ZERO HUNGER | EQUITABLE FOOD DISTRIBUTION

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Definition

Equitable Food Distribution means producing, processing and distributing food in a timely way to ensure food security for the entire population by the safe and healthy food access to all segments of the population on sustainable conditions from production to the global distribution. This phenomenon could occur in situation of crisis and emergency and also in poor regions with a strong deficit to access to secure and health foods. In both situations contributes to the malnutrition and/or hunger with strong negative impacts in the health of populations where vulnerate people are most affected.

Introduction

Food is fundamental to human wellbeing, and human development is central to achieving food security. Yet despite global food production over the past half century keeping ahead of global demand, around one billion people today do not have enough to eat, and a further billion lack adequate nutrition (Misselhorn et al., 2012; Pinstrup-Andersen). This situation trends to increase due the increasing of population in the world. On the other hand, the war conflicts spread for various continents and the economic migrants as a result and (due the climatic change due shortage of food and basic income level are also increasing. Beyond this, nowadays, the world is also facing a number of serious problems such as population rise, climate change, soil degradation, water scarcity and food security (COST FA1305,2015; Dos-Santos, 2016). Also, the food distribution is very desigual across continents and regions of the world. Seen as a response to the incumbent crisis affecting the food system, alternative food networks are a promising link of a new food chain, founded on a sustainable paradigm (Matacena, 2016).

According to this author their activities aim at realizing a process of 're-localization' and 're-socialization' of food production distribution-consumption practices, holding a prospect for the construction of a more environmentally sound, socially just and economically sustainable local food system (Dos-Santos, 2017).

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In recent years, both academics and institutions have recognized the emergence of Equitable Food Distribution (EDF), namely, the FAO (2017); the UN (2019) and also academics, namely, Matacena, (2016). Modern food production-consumption regime has developed around ideas of productivism and efficiency on the past follow the Malthus Theory and based on profit-seeking, global supply and resource exploitation. This situation and has caused a series of externalities and negative impacts on the social, economic and environmental scenarios that now seem to have reached a critical threshold (Matacena, 2016). The need for a renewed model, i.e. the urgency to build a sustainable paradigm within which to insert (not only) the food system is therefore becoming the common denominator of many political and economic programs (Matacena, 2016).

The Situation of Hunger at the World and the Imperative Need of Food Security

About 821 million people were undernourished in 2017 in the world (FAO, 2017). The majority of the world's hungry people live in developing countries, where 12.9 per cent of the population is undernourished and Sub-Saharan Africa remains the region with the highest prevalence of hunger, with the rate increasing from 20.7 per cent in 2014 to 23.2 per cent in 2017. In that region the number of undernourished people increased from 195 million in 2014 to 237 million in 2017 according to the United Nations-UN (2019). The poor nutrition causes nearly half (45 per cent) of deaths in children under five – 3.1 million children each year and 149 million children under 5 years of age—22 per cent of the global under-5 population—were still chronically undernourished in 2018 (UN, 2019).

Agricultural production and equitable food distribution will be the way to end hunger. Also, will be necessary equitable food distribution. Agriculture is also the single largest employer in the world, providing livelihoods for 40 per cent of today's global population. It is the largest source of income and jobs for poor rural households (UN, 2019). About 500 million small farms worldwide, most still rainfed, provide up to 80 per cent of food consumed in a large part of the developing world (UN, 2019). Investing in smallholder women and men is an important way to increase food security and nutrition for the poorest, as well as food production for local and global markets (UN, 2019; Dos-Santos and Mota, 2019). Since the beginning of the century XX about 75 per cent of crop diversity has been lost from farmers' fields.

Food insecurity is defined as "a household-level economic and social condition of limited or uncertain access to adequate food and hunger as an individual-level physiological condition that may result from food insecurity (Dos-Santos, 2018). On the other hand, Equitable Food Distribution can occur in into two general categories: disasters and long-term humanitarian development issues. Studies in humanitarian logistics can be classified by the types of decisions (strategic, tactical, and/or operational); objectives and performance measures (cost, equity, sustainability, lead times, effectiveness, etc.); constraints (budget constrained, capacity constrained, time constrained etc.); and reasons for occurrence (natural versus man-made) (Beamon and Balcik, 2008).

Sustainable Development and Goals of the Millennium from the United Nations

In 2015, countries adopted the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs). In 2016, the Paris Agreement on climate change entered into force, addressing the need to limit the rise of global temperatures (UN, 2019).

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The SDGs build on the success of the Millennium Development Goals (MDGs to be achieved on 2015), developed and aim to go further to end all forms of poverty. The new SDGs are unique in that they call for action by all countries, poor, rich and middle-income to promote prosperity while protecting the planet (UN, 2019). They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and addresses a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection according to UN (2019). Among the 17 SDGs the SDG2 - Zero Hunger, requires a conjoint action in different fields, namely, not just in the agricultural production effort or international trade measures but also requires a better redistribution of food by the effective promotion and development of equitable food systems of distribution.

Sustainable Development Goal 2 (SDG2): Zero Hunger - United Nations Sustainable Development Goals

The main targets of Sustainable Development Goal 2 (SDG2): Zero Hunger includes, according the UN (2019), namely:

1. By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.

2. By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.

3. By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.

4. By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

5. By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

To achieve these targets various important economic agricultural policies and international trade measures will need to be taken at world level, according to UN (2019), namely:

1. To increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries.

2. To correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round.

3. To adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.

The Imperative Need of Equitable Food Distribution

Equitable food distribution (EFD) is a problem in food asymmetries distribution at country level or regional level, not just in in peace situation but also in refugee's camps/calamity occurrences. Celik et al., (2012) divide humanitarian issues into two general categories: disasters and long-term humanitarian development issues. Studies in humanitarian logistics can be classified by the types of decisions (strategic, tactical, and/or operational); objectives and performance measures (cost, equity, sustainability, lead times, effectiveness, etc.); constraints (budget constrained, capacity constrained, time constrained etc.); and reasons for occurrence (natural versus man-made) (Beamon and Balcik, 2008).

An equitable food system would produce different outcomes by making healthy food available to all, providing good jobs, and fostering healthy neighbourhoods. And it would strengthen the economy by bolstering incomes, spurring business development, and contributing to equitable economic development in segregated and long-distressed neighbourhoods (Woolf, 2017).

Methodologies to Analise Equitable Food Distribution

There has been a wide range of applications in the literature considering equity and the equitable allocation of different types of resources. The majority of them use quantitative analysis, namely, mathematical programming with a regional impact on equitable foof distribution.

Fianu, & Davis (2018) analyse a 2014 study on household food insecurity in USA. The reported results confirm that 14% of U.S. households were unable to access enough food at all times formulate this decision problem as a discrete-time. To analyse this country level study a discrete state Markov decision process that considers stochastic supply, deterministic demand and an equity-based objective. The authors investigate three different allocation rules and describe the optimal policy as a function of available inventory. They also provide county level estimates of unmet need and determine the probability distribution associated with the number of underserved counties (Fianu, & Davis, 2018).

Orgut et al., (2016) contributes with a numerical study that is performed on data from Food Bank of Central and Eastern North Carolina (FBCENC) to capture the major attributes controlling its food distribution system. FBCENC seeks to distribute donated food equitably so that each service area (county) receives food proportional to its demand while minimizing the undistributed food donations. In addition to seeking equitable and effective food distribution policies, FBCENC wants to identify distribution branches to maximize the accessibility of the counties to donated food. An assignment and distribution model are developed to minimize the cost of maintaining a user-specified cap on the maximum inequity in food distribution. A sensitivity analysis between the user-specified maximum inequity cap and effectiveness shows

the effectiveness of donated food distribution can be improved significantly by sacrificing equitable distribution slightly (Orgut et al., 2016).

Marsh et al., (1994) give a brief overview of the many areas where equity is used as an objective. Some examples of these areas are geographers' concerns regarding equitable distribution of water rights in Western states, political scientists' discussions on each state having equal representation in Congress and economists' studies on public welfare distribution and equitable distribution of income. Furthermore, they focus on facility siting decisions and they state that equity is obtained if each group that is affected by the facility siting decision receives their fair share from the total effect. Their objective is to minimize inequity by using 20 different measures proposed in literature and compare and analyse them for different situations. Meng et al. (2002), formulate the Continuous Network Design Problem which is basically the problem of allocating a capacity increase among existing roads under a budget constraint. They use a bilevel programming approach and incorporate equity as a constraint where different network users receive equal benefit from the capacity increase in terms of their average origin – destination travel costs.

Vossen et al., (2003) also focus on an interesting equity problem. Their objective is to allocate the national air space equitably such that the amount of possible delay is distributed equitably among flights. They propose that the ration-by-schedule approach gives nearly equitable allocation of resources and minimizes total delay. Mazumdar et al., (1991) study a multiuser telecommunications network in which each user has the objective of optimizing its performance while being fair to the other users. They propose that the Nash arbitration scheme from Game Theory gives a desirable and fair solution for individual users and different performance criteria. The solution obtained from this method is Pareto optimal. Finally, Ogryczak (2007), analyse the trade-off between equity and effectiveness in resource allocation models. He explains different performance measures to achieve Pareto optimality of a solution since this solution is also efficient and states that the max-min types of objectives give both equitable and effective solutions and can be used in some applications. As seen above, there have been many studies with the objective of satisfying equity over some measure. However, to the best of our knowledge, determining the optimal allocation of food in a donations-based supply chain remains undiscovered despite its theoretical and social interest.

Besides the important contributes to optimize equitable food distribution in all the referred situations in microeconomics contexts, the problem of equitable food distribution are a multidimensional problem and the quantitative approaches just optimize the local problem, but not solve the origin of the problem.

New Challenge for Food Security and Equitable Food Distribution

Climate change is predicted to exacerbate food insecurity in developing countries and will further intensify the challenge of sustainably feeding a world population of 9 billion by 2050. Eradicating hunger was one of the principal objectives of the post-war international system. Alongside the desire for peace and prosperity and trade the food security and equitable food distribution has new challenges (Dos-Santos, 2019).

Nowadays, climatic change and the severe impacts in food production in a new challenge to joint to the uneven distribution of food and food security problem. Climate change is predicted to exacerbate food insecurity in developing countries and will further intensify the challenge of sustainably feeding a world population of 9 billion by 2050. The literature has consensus that countries with more insecure and weaker agricultural and economic infrastructures will be more vulnerable to the impacts of climatic change (Dos-Santos, 2016).

The main challenges for equitable food system depend if this refers the situation of emergency or not. In the last one the challenges could be exacerbated due the emergency need of food and the situation of crisis requires and treatment of rapid answer with a previous planning process. But in situations of desigual distribution of food in time of peace also requires an emergent treatment. The other challenges in this situation includes:

1) Financial and institutional access to food – The lack of access to healthy food due financial restrictions and infrastructure. Nowadays millions of low-income people live in poor areas with low income without access of healthy foods. That can occur in rural or remoted areas or in marginalized areas.

2) Environmental and health risks in food supply - Agricultural inputs used in food production without control (as pesticides use) have numerous negative impacts on the health of people, animals, and the environment. The extensive use of pesticides on farms exposes farmworkers and rural communities to toxic chemicals and can contaminate water supplies and food production.

3) Social restrictions to access food - Low-wage jobs and poor working conditions. Many jobs inside and outside the food system pay low wages and provide few benefits or career ladders, and, although the sector is growing, wages are stagnant or declining. Farmworkers and food processing workers, who are disproportionately immigrants, are subject to health and safety risks, wage theft, and human rights violations. Food sector jobs are increasingly temporary or part-time, resulting in inconsistent income and low economic security. These situations occur mainly in intensive agricultural industry and production sector. Also, social restrictions, like age, illness, social isolation and dementia may affect access to food by millions of people around the world. These situations require special attention from policy makers.

Towards a World Contribute for Zero Hunger

As referred before one of the greatest challenges of the present century is to ensure that the world population has reliable access to adequate, affordable and nutritious food sufficient to avoid hunger (Mary, 2019; Dos-Santos e Diz, 2019). Agricultural trade liberalization is often considered a central element of economic strategies aiming at improving food security in developing countries. Some authors, namely, Mary (2019); Miličić et al., (2017) however, argue that most developing countries may not benefit from freer agricultural trade and that liberalization may accentuate food insecurity. But from an empirical perspective, the literature is incipient in the effects of trade on food security in developing countries (Mary, 2019). Also, few references not very consistence occurs for countries in development. The literature refers more partial effects from results of econometric methods or mathematical programming.

Mary (2019) analyses the effects of food trade openness on extreme hunger in developing countries. The results of this author confirm that a 10% increase in food trade openness would increase the prevalence of undernourishment by about 6%. They also confirm that developing countries reduce food trade openness as a response to increased hunger, that suggest the increasing of protectionist policies.

According to Mary (2019) a "percentage point increase in undernourishment prevalence would decrease food trade openness by 0.9%". So, this author the main conclusions highlines that countries may be better off adopting food self-sufficiency for some time, despite such actions clashing with World Trade Organization's regulations and current agenda. To promote national country self-sufficiency is difficult due the limited natural resources. To overcome this situation the best strategy is to promote and develop local and short supply foods systems, that means, local food production with a less of resources. In this situation the development of aquaponics systems could be one solution to solve local level (Goddek et al., 2019).

On the other hand, the increasing of population around the world is also another challenge for food security and for the reduction of hunger, mainly in the countries in economic development and small and medium income level. That increase of population around the world is another challenge nowadays. Urban areas need here a special attention. The majority of authors agree that equitable food distribution and food security has more gaps and difficulties on urban areas, because the subsistence farming systems don't exist here. Indeed, the problem of urbanization became more relevant since the last decades.

Since the pioneering work of Krugman (1998), new economic geography has been developed and sophisticated in several directions in order to show how the spatial distribution of economic activities is evolving in the real world (Tabuchi 2004; Dos-Santos, 2016). There is consensus that while regional populations were dispersed in early times, there has been, in recent years, a growing rural exodus causing the cities' population to increase considerably, according to Tabuchi (2014).The year 2007 marked an important development in the history of urban cities because, for the first time, the share of total population living in cities exceeded 50%. Urbanization has become a major global trend, with ever increasing degrees of urbanization reaching70% and more in various European and Asian countries (Kourtit et al., 2012). Cities are becoming smart not only in terms of the way we can automate routine functions serving individual persons, buildings traffic systems but in ways that enable us to monitor, understand, analyze and plan how the city can improve its efficiency, equity and the quality of life of its citizens, all of this in real time (Batty et al.,2012).

That levels of urbanization rates includes regions when besides the urbanization rate is high the problem of equitable food distribution remain the majority of the times associated a problem of vulnerable people, social problems, young unemployment and some times insecure places. Also, in refugees' camps, and climatic emergency phenomena could acerbate the problem and require a rapid answer.

In some of this cases aquaponic production could be a solution, because is an innovative smart and sustainable production system for integrating aquaculture with hydroponic vegetable crops, that can play a crucial role in the future of environmental and socio-economic sustainability. These systems acquire more importance in sceneries of poverty and food insecurity that mainly occurs in humanitarian crises. Aquaponics, as a closed loop system consisting of hydroponics and aquaculture elements, could contribute to address these problems (COST FA1305, 2015; Dos-Santos (2016**).**

Aquaponics don't need to any agricultural land as a based resource on an extensive way. Also, in poor regions or cities or in countries in development, in urban areas aquaponics systems can be set up almost everywhere and have the potential to urbanize food production. This could bring important socio-environmental benefits besides your contribution.

Aquaponics farming plants could be implemented in old industrial neglected buildings with the advantages of re-establishing a sustainable activity without increasing urbanization pressure on land. (Goddek et al., 2019).

Aquaponics systems can be set up almost everywhere and have the potential to urbanize food production. This could bring important socio-environmental benefits. Aquaponics farming plants could be implemented in old industrial neglected buildings with the advantages of re-establishing a sustainable activity without increasing urbanization pressure on land. (Goddek et al., 2015). So, can be solved several problems that currently affect smart cities, which need to be sustainable. On the one hand, the price's pressures on the arable land and urban land can reduce, utilizing abandoned buildings that already have a lower residential value, and on the other, fresh food will be produced with no environmental contamination nor long transport cycles and expensive storage from long distances.

So, aquaponics production could solve several problems that currently affect urban poverty, or scenarios of catastrophe, contributing to reduce the hunger among population. On the one hand, the price's pressures on the arable land and urban land can reduce, utilizing abandoned buildings that already have a lower residential value, and on the other, fresh food will be produced with no environmental contamination nor long transport cycles and expensive storage from long distances Miličić et al., (2017; Dos-Santos, 2016). That resulting in short supply chains, with economic, environmental and social benefits, for producers, consumers and inhabitants in general. Similarly, this farming systems can also be a way of creating new jobs in cities/urban areas contributing to the increasing of food security, equitable food production by the local production and reduction of unemployment; help disability people and promote the social cohesion.

Also, other forms of local production with short supply food systems could be promoted in order to solve the problem of equitable food distribution. By the other hand, the infrastructures to rapid deliver food to vulnerable people must be developed.

Benefits of an Equitable Food System

Building a more equitable food distribution would have many positive impacts on the economy, namely, job creation; local and regional economic development, high positive contributes on health of population and reduced health care and public assistance costs. In regions of more weak equitable food distribution systems Support community gardens and local food production encouraging stakeholders and communities can be encouraged to grow their own food by removing barriers to food cultivation and providing access to land, water, seeds, training, and financial resources to support community gardening and urban farming. The access to microcredit and other financial and politics measures could be implemented to support this local development. In situations of war and fields of refugees these measures could be implemented joint with other educational measures.

Conclusion

Equitable Food Distribution means producing, processing and distributing food in a timely way to ensure food security for the entire population by the safe and healthy food access to all segments of the population on sustainable conditions along all the process.

To achieve the Sustainable Development Goal 2 (SDG2) Zero Hunger a holistic approach based on quantitative models of decision for equitable food distribution will be need at partial or national programs. This problem also requires a comprehensive database when Big Data could have a particular relevance to allow and obtain comparable data in order to achieve common goals, besides the different situation from each region or case.

Local problems of equitable food distribution could be solved by local forms of production foods with low inputs on a sustainable way, like aquaponics and other forms of urban agriculture due the high level of urbanization and the increasing trend.

At the same time the international agricultural policies and trade policies must contemplate the particular restrictions of countries of medium income to overcome the initial restrictions. The achievement of SDG 2 and other goals also must include an approach including the particular social, natural, economic and institutional conditions from the baseline of the region in order to answer with efficiency and on a sustainable way to a part of the needs of the population on the world.

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To promote an equitable food production requires a holistic approach that includes to solve from social, economic, environmental and institutional level.

Cross-References

Food security

End Poverty and Hunger

Sustainable Development Goals

Equitable Food Distribution

Sustainable Development Goals

Aquaponics

Urbanization

Conflict regions.

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