GOAL 2. ZERO HUNGER

Geography: Origin of the Complexity of the Food System

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Abstract

Geography imposes barriers. These barriers hinder and limit the movement of people and create environments with defined characteristics. Globalization and the added effects of climate change have increased migration. New cultural food systems have proliferated in large cities, seeking a balance between purchasing power and satisfaction, which will coexist in certain cases with genuine aspects of traditional food identity.

The important interrelation due to globalization of the cross effects between cause and effect in the food sector (for example climate change-food-migration-hunger or obesity-education-economics) is highlighted as indicated by the United Nations in the 2030 Agenda and its Sustainable Development Goals. The right to food is fundamental and we must all contribute, in our daily behaviour, to make sure that nobody is excluded from this essential facet of human dignity. It is no coincidence that this is Goal 2, Zero Hunger.

The Triptolemos Foundation considers that only from the approach of a sustainable global food system, which includes the availability of food, the economy, policies, and culture, all of them interrelated and in balance, with the support of science, technology and responsible business activity, can we face the food challenges of the XXI century with a minimum guarantee, included Zero Hunger, and aligned with the 17 Sustainable Development Goals (SDG).

Keywords: Food and Geography, Food Sustainability, Global Food System, Availability and accessibility, Economy, Policies, Culture, Education, Triptolemos, ITRIn Index, Climate Change, Water, Zero Hunger.

All Human Rights are inherent and indivisible. But one of them, the right to life, is the supreme right because it determines the exercise of all the others. For this reason, the right to food is fundamental and we must all contribute, in our daily behaviour, to make sure that nobody is excluded from this essential facet of human dignity.
Federico Mayor Zaragoza
Honorary President of TRIPTOLEMOS Foundation
Former General Manager of UNESCO (1987-1999)

Climate change, conflicts in various areas of the planet and for various reasons, uneven and unstable economic growth and an increase in inequalities are all factors that contribute directly to an increase in poverty and hunger in the world. FAO's projections for 2030 are not promising, an increase in the number of people suffering from food insecurity is expected from the current 811 million to 900 million. We are moving away from achieving Sustainable Development Goal 2, Zero hunger.

The TRIPTOLEMOS Foundation for the development of the food system was created in 2002 with a universal projection under the Presidency of Mr. Federico Mayor Zaragoza, Former General Manager of UNESCO (1987-1999). The Foundation contributes to optimize the food system with its activities, and thus achieve adequate food for the entire population, the confidence of the consumer and the dignity of the sector. The motor of the system is responsible business activity. Its vision and activities are supported by validated and updated scientific knowledge. Today it includes 26 universities, the CSIC (*Spanish National Research Council),* companies, consumer associations and various representative institutions among its members. With a projection both nationally and internationally it is open to any new additions which share its goals.

Triptolemos´ s approach and actions have led to recognition by **UNESCO** with the creation of the Chair "***Science and Innovation for Sustainable Development: Global Food Production and Safety***" (Fig.1) with the UNED (National Distance Education University), from which the Foundation develops part of its activities (Martin, R., et al 2020). The Foundation is also a member of the Global Soil Alliance and the Global Food Safety and Nutrition both FAO working groups, among others.

United Nations
Educational, Scientific and
Cultural Organization

UNESCO Chair on Science and Innovation for
Sustainable Development: Global Food Production and Safety
Triptolemos Foundation for agrifood development

Figure 1: UNESCO Chair "Science and Innovation for Sustainable Development: Global Food Production and Safety" Logo. (Source: Triptolemos Foundation)

Food systems constitute the largest economic system in the world in terms of employment, livelihoods and planetary impact, 4 billion people work directly or indirectly in food systems. However, hunger and poverty persist in endemic form in all the world. By describing in general terms how the Triptolemos Foundation (Fig. 2) interprets the global food system, it will be possible to have a better understanding not only all the importance of the SDG 2, **Zero Hunger** objective but also the relationship of food with the rest of the **SDGs and geography**, all of them are interrelated.

Figure 2: UNESCO publication "Humanistic Futures of learning" cover (Source: UNESCO)

Geography imposes its barriers

If we refer to the planet, approximately **75% is water and 25% is land**, with 3 large continental masses: Eurasia, America and Africa. Of this 25%, 9% is dedicated to non-primary uses (cities, roads ...), 8% mountains and forests, 7% permanent pastures and only 3% of the total surface of the planet is used for permanent crops. That is, **barely 10% of the total surface of the planet is related to food uses** (agriculture, pastures, forests ...). These percentages have marked the development of the food systems.

These barriers have hindered and limited the movement of people. They limit it in an environment with defined availability and characteristics. In this environment man must subsist by creating his own food system. Transportation techniques have been advancing slowly and have facilitated exchanges between populations. Some of these exchanges have been fundamental in the alimentary aspects. Globalization and the added effects of climate change have **promoted migrations**. New cultural food systems have been promoted in large cities, seeking a balance between purchasing power and satisfaction, which in certain cases coexist with genuine aspects of traditional food identity.

Development of the food system in three major stages

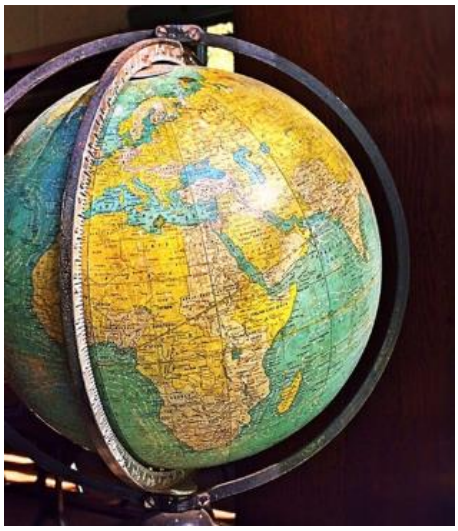

Figure 3: Conference "Geography: origin of the complexity of the food system" in EUROGEO International Conference 2021 (Image: Free photo deposit)

In this environment, humanity has developed the evolution of its several food systems (UN Food Systems Summit, 2021), with tendency to a one global food system in 3 major stages (Fig. 3). This approach will help to better understand spatial problems through the concepts of the Sustainable Development Goals (SDG's):

The **first stage** originates from the first population movements from the Neolithic Era until the discovery of America (15th century). This stage is characterized by restricted mobility due to little technological advance, which resulted in a stage that we can call closed systems, some exceptionally so. Some examples could be the culture of the Inuit, Polynesia, the African jungles or the cultures in the great valleys of Europe or America. Geography and climate determine agriculture, livestock and cuisines. At this stage there were some larger nuclei, such as the countries around the Mediterranean Sea or the China Sea, which constituted somewhat more open food systems thanks to the sea and with incipient trade.

At this stage we can refer to Marco Polo's travels, the spice route, among others. But the journeys were by land with what little could be transported. This first stage is also characterized by the sacralization of the food system. Regulations were introduced into the food system through religion. We find examples of this in Christianity, Judaism, Mohammedanism ...

In the first stage the development of the food system was done mostly carried out by land. Stable products with high added value in the cuisine, such as spices, were traded overland, with some exceptions such as maritime trade in wine, oil, cereals, beers in the Mediterranean or salted foods in the area of the North and Baltic Seas.

The **second stage** begins with the discovery of America and it last until the end of the Second World War. The discovery of America and crossing the Atlantic are important events in the development of the food system. Let us bear in mind that with the belief that the earth was flat, Gibraltar meant the end of the world as it was believed that great precipices existed, and this greatly conditioned exchanges. In this second stage it is verified that the earth is round and there is great concern to explore the planet. Technological advances and the strengthening of maritime travel facilitate product and seed exchange. At this stage the world population was around 450 million people.

The integration of the world economy after the Age of Discovery allowed an exchange of crops on a planetary level: products from the Old World, both from temperate zones such as wheat and grapevines, as well as from warm zones such as sugar cane, cotton and coffee, were successfully introduced in America; while New World products such as corn, potatoes, tomatoes, peppers and tobacco diversified European agriculture and the rest of the continents.

In this second stage, the globalization of the food system slowly begins with the exchange of products. However, we still cannot refer to the globalization of the cuisine, that is, we still cannot speak of the globalization of culture. There was an exchange of food cultures, but in a very restricted way, not at a popular and massive level as we understand it today.

Humanity has advanced extraordinarily throughout history, accepting and adopting the innovations that have been produced in all disciplines. Thanks to the development of knowledge and innovation, increases in productivity and quality of agricultural products and, to summarise, the profitability of agricultural exploitation has been achieved. Humanity has been particularly bold in its diet, for example by incorporating exotic plants from different continents. The acceptance in Europe of species such as potatoes or tomatoes of American origin in the 16th century could not have been easy (Beltrán et al, 2020).

In this second stage, it was Europe which directed the great voyages. The European coasts were schools for sailors, we refer to the vikingos or the Spanish-Portuguese culture with Magellan and Vasco de Gama and the English with the voyage of Captain Cook or the Dutch, Jan van Riebek, the scientific expeditions of Darwin among others. China was isolated at this stage. The second stage is an important technological advance. The development of the food system is made by sea, and it is reinforced mainly by the exchange of products. Technology propelled the initial shift from local food systems to global ones.

It should be noted in this second stage that the FAO was created on October 16, 1945. FAO is the **Food and Agriculture Organization of the United Nations**, in which more than 194 countries represented and their mission is to contribute to building a world where food security prevails for present and future generations. Its 75th anniversary

was celebrated in 2020, and its General Director, Mr. QU Dongyu, referred to the fact that a comprehensive reorganization of the world's food systems is one of the most powerful tools we have to change course, move towards achieving the 17 Sustainable Development Goals (SDGs) and 'building back better' after the COVID 19 pandemic.

The **third stage** goes from the Second World War (1939-1945) to our times. This stage is characterized by significant progress in two major areas: scientific / technological and cultural by the exchange of cuisines and cultures which occurs in a very important way.

In the scientific / technological area, the advances in plant genetics, among others, stand out. This generates initiatives such as the Green Revolution that began between 1945-1960, which led to a strong increase in production, and the development of varieties resistant to specific situations. As a negative aspect is the scarcity of water and in addition some agricultural productions are part of the global energy economy strategy and with this, food resources are used to obtain energy.

An important fact is that in 1940 the world population was about **2.2 billion people**, and in 2021 the world population was around **7.8 billion people**.

This is the scenario in which we find ourselves. Geography is no longer an insurmountable barrier. Technology makes it easier for us to approach and exchange. The cultural defence of protection of the original food systems begins. UNESCO awards labels to different cultural food heritages (Medina, F.X., 2016).

To summarize it, we could say that the symbol could be McDonald's. We can find brands with a global presence in any country. At this stage, globalization and the global vision of the food system is in full swing. We refer both to the trade of products and to the exchange of cuisines and the combination of cultures (Contreras, J., 2016).

If we dare to predict the future from cultural traditions and cuisines, we could focus on two scenarios:

a) A food system with homogeneous and globalized cuisine and food products and local cultures with a testimonial and tourist projection or
b) A scenario in which the different gastronomic and culinary cultures prevail with their characteristics and personality, and in turn coexist with a more global food system.

This possibility may be the prevalent one, taking into account that sustainability will force a reduction in food globality. We will have to see this evolution.

However, before analyzing the cultural aspects through the cuisine, we must ensure adequate and sufficient sustainable production in balance with the planet and the population, to achieve the goal of Zero Hunger. We can make some comments related to the complexity of the food system.

The complexity of the global food system

The first objective of any biological system is to survive, and the human species is no exception. The necessary energy which we obtain from food comes almost exclusively from photosynthesis, from agriculture, grazing livestock and deep-sea fishing.

If we focus on some aspects of the complexity of the food system and how they are affected by the geographical structure of the world, the challenge is that we are heading towards a universal global food system, whose population will continue to grow to exceed **10 billion people** by the end of this century, that can call into question Food Security. Maybe we have to change our habits of consumption.

Today's agriculture, with its light and shade, is capable of feeding a world population of more than **7 billion people**, but we have a global problem of accessibility to food. Maintaining the balance in the global food system described in this chapter is key to achieving the Zero Hunger Goal.

Vaclav Smil, in "Feeding the world. A challenge for the 21st century" (2000), states: "The only way to maintain **10 billion people** (which is a plausible prospect in the medium term) with a traditional farming system based exclusively on recycling organic matter and legume rotations, would represent doubling, or even tripling the amount of land that is cultivated today.

Today, **the problem is more the lack of economic resources**, than of food and the destabilization of prices are the gateway to new legions of the hungry. It has been estimated that if there is a 20% rise in real food prices in 2025, the world's undernourished population would increase by 440 million people (Senauer et al, 2001).

Figure 4: The key concepts to understand malnutrition in our world are, poverty, food dependency, urban population and price instability (Image: Free photo deposit)

The **groups most exposed to malnutrition** (Fig. 4) are those that have moved away from the classic agrarian systems (De Castro P., 2012) based on diversity and self-sufficiency and, for this reason, urban areas are the most sensitive population centres, but also the environments and areas dependent on the monoculture agriculture for export. Obviously, it is not about idealizing "primitive" agriculture, but it must be considered that some models of "unbridled" development involve weaknesses if forms of regulation and guarantee of supply are not foreseen for impoverished countries and populations. The key concepts to understand malnutrition in our world are, poverty, food dependency, urban population and price instability (Reguant F., 2009).

Food production per unit area has remained, in relative terms, more or less constant since the origin of agriculture until a little over one or two centuries ago, with the agricultural area increasing at practically the same rate as the population. Globally, if we compare the increase in **world population in relation to the increase in agricultural production** in the last 60 years, the population has multiplied by almost 2.5, while the production of cereals, as well as many other crops, by 4. In the last 50 years, it has gone from requiring 1 ha of agricultural crops to feed one person for a year to only 0.32. It is

estimated that 50% of all these advances in production are due to science and technology.

At the crossroads of climate change, the decisions we make today will greatly determine the sustainability and food security of our continent in the future (Peyraud et al 2020).

Climate change has and will have influence on food production and health. The question is whether there is a shortage of food or if there will be in the near future (Reguant, F. 2009), since despite the fact that hunger and malnutrition affect some 900 million people, there has been food availability at all times in order, on paper, to supply the total demand (EEA 2021). In any case, it is indicated that the "solvent demand" is considered, that is, that of the population with sufficient purchasing power to buy food, since the "real demand", which includes that of those who lack economic resources, goes further (Colomer, Y. et al, 2021).

Figure 5: The European Green Deal (Source: EU website)

The United Nations considers climate change as "a multiplier value of threats, as it exacerbates those caused by violence, persistent poverty or poor resource management." Climate change, the overpopulation of certain geographical areas or the malnutrition that many countries will suffer are presented as true pandemics of the 21st century. We have to add that according to the **United Nations World Food Programme**, the incidence of COVID-19 could almost double the number of people suffering from acute hunger worldwide (Eurostat, 2021).

The **European Green Deal Strategy** (Fig. 5) can contribute to achieve the 17 Sustainable Development Goals. We refer to climate change as a factor that conditions the future of the territories, the development of the food system and food safety. In this sense, the European Commission has launched the Green Deal and the “Farm to Fork” strategy (European Commission, 2019). The European Green Deal establishes the way to make Europe the first climate-neutral continent by 2050. It defines a new strategy for sustainable and inclusive growth to boost the economy, improve people's health and quality of life, take care of nature and leave no one behind. The **Farm to Fork Strategy** (European Commission, 2020) is an essential element of the Green Deal. It comprehensively addresses the challenges of sustainable food systems and recognizes the inextricable links between healthy people, healthy societies and a healthy planet. The strategy is also a fundamental component of the Commission's agenda to achieve the 17 Sustainable Development Goals (SDGs) of the United Nations, and we place special emphasis on the challenge of achieving compliance with SDG 2, **the challenge of zero hunger.**

The strategies adopted by the EU to reduce the impact of agriculture on the environment impose a drastic reduction in the use of fertilizers, antimicrobial agents and pesticides, predictably accompanied by a decrease in the total cultivated area. Regardless of the impact that these measures end up having on global sustainability, the truth is that the “Green Deal” strategy will put great pressure on our agricultural production systems (Beckman et al, 2020).

The pressing reality is that, today, our agriculture is not ready for this change. To adapt to the new situation, we need crops that produce more with less input (Bernard et al 2017). We need to develop new and better comprehensive strategies for pest control, adapt our varieties to climate change and we must learn to acquire and process better the data that is generated from farm to fork (UE strategy) to optimize the management of the process as a whole. As has been shown on other occasions throughout history, a transformation of these dimensions can only be brought to fruition if it is accompanied by a great boost to research, development and innovation.

Also, we should keep in mind that "there is no end to chronic hunger, the cost of nutritional deficits, or the challenge of unhealthy diets without bold actions to change. There is no route to better livelihoods and greater gender equality unless we start to pay farmers and farmworkers fairly" (UN special envoy Agnes Kalibata, 2021).

Referring to **food waste** this is a great challenge to the fight for zero hunger and it affects all stages from production to consumption (Conrad et al 2018). According to the FAO, in the EU a third of food waste occurs once food has reached our homes. Consumers, producers and distributors must design strategies to avoid them.

However, the other two thirds of food waste is produced because either we do not have the appropriate varieties, or we do not use them, or because crops are produced under adverse conditions derived from climate change. Harvests also decline due to the action of pests or attack by pathogens such as viruses, fungi and bacteria that, in turn, are also developing emerging diseases due to climate change and the mobility of people and goods. We have to bear in mind that we only have agricultural products that have not been devastated by pests. Losses occur during post-harvest, food storage or transportation or as a consequence of unintelligent production strategies that lead to the disposal of crops because their marketing value does not compensate for production costs (Stuart T., 2009).

The current **international human rights** system was born in 1948, when the United Nations General Assembly approved the Universal Declaration of Human Rights, an essential element in a modern state and linked to the availability of food, and FAO proclaimed the food rights of man (Barcelona 1992).

The **right to food** is a universal human right recognized by international law, which protects the right of all people to obtain food, either by their own production or by the means necessary for its acquisition.

The World Food and Agriculture Organization (FAO) urges us to achieve Food Security, understood as the situation in which everybody, at all times, has physical and economic access to enough food, safe and nutritious, to satisfy their nutritional needs and preferences, in order to lead an active and healthy life (FAO, 2014).

Feeding a growing population in balance with the SDGs

The world population is growing with the tendency to concentrate in **urban areas**. The right to adequate food for the entire population represents a major challenge in the

current context.

Over the next 30 years, **the lack of access to food and water** will increase if there is no urgent global cooperation, if the issues are not approached from a global vision of the system.

Directly or indirectly, humanity provides itself with most of its food through agriculture, as well as a very important proportion of its clothing and medicinal, industrial and energy products. Agricultural progress has allowed us to continually overcome the demographic challenges we have faced and we will undoubtedly successfully overcome the planetary challenges of the coming decades. Megan Clark, former director of the CSIRO (Australian National Research Agency) is credited with the phrase "**In the next 50 years we will have to produce as much food as we have in the previous ten thousand**," which reflects the food challenge we face, in order to overcome which a new agriculture is being developed, incorporating new tools from information technologies, data science, artificial intelligence, terrestrial and spatial sensors and all molecular tools, particularly genomic, available to the more conventional techniques (Blackstock et al, 2020).

For the geopolitics of the 21st century water is destined to be what oil was for the 20th century, so it will become the subject of great conflicts. Competition for limited water resources is one of the main concerns for the next decades. **Agriculture needs large amounts of water.**

Figure 6: Irrigation is the basis for food production faced with the challenge of a growing world population (Image: Free photo deposit)

Irrigation is the basis for food production faced with the challenge of a growing world population (Fig. 6), despite the fact that there are currently more than 800 million inhabitants below the threshold of malnutrition. Unlike oil, water has been the subject of an eternal debate on whether it should be luxury goods or a social goods accessible to all. Irrigation multiplies wealth generation by 4.8 and job creation by 4.5, compared to dry land.

Irrigated agriculture produces up to six times more than rainfed agriculture. One hectare of intensive irrigation can produce the equivalent of 40 hectares of dry land. For example, in Spain, 13 of the 15 provinces that have lost the most population in the last 10 years are the ones with the smallest irrigated area (Fig. 7), and among the provinces that maintain or grow in population, there are many that have the highest proportions of irrigated crops. In

Figure 7: Irrigated agriculture produces up to six times more than rainfed agriculture (Image: Triptolemos Foundation)

addition to absorbing CO2, irrigation contributes oxygen to the atmosphere through the photosynthesis of the vegetation cover and also contributes to reducing erosion and desertification, two dangerous consequences that could be accentuated by climate change.

Aging is more pressing in rainfed areas and the distribution of the **male-female population** in irrigated areas is more balanced, given that these crops contribute to reducing migration, especially of women from the rural world.

The strategic aspect of water is reflected in the fact that water begins to trade on the stock market. At the moment, it only affects the area of California, in the United States, meaning that the price of water in California fluctuates depending on the evolution of the Wall Street futures market. The demand for water is "practically inelastic". The amount required hardly varies because it is an indispensable resource in our daily life. Drinking water is limited, and in a world with almost 8,000 million people, what is clear is that an effort must be made to rationalize its use and consumption and **move towards a new model of production and consumption** different from the current one (European Commission, 2019). Since 2010, access to drinking water is recognized as a "basic human right" by the United Nations.

A study by the Institute for Economics and Peace (Institute for Economics & Peace. Ecological Threat Report 2021) based in Australia, warns of the massive displacement of 1.2 billion people worldwide by 2050 and estimates that 2.6 billion people in the world are currently suffering from **water stress**, a figure which is forecast to increase to 5.4 billion people by 2040. It is estimated that about a fifth of the world's countries will experience water scarcity in 2040 and consequently **hunger and migrations will increase**.

Water is the source of life. Its importance is evident in several of the SDGs. Figure 10 shows the relevance of the coordination between the different SDGs, and in this case the strategic importance of water that determines the objective of several of the SDGs, in a special 2.

There is a consensus on the potential of new information technologies, data science, artificial intelligence, terrestrial and space sensors, and available molecular technologies, particularly genomics. All these technologies in an integrated way should reduce the production costs of healthier agricultural and livestock products, moderating the expenditure on inputs, as well as limiting the presence of pollutants and residues in the environment and in the final products, translating into greater food safety. We must rely on unfettered science and technology to meet the food challenges of the 21st century.

In order to achieve the ODS 2 (Clotet et al, 2010), the EU is a global agricultural power, but with very diverse cultural, geographical and climatic realities. For the sustainability of agriculture, farmers must have the freedom to choose the tools and practices that are best suited to their specific needs and agricultural environments according to proven science. Excluding tools that can contribute to this is dangerous (Pretty et al,2014).

Figure 8: The Harvest "Wheatfield - A Confrontation", Downtown Manhattan NYC. © 1982 Agnes Denes

As a result of **agricultural advances**, we have never before had access to so much food and quality in human history (Fig.8). In the agricultural field, the quotation of Jonathan Swift (1667-1745) that appears in Gulliver's Travels is frequently mentioned: "….whoever could make two ears of corn, or two blades of grass, to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together…".

Sustainable Global Food System and SDGs for Zero Hunger

The preceding paragraphs outline the path that humanity has travelled, overcoming difficulties of various kinds and with a constant struggle for its survival. This complex environment, if we refer to SDG 2 Zero Hunger, requires a global approach and a balance of multiple factors (Beltrán J.P.et al, 2021).

Only from the approach of a sustainable global food system (Clotet et al, 2013), which considers the availability of food, the economy, policies, and culture, all of them interrelated and in balance, with the support of science, technology, responsible business activity and consumption, can we face the food challenges of the XXI century with a minimum guarantee aligned with the Sustainable Development Goals (SDG), and try to achieve the Zero Hunger.

From the Triptolemos Foundation the **Sustainable Global Food System** is focused on 4 basic main axes or macro areas (Fig. 9): availability, economy, politics and culture and the multiple interrelationships between them. All of them are interrelated and have to be in balance for the proper functioning of the Sustainable Global Food System.

Figure 9: Definition by Triptolemos Foundation of the Sustainable Global Food System. Colomer et al, 2016. (Source: Triptolemos Foundation)

These 4 axes or macro areas are aligned with the 17 United Nations Sustainable Development Goals (Colomer et al, 2016, Thomson-Reuters).

- In the **Availability and accessibility axis**, all the elements that ensure that there is enough food for adequate nutrition for everybody in balance with the planet are considered (land, water, supplies, climate change, agriculture, food transformation, food waste, nutrition…).

- In the **Economy axis**, the set of all economic activity from the field to the table is included. It is the total food economy concept. It is considered the economy of the citizen that indicates their ability, in their environment, to acquire food at affordable prices. This concept that has a very close relationship not only with the global aspects of the economy (macro and microeconomics), but also with aspects of the policy and cultural axes considered.

- In the **Policy axis**, all activity that society as a political entity generates around the food system is considered. It is based on a fundamental right, the right to life. The availability and safety of food must be guaranteed (food security and food safety). Here we look at food policies, regulations, legislation and human rights.

- The **Culture axis** considers knowledge, training, social behaviour (sociology, anthropology, consumer trends, cultural and religious taboos ...). Eating goes beyond scientific bases, it has important emotional implications (beliefs, pleasure, social aspects ...).

The necessary balance between the 4 axes of the food system model described, coincides with the necessary balance between the 17 SDGs set by the United Nations.

They are all important and interrelated. Any maximalization of a variable unbalance the system and generates dysfunctions and problems.

The **growth of humanity** must be harmonious and sustainable within an ethical framework to achieve the 17 SGDs (Fig. 10). This will not be achieved if the same evolution does not occur simultaneously in the global food system, where all the vectors that make up the food system evolve proportionally and are in balance. At present, one of the problems is that solutions are not always sought from the point of view of a sustainable global food system. If only one of the parameters of the system is maximized, either in a self-interested or ignorant way, the imbalance in the system inevitably increases.

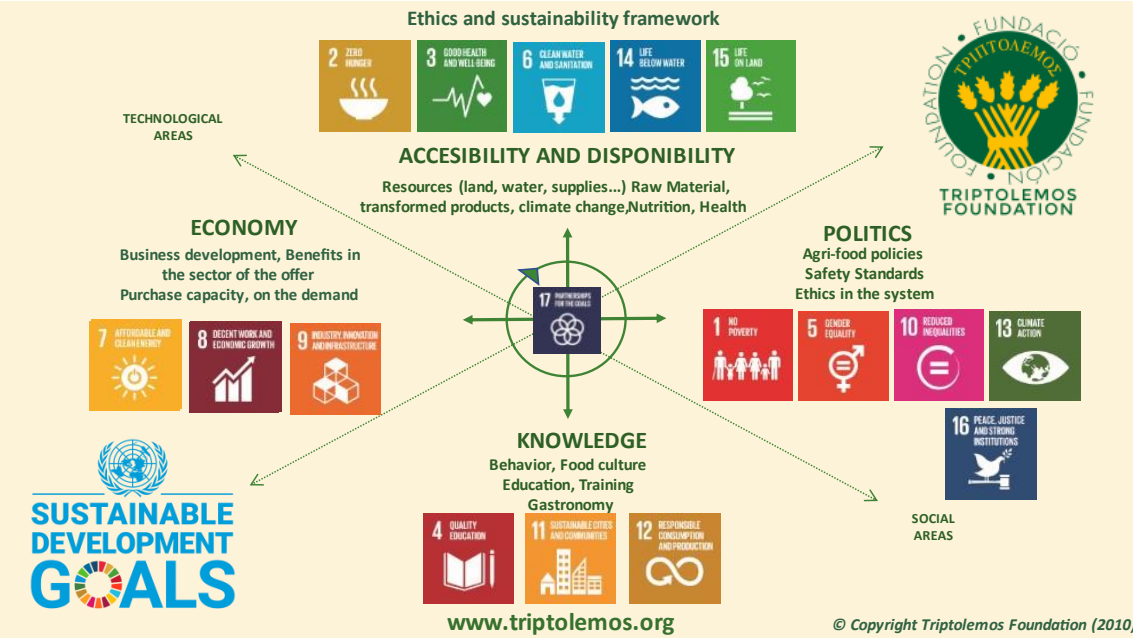

Figure 10: The SDGs and the challenges of the sustainable global food system. (Source: Triptolemos Foundation website)

By describing in general terms how the Triptolemos Foundation interprets the global food system, it will be possible to have a better understanding not only all the importance of the SDG 2 objective but also the relationship of food with the rest of the SDGs and geography, all of them are interrelated.

It will be difficult to achieve SDG 2, Zero Hunger, and refer to global food security, if simultaneously we do not have enough food for an adequate diet for the needs of each person, at the same time that we have access to it with a guaranteed distribution and, most important, the population has sufficient financial resources to buy this food.

A quantitative model of approximation to the SDGs. Zero hunger

Triptolemos Foundation has developed a quantitative model around the **Global Food System.** The model based on defined variables allows prospecting and comparisons between food systems in different countries and territories, with the Trademark Registry, **TRIPTOLEMOS Index of the Global Food System (ITRIn).** The Triptolemos Global Food System model allows the quantitative analysis (Clotet et al, 2018),

diagnosis and prospective modelling of the Global Food System, with quantitative variables defined in very different areas (agricultural production and climate change, consumption trends, prediction of markets and sectors, social behaviour of both citizens and governments, availability of food, economy, among others), countries and territories and their business application. **The approach of the model contributes to the foresight and quantification of the SDGs**.

Delving into one of the most important aspects, such as agriculture (availability and accessibility axis), an important but not the only factor to achieve SDG 2 (**zero hunger**) since its achievement is linked to economic aspects of the population (SDG 3, 4 and 8 among others), as shown in Figure 2.

We have the challenge of adequately **feeding a growing population** in balance with the economic and social sustainability of the planet, and in an unquestionable scenario of climate change. The current challenge of agriculture is to ensure sustainability, being aware that in the next half century we have to produce as much as in the previous ten thousand years, at the same time, having to worry about improving crop resilience, in an unquestionable scenario of climate change.

Population, resources, strategies, ethics…. All these influenced by the geography that conditions the concept of globalization. Sustainability in a humanly ethical context must be the solution, not only for the planet but for the society that is its tenant. It is important, for the growth of humanity to be harmonious and sustainable within an ethical framework, that all the vectors that make up the food system evolve proportionally and are in balance, and all of them aligned with the 17 SGDs.

In the opinion of Triptolemos Foundation, the food challenges of the XXI century can only be faced with a minimum guarantee through a sustainable and ethical global food system, which considers the availability of food, the economic, policies, behaviour and culture, all of them interrelated and in balance, with the support of science, technology and responsible business activity. If only one of the parameters of the system is maximized, either in a self-interested or ignorant way, the imbalance in the system inevitably increases and this distances us from achieving Goal 2, Zero Hunger.

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