

# Sustainable Food Security, A Paradigm for Local and Regional Food Systems<sup>1</sup>

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## Abstract

*In this paper, in the light of sustainability, we analyze the current dominant industrial agriculture and food system. The system was developed successfully regarding production, output and profitability, but social inequality and environmental problems increased and the system did not succeed in bringing the world food problem closer to a solution. Since elimination of hunger is top priority among world's leading institutions it is justified and not out of proportion to exacerbate the definition of sustainability to food and take food security into account explicitly. We define a new paradigm – called sustainable food security – that is urgently required to provide sufficient and healthy food for all people, without exhausting our planet. This paradigm of sustainable food security requires a focus on local resources. We argue that the best way to achieve this is by means of the local and regional food systems that we see springing up globally. We discuss opportunities and challenges of the re-emerging local food systems in the light of the new paradigm of sustainable food security. To proceed we propose the development and ratification of a new global treaty based on the concept of sustainable food security.*

**Keywords:** sustainability, food sovereignty, food security, food safety, agriculture, food systems, local, regional, industrial

## 1. Introduction

Worldwide small farms produce a large part of our food. Even in Russia, with its tradition of large farms, half the food production currently comes from small and medium-sized family and private farms. Before World War II this was also the case in most western countries. The agriculture and food system was a decentralized system, based on family farms and focusing on the regional provision of food. Though not formally certified or registered as such this system could best be described as a 'natural' way of production (i.e. without input of chemical fertilizers and pesticides), mixed farming and short cycles of production.

After World War II the provision of plentiful and cheap food for the impoverished population of Western Europe was crucial. Based on the thoughts of Sicco Mansholt (European Commissioner for Agriculture from 1958 until 1972 and fourth President of the European Commission in 1972–1973) the postwar agricultural policy was inspired by the conviction that hunger should belong to the past ('Never a hunger winter again', Westerman, 1999). This was implemented successfully by means of agricultural policies that offered support and subsidies, but that also contributed to the use of technologies that proved damaging to the environment (Ingemann, 2009). Depending on antibiotics and with the aid of chemical fertilizers and chemical pesticides, herbicides and fungicides, and the use of genetically modified products, agriculture and agricultural firms were able to develop into bigger farms outcompeting small farms. The system developed into the industrialized system of agriculture and food that we are confronted with in our days.

In the seventies and eighties of the 20<sup>th</sup> century the first limits of this spectacular growth became visible in western countries. Market distortions were one of the first signals. Moreover, the negative environmental effects of the production bubble became apparent in the pollution of soil, surface water and air, and stench. The use of chemical fertilizers resulted in soil degradation. Several large crises in animal diseases and food crises followed in quick succession. Consumer and civil society concerns increased.

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The United Nation's Brundtland Commission (Brundtland, 1987) introduced the concept of sustainable development. Various solutions were proposed, mostly of a technological nature. Despite the several adaptations that were made and that are still being proposed, the system remained essentially the same. This is now the dominant industrialized agricultural production system in western countries. It consists of a relatively small number of large farms, which operate according to the mainstream economic paradigm of economic growth. In the last few years firms in the agro-food sector have been merging rapidly into mega-farms. This is partly due to the globalization of the markets and could take place because decisions on policies and research were taken centrally, favouring this large-scale industrial system.

Although Mansholt at the end of his career warned against the unbridled growth of agricultural production and proposed to limit production volumes, the agricultural businesses continued (Westerman, 1999). Ironically – as is argued by many – it is this system of industrial agriculture, established to avoid hunger, which is now contributing to crises in food production and to hunger. Food insecurity is now, next to climate change and peak oil, one of the three global crises threatening our lives on this planet we are currently facing, that Shiva (2008) draws attention to. After a number of attempts to change agriculture, called ‘green revolutions’, the world food situation has not improved. It is even worse than a century ago.

De Schutter (2011) even argues that the current food crisis actually is a threefold crisis: a poverty crisis, an ecological and a nutrition crisis. Small-scale farmers have received too little support, which has resulted in rural poverty and in rural-to-urban migration that cities cannot cope with. The current system of agriculture and food exerts heavy pressure on ecosystems. It is not only the shortage of food that matters, but also nutrient deficiency in food.

In section 2 we analyse the current global industrial food system. We discuss the characteristics and problems of the system at the hand of the sustainability aspects of people, planet and profit. Analysis of the current dominant system of agriculture and food shows that the definition of sustainability is interpreted too narrowly and that food access for all is not a priority in the current dominant system. This leads to the observation that our post World War II-system of agriculture and food is de-coupled from social and environmental systems, with uneven value distribution in chains and lasting food insecurity.

These drawbacks create imperatives for change for our current industrial agricultural and food system. The challenges lie in solving the environmental and social problems and in taking food security into account explicitly. In section 3 we develop a new paradigm of ‘sustainable food security’. This paradigm combines the food security concept of Shiva (2011), which consists of three vital aspects - ecological responsibility, food sovereignty (the right of people and nations to determine their own system of agriculture and food) and food safety - along with the sustainability concept of Brundtland (1987). This paradigm urges us to reconsider social and ecological values, to develop quality products and fairness in attributing values along the chain and to aim for food sovereignty and food safety. The best way to achieve this is by means of the local and regional food systems that we see re-emerging globally.

In section 4 we will discuss the characteristics and challenges of the local and regional food systems according to the concepts connected with sustainable food security: people, planet, profit, food sovereignty and food safety. While reviewing these local and regional food systems we will pay attention to the re-connection of producers and consumers, to the re-valuation of eco-systems and biodiversity, to fundamentally new forms of capitalisation, and to the local right to sufficient, safe and nutritious food and food production. The review shows that where workers operate in small- and medium-sized farms and firms and are rewarded on the basis of their merits, producing safe, healthy, adequate and affordable food for all, are the systems that are most satisfying and rewarding for producers and consumers.

In section 5 we will summarize our conclusions and present suggestions for further research and work.

## ***2. Analysis of the Industrial System of Agriculture and Food***

The development of the industrial system took off and subsequently went haywire. To illustrate the developments and the consequences this can lead to, we go into further detail of the current dominant industrial system and look at the sustainability issues in the social, ecological and economic fields. Table 1 presents an overview.

**Table 1: Characteristics and Problems of the Current Dominant Agriculture and Food System**

Issues	Characteristics	Problems
<b>Social, well-being</b>	Far removed	Large distance between producers and consumers Up-scaling leads to an exodus of smaller farmers Entrepreneurs become employees Loss of awareness of food quality Cheap and poor quality basic food commodities, 'enriched' by the processing industry Hunger on the one hand and obesity on the other hand
<b>Ecological</b>	Mono	Use of chemical fertilizers and herbicides Loss of biodiversity
<b>Economic</b>	Mega/Global	Oligopolistic competition: worldwide by multi-nationals and nationwide by heavy concentration in processing and retailing companies Mega-farms, industrial processing Food products treated as commodities No fair prices for farmers

Source: Own preparation

## 2.1 Social Issues

The current dominant agricultural production and food system is embedded in long global chains. The long global chains increase, literally and figuratively, the distance between farmers/producers and citizens/consumers. Producers are far removed from consumers, with a resulting loss of agri- and foodculture. Farmers and consumers have no control of the industrial agriculture and food system. Production is disconnected from consumption. The society in which we live shows a trend toward hedonistic characteristics. It is easier, more comfortable and economical to resolve the problem of getting a daily meal by buying packed industrial products rather than fresh food. The question is whether possibilities for eating well can be re-created and whether social conditions can be optimised so that each and every person can eat healthily (Diaz Méndez and Benito, 2008).

Global systems contribute to the vulnerability of people living in cities (Carolyn Steel, 2009). In developing countries the upscaling has led to rural-to-urban migration combined with unemployment. People living in cities, and for that matter whole nations, cannot provide their own food any more and become vulnerable in case of faltering global systems.

The effects of mega and monocultures and of the industrial system on human health are enormous. In the first place the system has come to depend on the use of chemical elements such as fertilisers, pesticides, herbicides and fungicides that have toxic effects on humans. Moreover GMOs have been introduced, not only to increase the volumes of production, but also to build resistance against pesticides. The GMOs or at least the large quantities of pesticides, have possibly harmful effects on food quality and human health (Boyers, 2011).

Growing monocultures in mega-farms adding only a few nutrients (mostly restricted to N, P and K), leads to nutritionally poor bulk food products, loss of biodiversity and organoleptic quality. In firms where industrial processing take place attempts are made to 're-value' these bulk products with supplements – often of an artificial nature. However, a lot of questions have been raised about the nutritional value of this 'ultra-processed' food (Monteiro, 2010). Monteiro concludes that the main dietary reason for the rapid increase in overweight and obesity throughout the world especially since the 1980s - which is now an uncontrolled pandemic - has been, is, and continues to be, the correspondingly rapid increase in production and consumption of ultra-processed food and drink products. Obesity is a new disaster. Also Pollan (2008) showed that healthy food couldn't consist of poor quality basic food to which some nutrients have been added.

It is argued by some that the industrial agriculture and food system, with its emphasis on increasing volumes of production by means of monocultures in mega-farms and firms will make food available for all people. However, it is highly doubtful whether the world food problem can be solved in this way. The food situation has improved in recent decades in countries like China and India, but this is not due to the development of industrial agriculture. Research of the Stichting Onderzoek Wereldvoedselvoorziening of the Vrije Universiteit (SOW-VU) indicates that the improvement in the food situation is especially a consequence of economic growth in the cities.

This economic growth entailed more purchasing power and consequently regional agricultural production has increased in those countries (Keyzer, 2008). The hunger problem has not been solved. About 925 million people are in chronic hunger worldwide (FAO, 2010), while 1,4 billion people have to live on less than \$ 1,25 per day (UN, 2011).

In animal husbandry attempts to achieve food safety are based on keeping monocultures strictly apart and keeping them under hygienic control by means of antibiotics. Antibiotics are not only used to cure sick animals, but also to a large extent to prevent all animals from getting sick in the first place, and also to hasten the growth of the animals and therefore increase production volumes. As a consequence of these overdoses bacteria become resistant to antibiotics, causing serious health risks not only for the animals but also for people. E.g. the multi-resistant ESBL (Extended-Spectrum Beta Lactamase) bacteria from poultry farming, just one of the growing numbers of antibiotics resistant pathogens, are found not only in chicken meat, but also in surface water and on vegetables and fruit.

Other risks of the over-use of antibiotics relate to damage to the soil life.

## 2.2 Ecological Issues

In principle eco-systems of the earth produce sufficiently to feed a growing world population (FAO, 2002). The production systems dramatically threatened however, because of declining eco systems services and loss of biodiversity. MEA (2005) defined 19 eco-systems services at a global scale, of which 15 services have declined and only 4 improved. Mean species abundance has decreased strongly in most parts of the world since the beginning of the twentieth century (Tekelenburget *al*, 2009). The Netherlands lost 85% of its original biodiversity (PBL, 2010).

Large-scale industrial forces induce reclamation and overuse of natural eco systems. Also in developing countries we see that governments allow multi-nationals to use mono-cropping methods - with deforestation as a consequence - in this case to be able to dispose of foreign currency from exports (DeFrieset *al*, 2010). Soil erosion and desertification are caused by overstocking, mono-cropping, and ploughing of marginal lands.

Monocultures are standard in the current industrial agriculture and food system. The system is based on chemical fertilizers and the use of chemical pesticides that are used to increase the yield per hectare. Working with chemical fertilizers and pesticides destroys the vitality of and the living organisms in the soil, with serious consequences for future fertility. This intensive cultivation has led to exhausted soils.

Multiplied volumes of production were made possible by the large increase of the use of chemical fertilizers (artificial carbon manure) after World War II. This was combined with the selection of crop varieties based on response to mineral nitrogen. The development was supported by centralised agricultural policies and research, through FAO, national governments and other institutions. This practice did increase production volumes enormously, but at the same time a process set to work that destroyed the living soil structure. In fact a decoupling of the carbon and nitrogen cycles started, which is disastrous for soil life. Organic matter is the basis of life and organic carbon is the basis of the normal ecological nutrient situation. It is possible to restrict fertilization to only very small amounts of chemical fertilisers when organic materials are available in abundance. Bacteria need carbon from the soil to process the nitrogen. When there is no organic carbon available the bacteria use the carbon from their own polysaccharide layer, which damages the soil structure and increases the proneness to diseases (Visser, 2010).

There is another reason why chemical fertilizers must decrease. For chemical fertilizers are one of the by-products of the production of oil. As mentioned in the introduction peak oil is one of the three global crises threatening our lives on this planet we are currently facing. 'Peak oil' is the term used for the point at which the world reaches its highest possible level of oil production. According to some, we have already reached this point. This means that the age of oil is coming to an end.

Another effect of monocultures and an increasing use of chemical pesticides is the loss of pollinators ('pollinator decline').

To increase the volumes of production even further plants are genetically modified (GMOs). This is applied at a large scale in the case of soy, maize and cotton. Roundup Ready soy is manipulated in such a way that this soy is resistant against the herbicide glyphosate (Roundup), a herbicide that kills all weeds and plants except this soy.

However the use of this herbicide has led to the development of a number of resistant weeds that are even more difficult to combat.

### 2.3 Economic Issues

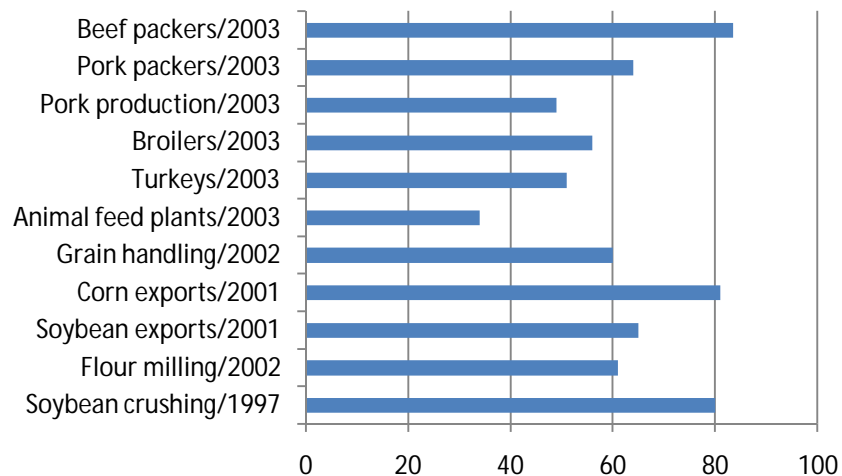
The current agriculture and food system is based on the dominant market culture, characterized by scaling-up by ever larger farms and larger processing firms, applying cost-minimisation and specialisation, with a high degree of division of labour (simple tasks in a complex organization) and with traditional Anglo-Saxon forms of organisation (competition and individualism). The current system strives for efficiency at a global level with high levels of transport, strict and extreme divisions of production and processing in (global) chains.

To satisfy the need for feed for animals large amounts of products containing high levels of protein are produced, such as soybeans. The EU annual soybean import from Brazil almost doubled in the period 1995-2004, which required extra land amounting to about 1 million ha. The large-scale production of soybeans has been a major driver of the increasing deforestation in Brazil (Elferink *et al.*, 2007).

Economic theories behind the current industrial agriculture and food system are based on the idea that a system of free trade will benefit everybody. However, the conditions for a fair form of free trade have not been fulfilled. Not all costs are reflected in the product prices. E.g. fuel for international transport flights is not taxed and the costs of the emissions are not taken into account. These 'externalities', that are not paid for keep prices low and the competition is not fair. Indirect costs in the global chains are shifted on to primary producers and society.

Oligopolistic tendencies are prevalent on the world market and on the national markets. At the world market level only a few large firms control the agricultural commodity markets. See Figure 1. In this Figure the concentration of agricultural markets is expressed as the CR4-Ratio, i.e. the concentration ratio of the top four firms in a specific food industry. In the course of time this ratio has generally increased.

**Figure 1: Concentration of Agricultural Markets, CR4-Ratio**



Source: Hendrickson and Heffernan (2005)

Large players get ample scope on the world market and disturb the production of local farmers. Entry barriers make it difficult for new firms to enter this market.

Multinationals have branches in many countries. In this way they can control the way our food is produced, processed, distributed and consumed. They use this flexibility to buy the agricultural products as 'commodities' wherever they are cheapest. They process the products and sell them to consumer markets anywhere in the world that have the best purchasing power. Multinationals have few loyalties to specific countries. They can establish branches strategically wherever it is most favorable from the point of view of materials supply, infrastructure, labour costs, availability of resources and legal aspects. They can do so regardless of the situation of the national agriculture and food systems. Local food producers cannot use such strategies, and this can result in loss of self-sufficiency in the country concerned. This is one of the main reasons why the world food problem has not yet been solved.

Genetically modified foods are subject to intellectual property laws. Developers of transgenic plants or animals, often multinationals, have in many cases acquired patents on living material (GM seeds and crops). Farmers are not allowed to keep the seeds and use them for sowing next year; they have to buy new seeds every year. Moreover with the help of 'genetic use-restriction technologies' or 'terminator technology' it becomes possible to sell seeds that can germinate when they are sold to the farmer, but whose seeds resulting from the subsequent harvest are sterile. As a result, farmers are unable to preserve a commercial variety from their own seed stocks and are forced to return to the seed provider (Visseret *al*, 2001).

Another aspect of concentration is the oligopolistic structure of agrifood businesses at a national level. Upscaling and specialization has taken place in food processing and distribution as well. Food processing and food distribution are largely in the hands of only a small number of very large enterprises. Our current industrial agriculture and food system functions according to a sand-glass model: many farmers produce for many consumers, but the food stream goes through only a handful of large distributors and supermarkets. Therefore there is no fair competition in the food market. The large numbers of farmers are at the mercy of a small number of processing and retailing companies that have the power to deny farmers a fair price. Competition laws are biased in favour of large firms. Essentially it can be characterized by the concepts of economies of scale, competitiveness, increasing size to cope with the buyers' market power and a monopolistic position in dealing with the suppliers (Barjolle and Chappuis, 2000).

Technological development has made it possible for the current agriculture and food system to become a mega-industrial business by means of large-scale technologies. The use of ever bigger and heavier machinery for the monocultures at agrarian mega farms and in -agro parks has resulted in tightly packed soils that can only produce thanks to chemical elements: fertilisers, pesticides and herbicides. Postwar governments of western countries have strongly stimulated this development by means of highly centralised policies and support policies biased in favour of specific science and technology. Through this development food products have lost nutritional value and taste and are treated as 'commodities' instead of as valuable products that are essential for our survival and health.

Some argue that agroclusters and mega-farms are necessary because of spatial pressure. There are (plans for) agro parks e.g. in China and India, and also in Amsterdam (Westpoort). The argument is that thanks to such concentrations more space would become available in the countryside for nature and landscape. However, constructing agrofood parks and mega-farms is not consistent with policies to arrive at urban-rural relationships and better contacts between citizens and farmers. Visiting mega-farms is not a stimulating experience for citizens and/or consumers, and a trip into a countryside without agriculture and related activities would not be a very interesting outing. It would be tedious, and maintenance is very costly. An example of this conflicting relationship is the rural policy in the Netherlands. On the one hand farms that are close to urban areas or to nature areas are removed to so-called Agricultural Development Areas, and on the other hand citizens are tempted to visit farms and the countryside to bring them into contact with farmers and provide recreational possibilities.

### ***3. Need, Definition and Scope of a New Paradigm: Sustainable Food Security***

#### **3.1 Need for a New Paradigm**

The industrial system encounters difficulties in achieving a production that is environmentally and socially sustainable. Efforts to overcome these difficulties are mostly restricted to new technologies. Once the industrial agricultural system has started out on this road it shows continuous growth, a one-sided directedness towards single value streams, continual increase of production volumes, and reliance on financial transactions. This leads to serious crises from time to time and strikes at our ecosystem and our health. It hardly contributes to solving the world food problem and leads to loss of taste and disconnectedness from that essential need, our food. In short the industrial food system has become a system of global monofunctional food chains that is far removed from us humans because its input comes from mega-farms and firms, with traditional forms of organization that are outside our reach.

From the analysis in section 2 we learned that the post-World War II agricultural and food system was developed successfully regarding production output and profitability, but that it increased social inequality and environmental problems and it did not succeed in bringing the world food problem closer to a solution. A voluminous food production became available at low cost, and not only for the domestic consumer. Food exports increased dramatically to the detriment of developing countries that were deprived of their own markets by the influx of subsidised food from 'developed' countries.

In this system, however, the environmental and social elements of sustainability lose out. The following quotation from a prominent Dutch agro-businessman makes this clear: ‘Through specialization and efficiency improvement Dutch agriculture became one of the golden eggs of the Dutch economy. But the financial success also brought along problems: the social and ecological values suffered. That’s why the agricultural sector has to change now in such a way that economic, social and ecological values reinforce each other’ (Transforum, 2011).

Many agree that measures should be taken to overcome or mitigate the problems caused by industrial agriculture. However, a clear roadmap is not available. For the agriculture and food system to provide physical and economic access to sufficient safe and nutritious food for all people in a sustainable way the social and ecological values of before the industrial system should be recovered, and an appropriate economic system should be developed that prioritises ‘food for all’.

### **3.2 Definition of the New Paradigm: Sustainable Food Security**

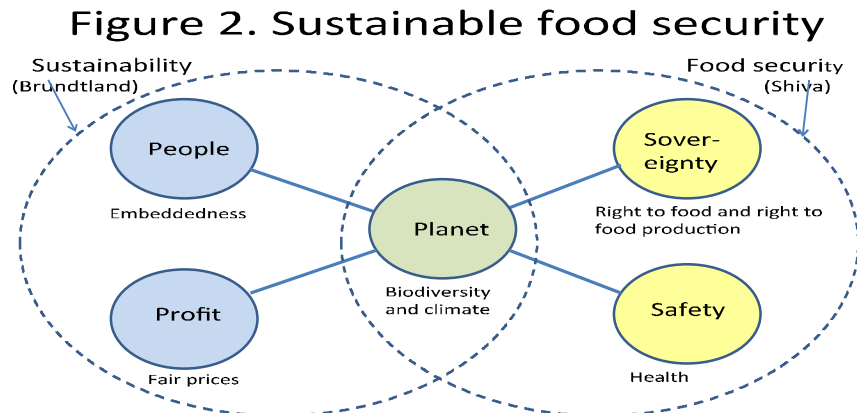
Despite its financial success and its spectacular growth the industrial agriculture and food system has not succeeded in bringing the world food problem closer to a solution. The World food problem is first of all a societal problem. It is not to be expected that this problem can be solved by means of even more volumes of production and even more financial success. Moreover, now that large farms are being established in the developing world, small farmers are dispersed and become even more impoverished, and thus the world food situation becomes even worse. We can only overcome these problems when we realise that people should have control over their food and food production. Consequently regions or nations should have the right to food, the right to food production and the right to protect their borders against undesirable imports. When regions or nations have the right to organize their own food production and consumption they in fact take food security as a criterion in their food policy. Achieving food security and elimination of hunger is also top priority among world’s leading institutions. So is achieving food security for all at the heart of FAO’s efforts ([www.fao.org/hunger/](http://www.fao.org/hunger/)) and UN launched the ‘Zero hunger challenge’ at the RIO +20 Conference in Rio de Janeiro in 2013. It is therefore justified and not out of proportion to exacerbate the definition of sustainability to food and take food security into account explicitly.

According to the World Food Summit 1996 we have food security when all people, at all times, have physical and economic access to safe and nutritious food that meets their dietary needs and their food preferences and that is sufficient for an active and healthy life. From this definition, four main dimensions of food security can be identified: physical availability, economic and physical access to food, food utilization, and stability of these three dimensions over time. For food security objectives to be realized, all four dimensions must be fulfilled simultaneously (FAO, 2008). For more information and an overview of food security and related items, especially the international negotiations and instruments related to food security and the international organizations behind them, we refer to Tansey and Rajotte (2008).

The world community has acknowledged that the human right to food must be realised progressively despite the enormous challenges and inequities that exist in the food systems of both rich and poor nations. The right to food is an overarching goal defined by the UN Special Rapporteur on the Right to Food (De Schutter, 2012) as: “The right to have regular, permanent and unrestricted access, either directly or by means of financial purchases, to quantitatively and qualitatively adequate and sufficient food corresponding to the cultural traditions of the people to which the consumer belongs, and which ensures a physical and mental, individual and collective, fulfilling and dignified life free of fear.” The current mainstream of industrialized farming and food provision has failed to deliver this right (Wibbelmann *et al.*, 2013).

Shiva (2011) put forward three vital aspects of food security: ecological responsibility, food sovereignty and food safety. Food sovereignty is the right of people and nations to determine their own system of agriculture and food. It prioritises local and national economies and markets and stimulates agriculture and food systems shaped by small farmers and family farms, artisanal fisheries, extensive animal husbandry and sustainable food production, distribution and consumption (Pimbert, 2008), (Desmarais *et al.*, 2011). Food safety refers to wholesome plants and animals that are good for our health. This can be achieved by continuously improving the hardiness of organisms. The best way to achieve this is by means of natural ways of production (Isaacs, 2010) and not by using preventative measures such as the application of antibiotics.

We combine the food security concept of Shiva with the sustainability concept of Brundtland (1987) (social equity and environmental and economic sustainability). This leads to a broader interpretation of sustainability in the field of agriculture and food, which involves a re-coupling of the social and environmental system with a more remunerative system for farmers and explicit attention for food sovereignty and food safety. This leads to the concept of 'sustainable food security' that could serve as a new paradigm for development in the sector of agriculture and food. Ecological aspects, including biodiversity, form the link between sustainability and food security. They appear explicitly in both concepts and therefore the ecological issues are the heart and soul of the concept, see Figure 2.



Source: Own preparation

We propose to use this concept of sustainable food security as a precondition for the agriculture and food system. A consequence of this observation is that it is not enough to judge systems only according to criteria of sustainability, as we usually do; we should widen this concept of sustainability to sustainable food security. Sustainable food security is within everybody's reach if the following conditions are fulfilled simultaneously: people, profit, planet, food sovereignty and food safety.

### 3.3 Scope of the New Paradigm

The new paradigm urges us to reconsider the social and ecological values, to develop relationships that reward quality and fairness and to consider food sovereignty and food safety. A reconnection of producers and consumers requires a local basis. Fairer incomes for farmers require fundamentally new forms of capital that people can arrange locally. The ecological processes should be developed with care, resources and energy cycles should largely be closed, and crop growing and animal husbandry should be interconnected. Also for these aims the local framework is the best option. For food sovereignty it is a precondition that regions or nations can decide themselves on their production and consumption of food. This requires nationwide, regional and ultimately local governance of food systems. The food sovereignty issue is perhaps the most important reason for regionalisation of the agriculture and food system. Monitoring food safety in short chains is less complex than monitoring food safety in global industrial chains.

From this discussion it appears that each of the five aspects of sustainable food security is connected with local issues providing good, tasty, healthy and sufficient food for all people without exhausting our planet. For achieving these goals local and regional food systems are best suited. This conclusion does not imply that all foods can and should be produced and consumed locally or regionally. Depending on climate conditions and land availability in relation to aspects like population density and production possibilities, the different regions themselves should address this issue in consultation with each other. Moreover the exchange of typical foods between regions can contribute to more intercultural understanding.

In most countries of the developing world and in Brazil, Russia, India and China (BRIC countries), there still exist local/regional agriculture and food systems consisting of small family farms. In western countries small farms almost disappeared in the postwar period. Since the seventies and eighties, during and parallel to the development of the industrialized agriculture and food system, however, a revival of small family farms has been observed, where environmental care and social fairness are incorporated. A relatively large number of these small enterprises now produce specific, local, often artisanal products in a traditional way and according to a common



mode of practice. This entails a paradigm of multiple values, characterized by economies of scope, high specificity of the products and a governance structure based on cooperation, collectivity and trust.

Worldwide these small-scale enterprises encounter difficulties in the highly competitive markets of today, but they still survive. Barjolle and Chappuis (2000) mention four reasons why this form of organization can continue to exist despite the difficulties on the markets, explaining historical issues, economic context and strategy issues, political and legal issues, and organizational issues.

Over the last few decades we have even observed a strong focus on local and regional systems of food production. These have received much attention from consumers, producers, governments, researchers, and partners in the food supply chain. Reviews have been published of various kinds of local and regional food systems. The opportunities and challenges have been explored in a number of reports and articles (Martinez *et al*, 2010; Cotler, 2009; Donkers, 2008; Jensen, 2009; Clancy and Ruhf, 2010; Egmond, 2010; DeLind, 2011; *Klimaat en Voedselcrisis*, 2011). Local Food Systems (2011) is a site for networking, co-operation, and the establishment of local food systems. CR (2011) notes that local food systems are more sustainable than the current ones. The Cornell University Library has an index of initiatives and sources related to local and regional food systems. We will characterise these new local and regional food systems as multi-functional food networks. These are close to people because they operate on the basis of small- and medium-sized farms, which have proved their merit by producing safe, healthy, adequate and affordable food for all.

As already stated above, a number of reports and articles have been published on the challenges of these local and regional systems in the last few years. Often the reports originate from concerns about the outcomes of industrial agricultural and food systems, emerging inequities in food distribution, and public health problems associated with consumption patterns, and the drive to generate new ideas for a more sustainable food system. It is in the context of these constraints that local and regional food systems have been re-emerging: many communities and regions have started with these small-scale systems to test possible solutions.

When products are produced, processed, and consumed within the region, the region itself benefits. This is especially the case when this food system is part of a multi-functional environment where value is placed on other aspects of life such as agricultural tourism, and care for nature, the landscape and eco-systems not directly related to the production of food.

#### **4. Opportunities and Challenges of Re-Emerging Local and Regional Food Systems**

The picture of regionalisation is diverse and covers all aspects of social life. To illustrate the opportunities and challenges, we will discuss local and regional food systems under the five aspects of sustainable food security: social, economic, ecological, food sovereignty and food safety, restricting ourselves to the main potential advantages. See Table 2 for an overview.

**Table 2: Characteristics of the New Regional Systems of Agriculture and Food**

<b>Issues</b>	<b>Characteristics</b>	<b>Potential advantages</b>
<b>Social well-being</b>	Proximity	Reconnecting producers and consumers (people and nature) Control of local food production and consumption Access to sufficient food
<b>Economic</b>	Micro/Regional	Fair prices Local/regional production Micro machinery and small scale processing Food is not seen as a commodity
<b>Ecological</b>	Multi	Access to the countryside Biodiversity
<b>Sovereignty</b>	Access for all	Right to food and right to food production Local/regional production ensures access to food for all people in the region
<b>Safety</b>	Nutritional	Awareness of food impact on health and well-being Wholesome food Building power of resistance Access to wholesome food (food democracy)

Source: Own preparation

For more views on benefits and challenges see e.g. Jensen (2009) and Martinez *et al* (2010). For a classification scheme and clear definitions for the varieties of local and regional food systems and a discussion concerning the (multi) governance of local and regional food systems, see Donkers (2013).

#### 4.1 Social Issues

In the social dimension of sustainability, the most important thing is to fully appreciate what we eat, to know where it comes from, and to be able to enjoy it without wasting it.

Another important aspect is the availability of good and wholesome food, and the reality of local control and decision-making. This is what Tim Lang calls ‘food democracy’, which he puts in the context of ecological and climate-related issues, where discussion centres on the sustainability of food chains and the specific use of the different elements of the food chain.

These aspects come together in the degree of ‘embeddedness’, ranging from distance (in the global industrial system) to social nearness or proximity (in the local and regional systems). We may distinguish between social proximity within regions, and proximity between regions. Social proximity within regions is related to the degree in which producers and consumers contribute to regional development, while social proximity between regions is a precondition for interregional and transregional developments. However, we must note that, especially in this age of information technology with its abundant availability of social media, social proximity does not necessarily imply physical or geographical proximity.

#### 4.2 Economic Issues

Since free trade is hampered by the oligopolistic position of a number of firms, there is an obvious imbalance of both opportunity and reward. Both global transport and trade liberalisation should be restricted. The industrial system of agriculture and food production has brought financial success, though not for all participants, for example, farmers, who do not receive fair prices. Fair prices for farmers will only be realised when the larger share of the price paid by the consumer goes to the producer; this in turn will only be achieved by decreasing unfair (oligopolistic) competition, abolishing the imbalance of externalities and adding increased value at the farms themselves.

Decreasing unfair oligopolistic competition would also make it easier for large groups of people to have economic access to food.

Local and regional food systems offer opportunities for small-scale farmers, allow farmers to earn a reasonable income, and restore the balance of power in the food supply chain. A growing number of consumers are willing to pay premium prices for locally produced food. Once a local product is recognised as desirable, local producers have the opportunity to scale up to larger distribution systems within the region and between regions.

Short supply chains put farmers in a better position for negotiation. In local and regional food systems, regional co-operation models are developed, based on a meritocratic ‘Rhinelands’ form of organisation dependent on co-operation and trust. These co-operation models give high priority to transparency, labour division and responsibility, i.e. complex tasks performed in a simple organisation. This is a completely different socio-technical regime compared to the industrial agriculture and food system.

The right to produce and consume locally is intimately connected to international trade relations. Because of free trade it is not possible to keep out cheap imports, which are in many cases as in the EU, even subsidised. This jeopardises production in each individual country. Therefore, local networks and controlled global trade flows (WTO) should be at the basis of the new food system, rooted in the regions, but connected to the rest of the world. This would also clash with industrialised agricultural and food systems, because of their dependence on international free trade.

Local and regional systems of agriculture and food focus more on the human level, with production mostly decentralized in small-scale farms, with the creation of ‘value added’ at the farm, and small processing firms in the neighbourhood. Food should not be seen as a commodity. Agriculture and food are different from manufacturing and public services, in that they deal with living material and are dependent on geographic conditions, such as land/soil, available natural resources, including water, regional climate conditions, etc. Therefore ‘local’ and ‘regional’ are important concepts for understanding these systems of agriculture and food. Locally, food is not seen as a commodity, but as a dignified product that ensures people’s survival and health.

### 4.3 Ecological Issues

The ecological aspect of sustainable food security implies recovering ecological values by abandoning chemical fertilisers and pesticides, herbicides, and fungicides. Attempts to reduce the use of these artificial means, e.g. by means of precision agriculture, have been undertaken, but will never lead to a healthy soil, because chemical fertilizers and agro-ecology cannot successfully be combined. A healthy and living soil cannot stand even a small quantity of chemical fertilizers.

What is needed is to make the soil and the fertility of the soil into a fundamental aspect of the system. This is also a precondition for achieving biodiversity (Visser, 2010). Biodiversity thrives when food production and the food cycle are intimately connected with nature and the landscape. The ecological processes should be fostered, material and energy cycles largely closed, and crop growing and animal husbandry interconnected (Kotschi, 2011).

Doing without the soil, as in cultivation on substrates, is not a solution either. This technique may perhaps deliver some of the needed minerals to grow strong, beautiful-looking plants of uniform quality, but it does not deliver tasty, nutrient-rich, healthy food; not even when additives are added during the processing phase, as demonstrated by Monteiro (2010) and Pollan (2008).

In local and regional agricultural and food systems, production methods without chemical fertilizers are used and developed, that are often based on natural, organic and/or agro-ecological production methods, such as permaculture (Holmgren, 2002 and de Waard, 1996). Biodiversity is of the utmost importance, along with a whole array of interconnected values to do with nature, production, environment, health, and experience. These in turn may provide a diversity of agricultural and eco-systems in the landscape. To avoid the 'local trap' (Martinez *et al*, 2010) it is important to test and verify that these systems are indeed being applied and that they are contributing to the environmental benefits that they aspire to.

Much work has been published to indicate that locally based small-scale agriculture, when compared to large-scale agriculture, may produce even higher output levels per unit area, and could produce enough food to sustain human population. Chappell and Lavallo (2011) found studies demonstrating that small farms, using alternative agricultural techniques, could produce enough food to sustain the human population, without increasing the agricultural land base. The increasingly high profile of agroecology is reflected in the growing body of evidence on high-performing agroecological management practices. Analysis of project outcomes demonstrated not only an average crop yield increase of 113%, but also numerous environmental benefits, including carbon sequestration and reductions in pesticide use and soil erosion, Wibbelmann *et al*, 2013). Moreover, research has clearly shown that small-scale farming, using natural, organic and/or agro-ecological production methods, has advantages in terms of environmental and biodiversity impact; and small-scale farms may be two to four times more energy-efficient than large conventional farms.

The energy-consuming transport of numerous agricultural raw materials and food products around the world is no longer needed. Likewise, the energy required to manufacture and use large quantities of chemical fertilizers and pesticides is not applicable. In local and regional food systems, the amount of transported items is relatively small. To keep the transport costs per food item under control, efficient transport vehicles remain crucial.

### 4.4 Food Sovereignty Issues

Local and regional food systems grow diverse and nutritious food. Everyone, from the household level, to the community and to regional and national levels, has the right to safe, wholesome, adequate and affordable food. In such a system of food sovereignty, food is produced locally, and production is in the hands of the hungry. Fair prices exist that cover the costs of production and allow farmers and farm workers a life with dignity.

The Forum for Food Sovereignty (Nyéléni, 2007) outlines six basic principles:

- To ensure a food supply;
- To appreciate producers of food;
- To integrate agriculture and food systems into the local environment;
- To keep local control;
- To build upon local knowledge and experience;
- To co-operate with nature.

Food sovereignty guarantees locally produced food. Local people have access to, control over, and are stewards of productive resources such as land, water, and forests. To achieve food sovereignty measures must be taken. Trade restrictions are necessary: for example, exempting food and agriculture from trade agreements, and prohibiting dumping. Subsidies in certain countries should not damage other countries; agri-business multi-nationals should no longer prevent farmers from accessing their own markets; seeds should not be patentable commodities; rural credit and investment schemes should be designed to support family agriculture (Pimbert, 2008).

#### **4.5 Food Safety Issues**

Food safety involves raising healthy animals and growing healthy crops/plants. The best way to ensure health is to increase the power of resistance to disease, instead of screening and separating monocultures under hygienic control by using antibiotics. In local and regional food systems there is no urgency to use antibiotic compounds for preventative purposes; the starting-point for achieving resistance to diseases is the use, as far as possible, of natural production methods in a rich biodiversity setting. If there is a direct connection between producers and consumers, large and complex tracking systems are not needed.

#### **5. Conclusions**

Before World War II the dominant system of agriculture and food was the regional/local agriculture system under the multiple values paradigm both in western countries and in the developing and BRIC countries. After World War II this regional/local agriculture was almost pushed aside in western countries and the industrialised system under the economic growth paradigm became dominant, whereas in the developing and BRIC countries the industrialised system is still going strong. The current system of agriculture and food exerts heavy pressure on ecosystems. It is not only the shortage of food that matters, but also nutrient deficiency. The current food crises create imperatives for change of our current agricultural and food system. To allow the agriculture and food system to provide physical and economic access to sufficient safe and nutritious food for all people in a sustainable way the social and ecological values of the industrial system should be recovered so as to develop an appropriate economic system and prioritise 'food for all'.

We combined the food security concept of Shiva, which consists of three vital aspects - ecological responsibility, food sovereignty (the right of people and nations to determine their own system of agriculture and food) and food safety - with the sustainability concept of Brundtland. This new paradigm of 'sustainable food security' urges us to reconsider social and ecological values, to develop quality products, to provide better rewards for farmers and to aim for food sovereignty and food safety.

Putting the paradigm of sustainable food security into practice requires a focus on local resources. The best way to achieve this is by means of the local and regional food systems that we see re-emerging globally. The opportunities and challenges of emerging local and regional food systems offer key perspectives on achieving sustainable food security. Many communities and regions have started with these small-scale systems to test possible solutions.

When food products are produced, processed, and consumed within the region, the region itself benefits. This is especially the case when this food system is part of a multi-functional environment where value is attached to other aspects of life such as agricultural tourism, and care for nature, the landscape and eco-systems not directly related to the production of food.

We discussed the characteristic features of these local and regional food systems according to the five dimensions of sustainable food security: the social, economic and ecological aspects, and food sovereignty and food safety. The new system is characterised by a system of local and regional, multi-functional food networks which are close to people, where workers operate in small- and medium-sized farms and firms and are rewarded on the basis of their merits, producing safe, healthy, adequate and affordable food for all.

As a topic for further research we mention a better cooperation between the local and regional parties at different levels. Serious obstacles may arise on the road to cooperation. It is difficult and it cannot always be flexible, certainly not in the case of a large group of individual entrepreneurs and in the case of groups with different interests. This means that individual interests have to be overcome and leadership is needed to get people to move in one direction. This requires good governance systems. A new policy and new knowledge development is needed to stimulate local and regional agriculture and food systems.

In western countries both government policy and knowledge development, which after World War II were put at the service of the industrial agriculture and food system, now have to be turned towards the needs of local and regional food systems.

We propose the development and ratification of a new global treaty based on the concept of sustainable food security, aiming at a fair society, economically thriving inhabitants, well-functioning/healthy eco-systems, sufficient and safe food for every human in the world, through the development of local food systems for global future.

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