, A. Food Fraud: Causes, Consequences, and Deterrence Strategies. *Annu. Rev. Resour. Econ.* **2023**, *15*, 85–104. [\[CrossRef\]](#)
70. Organización Mundial de la Salud (OMS). Residuos de Plaguicidas En Los Alimentos. Available online: <https://www.who.int/es/news-room/fact-sheets/detail/pesticide-residues-in-food> (accessed on 20 March 2023).
71. Rani, L.; Thapa, K.; Kanojia, N.; Sharma, N.; Singh, S.; Grewal, A.S.; Srivastav, A.L.; Kaushal, J. An Extensive Review on the Consequences of Chemical Pesticides on Human Health and Environment. *J. Clean. Prod.* **2021**, *283*, 124657. [\[CrossRef\]](#)
72. Boedeker, W.; Watts, M.; Clausen, P.; Marquez, E. The Global Distribution of Acute Unintentional Pesticide Poisoning: Estimations Based on a Systematic Review. *BMC Public Health* **2020**, *20*, 1875. [\[CrossRef\]](#)
73. Bär, J.; Bickel, U.; Bollmohr, S.; Bombardi, L.M.; Bourgin, C.; Bödeker, W.; Brühl, C.; Butscher-Schaden, H.; von der Decken, H.; Goulson, D.; et al. *Pesticide Atlas 2022*; Heinrich-Böll-Stiftung: Berlin, Germany, 2022; ISBN 9789464007473.
74. Carson, R. *Silent Spring*; Houghton Mifflin: Boston, MA, USA, 1962.
75. Mansfield, B.; Werner, M.; Berndt, C.; Shattuck, A.; Galt, R.; Williams, B.; Argüelles, L.; Barri, F.R.; Ishii, M.; Kunin, J.; et al. A New Critical Social Science Research Agenda on Pesticides. *Agric. Human. Values* **2023**, *41*, 395–412. [\[CrossRef\]](#)
76. Shah, R. Pesticides and Human Health. In *Emerging Contaminants*; Nuro, A., Ed.; IntechOpen: Rijeka, Croatia, 2020.
77. Islam, M.S.; Azim, F.; Saju, H.; Zargaran, A.; Shirzad, M.; Kamal, M.; Fatema, K.; Rehman, S.; Azad, M.A.M.; Ebrahimi-Barough, S. Pesticides and Parkinson's Disease: Current and Future Perspective. *J. Chem. Neuroanat.* **2021**, *115*, 101966. [\[CrossRef\]](#)
78. Samsel, A.; Seneff, S. Glyphosate, Pathways to Modern Diseases IV: Cancer and Related Pathologies. *J. Biol. Phys. Chem.* **2015**, *15*, 121–159. [\[CrossRef\]](#)
79. Hayes, T.B.; Khoury, V.; Narayan, A.; Nazir, M.; Park, A.; Brown, T.; Adame, L.; Chan, E.; Buchholz, D.; Stueve, T.; et al. Atrazine Induces Complete Feminization and Chemical Castration in Male African Clawed Frogs (*Xenopus Laevis*). *Proc. Natl. Acad. Sci. USA* **2010**, *107*, 4612–4617. [\[CrossRef\]](#)
80. Costa, N.Z.; Nora, C.R.D.; Souto, L.H.D.; Carlotto, F.D.; Afonso, R.D.S.; Riquinho, D.L. Exposure to Toxic Agrochemicals and Development of Congenital Malformations: A Scoping Review. *Texto E Contexto Enferm.* **2021**, *30*, 1–18. [\[CrossRef\]](#)
81. Dutra, L.S.; Ferreira, A.P. Tendência de Malformações Congênitas e Utilização de Agrotóxicos Em Commodities: Um Estudo Ecológico. *Saúde Debate* **2019**, *43*, 390–405. [\[CrossRef\]](#)
82. Rojas, R.A.; Ojeda, B.M.E.; Barraza, O.X. Malformaciones Congénitas y Exposición a Pesticidas. *Rev. Med. Chil.* **2000**, *128*, 399–404. [\[CrossRef\]](#) [\[PubMed\]](#)
83. Yang, A.; Chu, P.; Wang, C.; Lin, C. Association between Urinary Glyphosate Levels and Serum Neurofilament Light Chain in a Representative Sample of US Adults: NHANES 2013–2014. *J. Expo Sci. Env. Epidemiol.* **2023**, *34*, 287–293. [\[CrossRef\]](#) [\[PubMed\]](#)
84. Buchenauer, L.; Haange, S.; Bauer, M.; Rolle-Kampczyk, U.E.; Wagner, M.; Stucke, J.; Elter, E.; Fink, B.; Vass, M.; von Bergen, M.; et al. Maternal Exposure of Mice to Glyphosate Induces Depression- and Anxiety-like Behavior in the Offspring via Alterations of the Gut-Brain Axis. *Sci. Total Environ.* **2023**, *905*, 167034. [\[CrossRef\]](#) [\[PubMed\]](#)
85. Matsuzaki, R.; Gunnigle, E.; Geissen, V.; Clarke, G.; Nagpal, J.; Cryan, J.F. Pesticide Exposure and the Microbiota-Gut-Brain Axis. *ISME J.* **2023**, *17*, 1153–1166. [\[CrossRef\]](#) [\[PubMed\]](#)
86. Yang, Z.; Li, J.; Gui, X.; Shi, X.; Bao, Z.; Han, H.; Li, M.D. Updated Review of Research on the Gut Microbiota and Their Relation to Depression in Animals and Human Beings. *Mol. Psychiatry* **2020**, *25*, 2759–2772. [\[CrossRef\]](#)
87. Melnik, B.C.; John, S.M.; Carrera-Bastos, P.; Cordain, L.; Leitzmann, C.; Weiskirchen, R.; Schmitz, G. The Role of Cow's Milk Consumption in Breast Cancer Initiation and Progression. *Curr. Nutr. Rep.* **2023**, *12*, 122–140. [\[CrossRef\]](#)
88. Dong, J.Y.; Zhang, L.; He, K.; Qin, L.Q. Dairy Consumption and Risk of Breast Cancer: A Meta-Analysis of Prospective Cohort Studies. *Breast Cancer Res. Treat.* **2011**, *127*, 23–31. [\[CrossRef\]](#)
89. Larsson, S.C.; Mason, A.M.; Kar, S.; Vithayathil, M.; Carter, P.; Baron, J.A.; Michaëlsson, K.; Burgess, S. Genetically Proxied Milk Consumption and Risk of Colorectal, Bladder, Breast, and Prostate Cancer: A Two-Sample Mendelian Randomization Study. *BMC Med.* **2020**, *18*, 370. [\[CrossRef\]](#)
90. Organización Mundial de la Salud (OMS). Resistencia a Los Antibióticos. Available online: <https://www.who.int/es/news-room/fact-sheets/detail/resistencia-a-los-antibi%C3%B3ticos> (accessed on 28 January 2024).

91. Hirpessa, B.B.; Ulusoy, B.H.; Hecer, C. Hormones and Hormonal Anabolics: Residues in Animal Source Food, Potential Public Health Impacts, and Methods of Analysis. *J. Food Qual.* **2020**, *2020*, 5065386. [\[CrossRef\]](#)
92. Fajardo-Zapata, Á.L.; Méndez-Casallas, F.J.; Molina, L.H. Residuos de Fármacos Anabolizantes En Carnes Destinadas al Consumo Humano. *Univ. Sci.* **2011**, *16*, 77. [\[CrossRef\]](#)
93. Webb, P.; Benton, T.G.; Beddington, J.; Flynn, D.; Kelly, N.M.; Thomas, S.M. The Urgency of Food System Transformation Is Now Irrefutable. *Nat. Food* **2020**, *1*, 584–585. [\[CrossRef\]](#) [\[PubMed\]](#)
94. van Berkum, S.; Ruben, R. Exploring a Food System Index for Understanding Food System Transformation Processes. *Food Secur.* **2021**, *13*, 1179–1191. [\[CrossRef\]](#)
95. Ruben, R.; Cavatassi, R.; Lipper, L.; Smaling, E.; Winters, P. Towards Food Systems Transformation—Five Paradigm Shifts for Healthy, Inclusive and Sustainable Food Systems. *Food Secur.* **2021**, *13*, 1423–1430. [\[CrossRef\]](#) [\[PubMed\]](#)
96. Ruiz-Rosado, O. Agroecología: Una Disciplina Que Tiende a La Transdisciplina. *Interciencia* **2006**, *31*, 140–145.
97. Gavito, M.E.; van der Wal, H.; Aldasoro, E.M.; Ayala-Orozco, B.; Bullén, A.A.; Cach-Pérez, M.; Casas-Fernández, A.; Fuentes, A.; González-Esquivel, C.; Jaramillo-López, P.; et al. Ecología, Tecnología e Innovación Para La Sustentabilidad: Retos y Perspectivas En México. *Rev. Mex. Biodivers.* **2017**, *88*, 150–160. [\[CrossRef\]](#)
98. Borsellino, V.; Schimmenti, E.; El Bilali, H. Agri-Food Markets towards Sustainable Patterns. *Sustainability* **2020**, *12*, 2193. [\[CrossRef\]](#)
99. Pantera, A.; Mosquera-Losada, M.R.; Herzog, F.; den Herder, M. Agroforestry and the Environment. *Agrofor. Syst.* **2021**, *95*, 767–774. [\[CrossRef\]](#)
100. Jose, S. Agroforestry for Ecosystem Services and Environmental Benefits: An Overview. *Agrofor. Syst.* **2009**, *76*, 1–10. [\[CrossRef\]](#)
101. Céspedes, M.C. *Agricultura Orgánica. Principios y Prácticas de Producción*; Boletín INIA-Instituto de Investigaciones Agropecuarias: Chillán, Chile, 2005.
102. Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO). *Introducción al Decenio de Las Naciones Unidas de La Agricultura Familiar*; FAO: Roma, Italy, 2022.
103. Dal Moro, L.; Mazutti, J.; Brandli, L.L.; Casagrande, Y.G.; Mores, G.D.V. Overcoming the Challenges of Sustainable Family Agriculture in Southern Brazil: Contributions to the 2030 Agenda. *Sustainability* **2022**, *14*, 8680. [\[CrossRef\]](#)
104. Maloney, W.; Garriga, P.; Meléndez, M.; Morales, R.; Jooste, C.; Sampi, J.; Thompson Araujo, J.; Vostroknutova, E. *Competencia: ¿el Ingrediente Que Falta Para Crecer? Informe Económico América Latina y El Caribe*; Banco Mundial: Washington, DC, USA, 2024; ISBN 9781464821127.
105. Instituto Interamericano de Cooperación para la Agricultura (IICA). *Programa de Desarrollo Territorial y Agricultura Familiar*; Instituto Interamericano de Cooperación para la Agricultura: San José, Costa Rica, 2023; ISBN 978-92-9273-075-8.
106. Mulya, S.P.; Putro, H.P.H.; Hudalah, D. Review of Peri-Urban Agriculture as a Regional Ecosystem Service. *Geogr. Sustain.* **2023**, *4*, 244–254. [\[CrossRef\]](#)
107. Lucertini, G.; Di Giustino, G. Urban and Peri-Urban Agriculture as a Tool for Food Security and Climate Change Mitigation and Adaptation: The Case of Mestre. *Sustainability* **2021**, *13*, 5999. [\[CrossRef\]](#)
108. Mäkitie, T.; Hanson, J.; Damman, S.; Wardeberg, M. Digital Innovation's Contribution to Sustainability Transitions. *Technol. Soc.* **2023**, *73*, 102255. [\[CrossRef\]](#)
109. Tzachor, A.; Richards, C.E.; Jeon, S. Transforming Agrifood Production Systems and Supply Chains with Digital Twins. *NPJ Sci. Food* **2022**, *6*, 47. [\[CrossRef\]](#) [\[PubMed\]](#)
110. Bellon-Maurel, V.; Lutton, E.; Bisquert, P.; Brossard, L.; Chambaron-Ginhac, S.; Labarthe, P.; Lagacherie, P.; Martignac, F.; Molenat, J.; Parisey, N.; et al. Digital Revolution for the Agroecological Transition of Food Systems: A Responsible Research and Innovation Perspective. *Agric. Syst.* **2022**, *203*, 103524. [\[CrossRef\]](#)
111. Rolandi, S.; Brunori, G.; Bacco, M.; Scotti, I. The Digitalization of Agriculture and Rural Areas: Towards a Taxonomy of the Impacts. *Sustainability* **2021**, *13*, 5172. [\[CrossRef\]](#)
112. Sahadevan, V.K.; Mishra, U. A Green Manufacturer–Retailer Circular Economic Production Model with Carbon Emissions and Waste Control. *Environ. Dev. Sustain.* **2023**, *26*, 12367–12406. [\[CrossRef\]](#)
113. Coraggio, J.L. Economía Social y Economía Popular: Conceptos Básicos. *Serie Consejeros* **2020**, *1*, 1–16.
114. Coraggio, J.L. *Sobre La Espacialidad Social y El Concepto de Región*; Centro de Estudios Económicos y Demográficos: El Colegio de México, Mexico, 1979.
115. Jonker, J.; Faber, N. *Organizing for Sustainability*; Springer International Publishing: Cham, Switzerland, 2021; ISBN 978-3-030-78156-9.
116. Basso, M.F.; Neves, M.F.; Grossi-de-Sa, M.F. Agriculture Evolution, Sustainability and Trends, Focusing on Brazilian Agribusiness: A Review. *Front. Sustain. Food Syst.* **2024**, *7*, 1–18. [\[CrossRef\]](#)
117. Clark, M.A.; Domingo, N.G.G.; Colgan, K.; Thakrar, S.K.; Tilman, D.; Lynch, J.; Azevedo, I.L.; Hill, J.D. Global Food System Emissions Could Preclude Achieving the 1.5° and 2 °C Climate Change Targets. *Science* **2020**, *370*, 705–708. [\[CrossRef\]](#)
118. Wilde, K.; Hermans, F. Transition towards a Bioeconomy: Comparison of Conditions and Institutional Work in Selected Industries. *Environ. Innov. Soc. Transit.* **2024**, *50*, 100814. [\[CrossRef\]](#)
119. Lipper, L.; Cavatassi, R.; Symons, R.; Gordes, A.; Page, O. Financing Adaptation for Resilient Livelihoods under Food System Transformation: The Role of Multilateral Development Banks. *Food Secur.* **2021**, *13*, 1525–1540. [\[CrossRef\]](#) [\[PubMed\]](#)
120. Mapanje, O.; Karuaihe, S.; Machethe, C.; Amis, M. Financing Sustainable Agriculture in Sub-Saharan Africa: A Review of the Role of Financial Technologies. *Sustainability* **2023**, *15*, 4587. [\[CrossRef\]](#)

121. O'Callaghan, B.; Yau, N.; Hepburn, C. How Stimulating Is a Green Stimulus? The Economic Attributes of Green Fiscal Spending. *Annu. Rev. Environ. Resour.* **2022**, *47*, 697–723. [[CrossRef](#)]
122. Jin, W.; Ding, W.; Yang, J. Impact of Financial Incentives on Green Manufacturing: Loan Guarantee vs. Interest Subsidy. *Eur. J. Oper. Res.* **2022**, *300*, 1067–1080. [[CrossRef](#)]
123. Bannor, R.K.; Oppong-Kyeremeh, H.; Amfo, B.; Kuwornu, J.K.M.; Chaa Kyire, S.K.; Amponsah, J. Agricultural Insurance and Risk Management among Poultry Farmers in Ghana: An Application of Discrete Choice Experiment. *J. Agric. Food Res.* **2023**, *11*, 100492. [[CrossRef](#)]
124. Tarigan, E.S.; Mawardi, W. The Influence of Digital Based Payment System Innovation on Financial Inclusion and Poverty Alleviation: An Overview of Social Programs in the Sumatra Region. *Migr. Lett.* **2023**, *20*, 223–240.
125. Li, X.; Zang, M.; Li, D.; Zhang, K.; Zhang, Z.; Wang, S. Meat Food Fraud Risk in Chinese Markets 2012–2021. *NPJ Sci. Food* **2023**, *7*, 12. [[CrossRef](#)]
126. Lindley, J.; Bongiovanni, H.; Eastwood, D. Can Ethical Certification Prevent Food Fraud? *Int. J. Rural. Criminol.* **2023**, *7*, 334–356. [[CrossRef](#)]
127. Figurek, A.; Thrassou, A.; Efthymiou, L.; Vrontis, D. Digitalisation and Integrated Information Systems in the Agri-Food Sector. In *Agribusiness Innovation and Contextual Evolution, Volume II: Technological, Societal and Channel Advancements*; Galati, A., Vrontis, D., Thrassou, A., Fiore, M., Eds.; Springer International Publishing: Cham, Switzerland, 2024; pp. 131–152. ISBN 978-3-031-45742-5.
128. Mancoso, K.; Paes, A.; de Oliveira, T.; Massarani, L. Pesquisa Em Desinformação e Divulgação Científica: Uma Revisão Da Literatura Latino-Americana. *J. Sci. Commun.—América Lat.* **2023**, *6*, A01. [[CrossRef](#)]
129. Sánchez-Mora, M.d.C.; Macías-Nestor, A.P. El Papel Preventivo de La Divulgación de La Ciencia Para Poblaciones Vulnerables Ante Amenazas Ambientales. *J. Sci. Commun.—América Lat.* **2024**, *7*, N01. [[CrossRef](#)]
130. García-Cruz, J.C. La Comunicación de La Ciencia y La Tecnología Como Herramienta Para La Apropiación Social Del Conocimiento y La Innovación. *J. Sci. Commun. América Lat.* **2019**, *2*, Y02. [[CrossRef](#)]

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