NW Orago 'Sustainability of food systems: The role of legal and policy frameworks' (2018) 2 *Global Campus Human Rights Journal* 16-40
http://dx.doi.org/10.25330/1445

Sustainability of food systems: The role of legal and policy frameworks

Nicholas Wasonga Orago*

Abstract: *Food plays a critical role in human life for sustenance, nutrition, cultural expression and socio-economic development. It is, therefore, imperative that food production, processing and consumption systems are managed in a manner that ensures access to adequate, quality, safe and nutritious food for all for present and future generations. However, the world continues to struggle with different nutritional challenges such as undernutrition, overnutrition and malnutrition. It is essential that a system of food production, processing and consumption be adopted that effectively responds to these challenges in a comprehensive and holistic manner. This article elaborates on the food sustainability approach as an alternative to the prevailing conventional industrial approach to food production that has failed to end the world's nutritional challenge while, at the same time, adversely degrading the ecosystem. The food sustainability approach adopts a systems approach to the global nutritional challenge, addressing it in an integrated and holistic manner at all levels of the food chain to ensure that food production, processing and consumption are economical, socially just and environmentally viable in the short and long term. The article finds that legal and policy frameworks at the national and global level have played a critical role in the maintenance of the current conventional food systems that perpetuate hunger, inequality and destroy critical ecosystem services. It calls for the review and transformation of these legal and policy frameworks so as to create an integrated and holistic food systems framework for the management of the entire food chain to enhance the realisation of economic, social and environmental sustainability in the food system.*

Key words: *food; malnutrition; food systems; food sustainability; legal and policy frameworks*

1 Introduction

Food is a basic human need that is critical for human health, well-being and socio-economic development. In order to function physiologically and achieve their full potential, it has been stated that human beings daily need between 2 400 and 2 900 kilocalories of food (Helms 2004: 383). It is estimated that 55 per cent of this food energy requirement should be derived from carbohydrates; 35 per cent from lipids; and 10 per cent from

* LLB (Nairobi) LLM (Pretoria) LLD (Western Cape); Researcher and Lecturer, School of Law, University of Nairobi; nicholasorago@gmail.com. This article was elaborated as part of the project 'Towards Food Sustainability: Reshaping the Coexistence of Different Food Systems in South America and Africa' and was financed through the R4D research programme of the Swiss National Science Foundation and the Swiss Agency for Development and Cooperation.

proteins, with animal proteins contributing only half of the 10 per cent protein requirement (Helms 2004: 383). The current global production of food, estimated at 8,4 billion tons a year, therefore, is sufficient to adequately provide the required food calorie intake and nutrition to the estimated global population of 7,2 billion (FAO 2014: 6).

However, the current reality is that a large section of the human population continues to suffer from different forms of food deficiencies – overnutrition, undernutrition and malnutrition. It is estimated that 821 million people (one of every nine people globally) suffer from chronic undernutrition, with the prevalence at 14,3 per cent in low-income countries (FAO 2014: 9; FAO 2018: xii). Further, 22 per cent of children under five years (151 million) suffer from stunting, while 50 million are wasting and are at an increased risk of mortality (FAO 2018: xii). Micronutrient deficiencies – especially proteins, vitamins and minerals – afflict over one-third of the populations of low-income countries, with the estimation of over 2 billion people suffering from this form of malnutrition (Capone et al 2014: 17). The world is increasingly experiencing the phenomenon of overnutrition exemplified by overweight and obesity. According to WHO figures, in 2016 more than 1,9 billion adults (18 years and over) were overweight, with over 650 million of these being obese (WHO 2018; also see FAO 2018: xii that puts the figure at 672 million obese adults). In this period, 41 million children under the age of five years were overweight or obese, while 340 million children and adolescents (5-19 years of age) were overweight or obese (WHO 2018). The global food security situation is bound to become worse due to the expected 30 per cent increase in the global population to 9,3 billion by 2050; the continuing competition for scarce productive land; water and energy; as well as the adverse impact of climate change in all the processes of the food chain (Capone et al 2014: 13; FAO 2014: 6; Garnett et al 2016: 1). In this context, food production will be required to increase by 60 to 100 per cent to between 13,5 and 16,8 billion tons in order to feed the growing population and to account for dietary transition from a grain-based to an animal product-based diet occasioned by rising income levels in the world (FAO 2014: 8; Garnett et al 2016: 1).

Many questions are asked about how to address the current and future human nutritional requirements in the context of a growing global population and the ecosystem stresses that have been caused by current human activities, food production being key among them (Capone et al 2014: 13). The current conventional industrial approach to global food security advocates the increase in food production through the expansion of production areas, agricultural intensification and the use of nanotechnology and biotechnology; an approach that already has an adverse impact on nitrogen, hydrological and carbon cycles (Helms 2004: 383; Westley et al 2011: 762-765). This approach has come under heavy scrutiny due to its inability to effectively respond to global hunger and its adverse impact on biodiversity and ecosystem services that threatens future food production (Thompson & Scoones 2009: 1; Czarnezki 2011: 263-264).

Due to the challenges of this conventional industrial approach, alternative systems have been proposed, with food sustainability – or the development of sustainable food systems – being one of the systems. The basis of this approach is article 1 of the Rio Declaration that places human

beings at the centre of sustainable development and entitles them to a healthy and productive life in harmony with nature (UNCED 1992: article 1). Due to the importance of food to human health and socio-economic productivity in the short and long term as well as the finite nature of natural resources and their limited capacity to support life; it has been critical that a food system be developed that provides healthy and nutritious food for all while maintaining ecological services (Moldan et al 2012: 5-7). This has led to the proposal for an alternative sustainable food systems approach that is more economically viable in the long term as well as socially and environmentally just. Adopting a systems methodology that incorporates the entire food chain (activities, actors, roles and complex interactions), this approach looks at the economic, social and ecological/ environmental aspects of the food system (Capone et al 2014: 14). It envisages a holistic and integrated management of all the processes of the food chain to enhance the achievement of food security and the realisation of the right to food for all (Thompson & Scoones 2009: 2).

This article, adopting a food systems approach, delves into an analysis of the place of legal and policy frameworks in creating sustainable food systems. After this introduction, it undertakes a comprehensive overview of the different dimensions of the global food security challenge that a sustainable food system must deal with in section 2. Section 3 expounds on the concept of sustainable food systems, defining sustainability, food systems and integrating these to enhance an understanding and appreciation of the food systems sustainability approach. Section 4 delves into an analysis of the place of law and policy in the design and development of sustainable food systems. Section 5 briefly concludes the article.

2 Dimensions of the food security challenge

The global challenge in the context of food security is how to adequately feed a growing population while ensuring the sustainable management of the environment, land, water, biodiversity and other critical production resources (Premanandh 2011: 2707). All actors in a food system will affect the sustainability of the food system. Therefore, efforts towards sustainability must encompass all the food system actors – producers/ distributors, consumers and policy makers (Grunert 2011: 207; Goggins & Rau 2015: 2). These efforts may be categorised into three aspects: the production/supply efficiency dimension; the consumption/wastage dimension; and the governance dimension (Garnett et al 2016: 1; Capone et al 2014: 15).

2.1 Production/supply efficiency dimension

This dimension entails the transformation of food production and supply processes to improve unit efficiency of production and supply so as to ensure that the population has physical and economic access to enough of the right type of food to adequately meet their nutritional needs (Garnett 2013: 31). There is a dilemma in relation to production: the reality of an increasing population that requires increased food production (by 60 to 100 per cent by 2050), on the one hand, and the recognition that increased food production is having an adverse environmental and biodiversity impact that threatens the increased food production itself, on

the other (Moscatelli et al 2016: 106; Rasul 2016: 15-16; Roy & Chan 2012: 100; Johns & Sthapit 2004: 144). Global warming and the attendant climate change, which is bound to impact largely on the ability of low-income high-population countries to produce sufficient food for their populations, further compound this dilemma (Gonzalez 2011: 512;[1] Thompson et al 2010: 2720). As a result of these challenges, it is estimated that by 2050, crop yields will decline by 8 per cent in tropical areas – Africa and Asia – where the most food-insecure populations live (FAO 2014: 11). In this context, if the world is to ensure continuous production of adequate food to feed its growing population in a sustainable manner, a new system of food production that is in harmony with nature and judiciously uses ecosystem services to enhance production is required.

Effectively dealing with these food production challenges requires the adoption of sustainable food production and supply techniques that maximise efficiency of production and supply while prioritising conservation of the environment and biodiversity (Hamilton 1998: 425; Rao & Rodgers 2006: 441[2]). Some of the methods for sustainable intensification of agriculture are localised agro-ecological food systems (Johns & Sthapit 2004: 144-148; Thompson & Scoones 2009: 7; Czarnezki 2011: 266). These systems combine crop and livestock production with agro-forestry to enhance efficiency in land use, mitigate climate change, increase carbon sequestration, improve ecosystem services such as soil fertility and generate socio-ecological resilience (Gonzalez: 2011 513-514; Goggins & Rau 2015: 7;[3] FAO 2014: 16[4]). The basis for localisation is the spatial specificity or 'place-based' challenges of agricultural production, which must be addressed at the local level to integrate local ecological, economic and community development (Marsden 2012: 139-140).

Localisation in itself, however, is not sufficient. There must be incontrovertible evidence that localised food systems are more sustainable, that is, are able to meet the sustainability goals of ecological integrity, social feasibility and economic viability. In response to this challenge, several indicators have been developed and utilised to determine the sustainability of localised food systems (Rao & Rodgers 2006: 439-447).

1 Gonzalez states that agriculture is the single largest source of greenhouse gas (GHG) emissions at approximately 32,2%. Direct agriculture contributes 13,5%; land use change related to agriculture produces 17,4%, while the rest is produced indirectly in the manufacture of agricultural inputs as well as in the use of fossil fuel-run farm machinery, in the processing and in transportation of food.

2 Rao and Rogers define sustainable agriculture as 'a practice that meets current and long-term needs for food, fibre and other related needs of society while maximising net benefits through the conservation of resources to maintain other ecosystem services and functions, and long-term human development'. Sustainable agriculture is a critical part of sustainable food systems.

3 Goggins and Rau state that the essence of agro-ecology is the production of organic foods with limited use of chemical fertilisers, pesticides and antibiotics to avoid pollution and adverse human health impacts as well as the use of crop diversification and rotation so as to maintain biodiversity.

4 FAO states that mixed farming creates synergies, with crops providing fodder and feed for livestock and sequestering GHG emitted by livestock, while livestock produce manure that enhances crop productivity while reducing reliance on unsustainable chemical fertilisers. A combination with forestry further benefits the agricultural system due to the critical ecosystem services provided by forests, such as soil formation and conservation, nitrogen fixation, water purification and retention, biodiversity conservation and climate change mitigation as carbon sinks.

The measurability of the agro-ecological food systems in their contribution to sustainability has been demonstrated through the use of five indicators: productivity; stability; reliability; resilience; and adaptability (Rao & Rodgers 2006: 443). In this context, productivity entails the ability of the production system to profitably produce viable yields to bolster the livelihoods of farmers through increased total production and improved net farm income (Roy & Chan 2012: 106). Stability, derived from ecology, entails the continuous preservation of the natural resource base in the production process though an integrated land, soil fertility, water, nutrient and biodiversity management (Roy & Chan 2012: 108). Reliability is the ability of the system to retain a normal equilibrium when facing general perturbations while resilience is the ability of the system to recover from shocks and stresses. Lastly, adaptability is the flexibility of the system to transform in response to new conditions such as climate change while maintaining productivity (Rao & Rodgers 2006: 443). Localised agro-ecological food systems have been affirmed to meet these criteria of sustainability as they minimise greenhouse gas (GHG) emissions; promote agro-biodiversity; enhance carbon sequestration; rely on local inputs; strengthen rural economies; support the livelihoods of smallholder farmers; and has the potential to produce enough food to feed the current and future populations while conserving biodiversity (Gonzalez 2011: 493-494 & 516-517; Thompson & Scoones 2009: 7). They are also more energy efficient, using 50 to 70 per cent less energy as compared to conventional farming methods (Reisch et al 2013: 6). Marsden contends that 'local-scale food systems are more sustainable because they have "tight feedback loops" linking consumers, producers and ecological effects, which enable positive adaptive responses to negative effects' (Marsden 2012: 142-143). This is corroborated by Goggins and Rau who argue that

> [s]ustainable food procurement typically involves purchasing local, organic and fairly traded products from at home and abroad. Local and regional food systems form a central part of the sustainable food narrative and have the potential to foster a more sustainable food system (Goggins & Rau 2015: 5).

Educational and policy efforts aimed at creating sustainable food systems in the production dimension should thus be directed at the adoption and development of localised agro-ecological production approaches as alternatives to the modernist industrial agricultural production approach that has adversely impacted on ecosystem services and failed to provide adequate food for all.

Law and policy have a role to play in this context, especially in creating the necessary regulatory standards for the adoption and implementation of these new approaches as well as the provision of incentives for their adoption by farmers and other actors in the food chain. Such regulatory standards must incorporate an integrated system for the management of the main food production resources such as land, water, seeds, environment, biodiversity and labour. Agricultural and food production and supply laws and policies must integrate the management of these production resources with the objective of balancing the livelihood needs of farmers *vis-à-vis* the consumer needs for healthy and affordable food items while protecting the environment and social fabric (Goggins & Rau 2015: 5; Schneider 2010: 947). Although production efficiency and affordability are key concerns of national food security, ecological and socio-economic sustainability requires that they be honestly balanced

against ecosystem services, food safety and human health, with the direct and indirect long-term human and animal health externalities being critical factors in the balancing (Hodas 1998: 18-19;[5] Schneider 2010: 953). Production practices such as the heavy use of chemicals in crop production as well as the use of antibiotics and other growth hormones in animal production – even if effective in increasing the quantity of food items produced in the short-term and thus lowering prices – must be balanced with the long-term human health effects such as chemical residue in foods, human resistance to antibiotics and the heavy medical burden resulting from non-communicable diseases generated by unhealthy foods (Kirschenmann 2006: 3-5). If properly balanced taking into account all these factors, food production and supply processes have the capacity to ensure economic, social and ecological sustainability, as discussed more elaborately in section 3 below.

2.2 Consumption/wastage dimension

This dimension requires the transformation of consumption patterns and dietary preferences that determine food production and supply so as to ensure the availability of adequate food for all (Garnett 2013: 30; Capone et al 2014: 13). Consumers – through food choices, preferences and procurement – impact greatly on the type of food to be produced and the manner of its production (Goggins & Rau 2015: 4; Grunert 2011: 207). Due to population growth, globalisation, trade liberalisation, rapid urbanisation, a growing middle class, rising incomes and marketing, food preferences have changed – what is termed as nutrition transition (Capone et al 2014: 15-16; Kearney 2010: 2802-2804; Lang & Barling 2012: 319). This nutrition transition connotes a dietary change from simpler, traditional and locally-produced staple foods to the complex 'Westernised/ modern' highly processed fatty, syrup-filled and sugary diets (Hawkes & Popkin 2015: 144; Reisch et al 2013: 4; Lang & Barling 2012: 319; Garnett 2013: 32; Johns & Sthapit 2004:145). It is predicted that this dietary transition will in the long term override population growth as the main driver of land, water and energy requirement for food production, thus leading to further biodiversity loss and environmental degradation (Capone et al 2014: 16).

There are different aspects of this nutrition transition. The first is a disconnect between producers and consumers, creating the phenomenon of 'food from nowhere' that has resulted in health-related challenges being experienced in most societies today (Czarnezki 2011: 279; Koc 2010: 38; Reisch et al 2013: 4). The 'food from nowhere' phenomenon has resulted in food being heavily processed and transported over long distances (between 1 500 and 2 000 miles) using fossil fuels (Kirschenmann 2006: 3; Reisch et al 2013: 2-3; Tai 2011: 10-11). The consequences of this phenomenon have been the loss of food nutrition content; the increased use of chemical preservatives that have an adverse impact on human health; increased GHG emissions that have led to climate change and have also created the problem of food dumping that has distorted national food markets in low-income countries driving smallholder farmers out of

5 Hodas argues that if ecosystem services were actually internalised in pricing decision-making, then the market would encourage sustainable use of resources in a manner that reduces total environmental costs to society.

agricultural production (Ackerman et al 2010: 865 & 867-868; Schneider 2010: 954). The net effect of this has been the reliance by low-income countries on the international food market for food security, a situation that is unsustainable due to the increasing food prices in the international food markets. In order to improve this situation, it is critical that agricultural law and policy prioritise the sustainable national production of diverse and healthy foods for local populations to enhance food security and ensure substantive national food self-reliance. This can be achieved through the adoption of the localised agro-ecological agricultural practices as recommended in section 2.1 above.

This nutrition transition is further symbolised by the consumption of more meat and dairy products, with the global meat consumption projected to double by 2050 (Herrero & Thornton 2013: 20878; Reisch et al 2013: 4). Income is the greatest contributor to this nutrition transition, and Helms (2004: 383) elaborates the transition on account of growing incomes as follows:

- low-income diets that rely on staple foods such as cereals, roots and tubers (consumes about 200kg of grain per person per year);
- initial minimal raise in income is used to satisfy demand for food, with increased consumption of starchy staples (consumes about 300kg of grains per person per year);
- further increase in income leads to a shift from coarse grains like barley and millet to more expensive cereals like wheat and maize (consumes about 400kg of grains per person per year);
- income increase of GDP/capita >$500 leads to a shift to more luxurious foods such as vegetables, fruits and animal products that partly replaces cereals (consumes about 600kg of grain per person per year directly and indirectly);
- income increase of GDP/capita >$1 000 leads to the greatest shift to animal products and other affluent foodstuffs like oil, beverages and sweets (consume about 800kg of grains per person per year directly and indirectly).

This indicates that the wealthier populations become, the more food they consume, meaning that more food has to be produced to satisfy the expanding appetite, especially for animal products. The nutrition transition has had, and will continue to have, high adverse environmental, ecological and biodiversity impacts as 70 per cent of agricultural land and a third of arable land is already taken up by livestock production (Herrero et al 2010: 823). An increased demand for meat and its products is expected to lead to a significant increase in livestock production, further contributing to deforestation and loss of biodiversity (Garnett 2013: 7; Lang & Barling 2012: 319; Reisch et al 2013: 7). It has been estimated that it takes between 7 and 10kg of cereals to produce 1kg of meat (Helms 2004: 385). It is further estimated that one hectare of land has the capacity to produce enough rice or potatoes to feed 19 to 22 people per annum, while the same area can produce only enough lamb or beef to feed one to two people per annum (Capone et al 2014: 16). This indicates that the pressure for livestock feed will increase cereal prices, thus depriving low-income populations' access to cereals that they rely on as food – increasing global hunger (Garnett 2013: 30 & 33). It has also been affirmed that farm animals contribute 31 per cent of GHG emissions that enhance global warming, a further indication of the adverse impact of meat and milk preference to the environment and biodiversity (Lang & Barling 2012: 319). Achieving sustainability of the food system thus requires the

transformation of this adverse nutrition transition back to more plant-based diets that conserve and preserve ecosystem services.

Apart from the adverse ecological, environmental and biodiversity impacts; nutrition transition also has deleterious consequences for human health (Kearney 2010: 2801; Johns & Sthapit 2004: 145). Kirschenmann elaborates this by stating that 'human health cannot be maintained apart from eating healthy nutritious food, which requires healthy soil, clean water, and healthy plants and animals. It's all connected' (Kirschenmann 2006: 1). The truism of this statement is clearly reflected in today's societies. A change in dietary preferences and consumption greater than energy requirements, consumption of unsafe foods filled with pathogens and toxic substances, and sedentary physical activity patterns have led to the increase in non-communicable chronic diseases such as obesity, diabetes, hypertension, stroke, hyperlipidemia, cancer and other cardiovascular diseases (Belahsen 2014: 385-386; Capone et al 2014: 16-17; Kearney 2010: 2805; Reisch et al 2013: 7-8). These diseases are bound to cause great socio-economic strain to families due to the high costs of medical management and the lack of an operational governmental support structure to cushion households from these medical costs (Belahsen 2014: 386; Kearney 2010: 2805). Prevention is thus the better method of dealing with these burgeoning human health crises, with food systems producing healthy and nutritious foods as well as plant-based diets being critical cogs in the prevention approach. A sustainable food system must take this into account and ensure that food processes prioritise human health and safety.

Another challenge to food security in the context of consumption is food wastage or loss that occurs in all stages and results from poorly-functioning food systems (Capone et al 2014: 18; Goggins & Rau 2015: 14). It is estimated that about 30 to 50 per cent of the food that is produced annually (1,3 to 2 billion tons of food) is wasted; leading to the loss of the substantial environmental and financial resources expended in their production and processing (Ackerman et al 2010: 873; Capone et al 2014: 18; FAO 2014: 9). Food wastage at consumption level can be addressed through efficient procurement/purchase, storage and usage practices, the redistribution of surpluses to charity, as well as the utilisation of food no longer fit for human consumption as animal feed or for energy production (Goggins & Rau 2015: 14).

Achieving food sustainability thus requires the transformation of these adverse consumption patterns, especially meat and dairy preferences as well as preference of highly-processed fat-heavy foods with extreme food distances (Garnett 2013: 33;[6] Goggins & Rau 2015: 8; Helms 2004: 384). The reduction of adverse consumption through the transformation of animal product-based diets into more plant product-based diets as well as the reduction of food wastage has the capacity to generate better health outcomes as well as reduce environmental stresses of agricultural production and supply (Herrero & Thornton 2013: 20879; Heller & Keoleian 2003: 1035). This can be done through health and environmental education and awareness raising at all levels of society for behavioural change (food literacy) as well as through the adoption of facilitative legal and policy frameworks at the local and national levels (Czarnezki 2011:

6 Garnett states that by 2050 the consumption of meat and dairy products must reduce to around 20-40% of what it is today to ensure environmental sustainability.

266-267 & 279-280; Reisch et al 2013: 9-10; Westley et al 2011: 773-774). This is affirmed by Kearny who states the need for sustainable food policies that ensure the supply of micronutrient-rich staple foods without encouraging the consumption of energy-dense, micronutrient-poor foods (Kearney 2010: 2805). Czarnezki (2011: 266-267) elaborates on the need for this transformative legal change as follows:

> Changing what we eat and the way we eat will require significant and intentional modifications in individual behaviour. While many individuals have the ability, interest and resources to modify behaviors independently of cultural norms and civic structure, such choices are unlikely to bring about *wider* transformative change unless diffused to a broader audience that has the power to effect change through the power of numbers. This is the role of law and public policy, to impact both structure and numbers and alleviate ground-level hindrances to building a new agricultural model.

This framework, therefore, must be coupled with effective institutional implementation mechanisms, as counter-transition of nutrition from animal product-based diets is bound to face opposing social and economic forces.

2.3 Governance dimension

This dimension requires the transformation of food system governance structures to improve efficiency and resilience of food systems as well as enhance equity and social justice in accessing food entitlements (Garnett 2013: 29 & 31; Garnett et al 2016: 1). This dimension sees world hunger and malnutrition as an outcome of unequal power relations between and among producers, suppliers and consumers across and within countries and communities (Garnett 2013: 34). On the basis of Sen's work, this aspect affirms that hunger is not a consequence of insufficient production and supply of food products, but results from the inability of poor households to economically access the available food due to poverty, inequality and destitution (Garnett 2013: 34-35). It thus aims to address the inequality by transforming global food systems to ensure fair and equitable trade between nations; greater food self-sufficiency within nations and communities; and the development of localised food systems and markets producing/supplying a diverse range of healthy and nutritious food items. The essence of this dimension is to eliminate food injustices and enhance food equity with a view to ameliorating poverty and inequality so as to effectively balance food-related excesses and insufficiencies – to effectively deal with all the three dimensions of malnutrition: overnutrition, undernutrition and micronutrient deficiencies (Garnett 2013: 31 & 35; Johns & Sthapit 2004: 145[7]).

The food governance dimension has become an avenue for struggle and solidarity in the quest for socio-economic and environmental justice, with demands for localised democratic governance of food systems as opposed to the current vertically integrated and consolidated modernist/industrial food system (Blay-Palmer 2010: 4-5). This call for the democratic transformation of food governance structures are reflected in the Food

7 They affirm that poverty, environmental degradation and biodiversity loss are intrinsically connected, requiring an integrated management approaches – coupling investment in rural and peri-urban livelihoods and infrastructure development with the sustainable management of food production resources.

Sovereignty and Slow Food Movements, which aim to regain local control of food production, exchange and consumption infrastructure, enhance fair trade in food products, and ensure the socio-economic sustainability of smallholder farmers and their families (Blay-Palmer 2010: 4-5). Legal and policy reforms are especially critical in the transformation of food governance structures to enhance equity and food justice, as discussed more elaborately in section 4 below.

The three dimensions discussed herein – production/supply, consumption/wastage and governance – must be addressed in developing sustainable food systems. This must be done comprehensively in an integrated and holistic manner to ensure the long-term provision of safe, healthy and nutritious food and fibre to the entire spectrum of society – basically the development of sustainable food systems (Heller & Keoleian 2003: 1008). But what does it mean to have sustainable food systems? This is the topic of discussion in section 3 below.

3 Sustainable food systems – Understanding the critical concepts and components

3.1 Understanding the concept of sustainability in the context of food systems

The World Commission on Environment and Development (WCED) brought the need for sustainable management of resources for development to the fore of international consciousness. The WCED report affirmed the ability of humanity to make development sustainable in a manner that meets the needs of the present generation without compromising the ability of future generations to meet their own socio-economic and developmental needs (WCED 1992: para 27).

Sustainability is a compound concept devoid of any single all-encompassing definition. It encompasses social principles (social justice, eradication of poverty/inequality, positive health outcomes and inter/intra-generational equity), economic concepts (socio-economic development and internalisation of the value of ecosystem services) and ecological imperatives (environmental integrity, preservation of biodiversity and socio-ecological resilience) (Aiking & De Boer 2004: 359; Heller & Keoleian 2003: 1008). On this basis, sustainability can be broken down into three aspects – economic, social and ecological. Helms (2004: 381) elaborates on these different aspects of sustainability as follows:

> Ecological sustainability requires that development is compatible with the maintenance of ecological processes: the throughput of natural resources is reduced to levels dictated by the earth's carrying capacity, the availability and renewable capacity of resources and the resilience of natural systems. Economic sustainability entails economically feasible development in which production and consumption should serve to enhance quality of life rather than degrade it. Social sustainability entails that development is socially acceptable and should cover the need for global equity: all countries should have equal access to the world's resources and equal responsibility for the management of these resources.

This broad conception of sustainability is critical in understanding and designing sustainable food systems, as the food chain is the single largest human activity with the most adverse impact on the environment and

ecology (Aiking & De Boer 2004: 360; Garnett 2013: 29-30[8]). This is due to its demand on the world's natural resources such as land, water, energy and biodiversity. Food sustainability thus requires the responsible use of these natural resources to ensure the availability, accessibility, acceptability, safety and adaptability of food for the present and future generations (Wognum et al 2011: 66).

3.2 Understanding the food systems approach to food sustainability

Food systems are complex adaptive systems that entail interactions of entities, resources and activities that affect food production, processing and consumption (Chase & Grubinger 2014: 1). They entail interactions between and within biogeophysical and human environments, human activities related to these interactions (production through to waste disposal) as well as the outcomes of these activities in their interaction with the biogeophysical environment (food and environmental security and socio-economic welfare) (Ericksen 2008: 234). The Zero Hunger Challenge Working Group (ZHC-WG) (2015: 1) has defined a food system as follows:

> a system that embraces all the elements (environment, people, inputs, processes, infrastructure, institutions, markets and trade) and activities that relate to the production, processing, distribution and marketing, preparation and consumption of food and the outputs of these activities, including socio-economic and environmental outcomes.

The University of Vermont provides a more elaborate definition of food systems as

> an interconnected web of activities, resources and people that extends across all domains involved in providing human nourishment and sustaining health, including production, processing, packaging, distribution, marketing, consumption and disposal of food. The organisation of food systems reflects and responds to social, cultural, political, economic, health and environmental conditions and can be identified at multiple scales, from a household kitchen to a city, county, state or nation (Grubinger et al 2010: 2).

Due to the complexities of the interactions in the food systems, a food systems approach demands that these interactions be understood holistically as encompassing social,[9] economic[10] and environmental[11] dimensions. Chase and Grubinger elaborate these interactions in figure 1 below.

8 Garnett affirms that the global food system in its entire value chain contributes significantly to GHG emissions (agriculture contributes 30% of the total GHG emissions in the world), to biodiversity loss (agriculture-related deforestation is the main cause of biodiversity loss worldwide), to depletion of water resources (agriculture contributes to 70-80% of human water abstraction, which is unsustainable in the long run) and to pollution (agricultural use of inorganic fertilizers, pesticides, herbicides have adverse impact on soil health and quality and leads to water pollution with adverse consequences to aquatic ecosystems and marine life).

9 Focuses on the impact of the food system to human health, well-being and culture – how the food system impacts on culinary, dietary and cultural preferences to ensure healthy, nutritious and culturally acceptable food while eradicating poverty and inequality.

10 Focuses on the food value chain of production, processing and distribution – how much food is produced, how much is sold and to which markets.

11 Focuses on interactions between the food system and the environment, the impact it has on the ecosystem as well as the ecosystem services it provides.

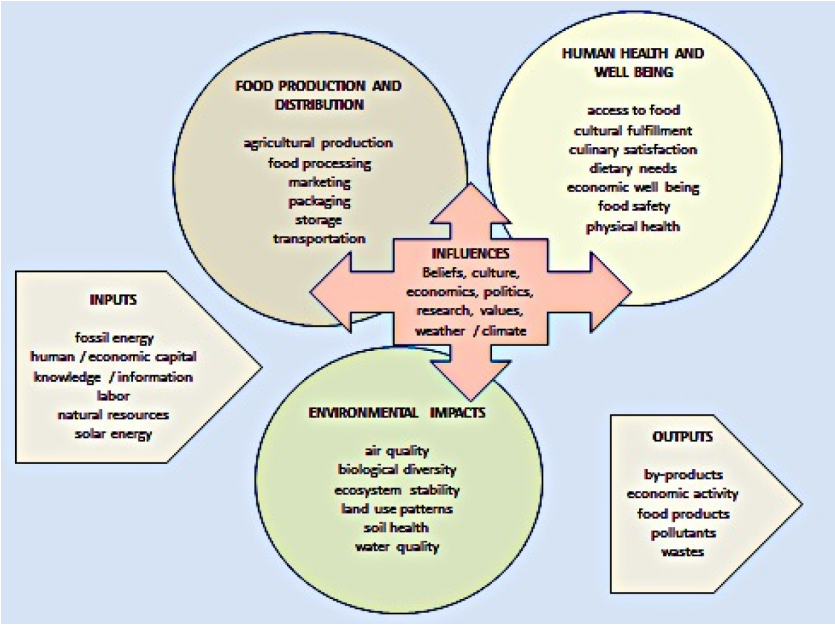

Figure 1: Source - Chase & Grubinger 2014: 3.

Therefore, in order to transform the food systems to enhance their sustainability, it is critical that a holistic, multi-dimensional and integrated approach is adopted at all levels of the food system – the food systems approach (Marsden & Morley 2014: 3).

3.3 Sustainability and food systems – Integrating the concepts for the achievement of sustainable food systems

Agriculture utilises 40 per cent of the earth's surface, shaping ecosystems, habitats and landscapes (Darnhofer et al 2010: 186). It is critical in the provision of food and fibre for human and animal survival, but can also have negative ecological and environmental externalities such as environmental degradation, loss of biodiversity, water pollution and land degradation (Darnhofer et al 2010: 186). The production, supply and consumption of food in a manner that maintains biodiversity and ecosystem services as well as integrates human and environmental health thus is one of the greatest challenges facing the world today.

The above challenge is reflected in the modernist/industrial food system that is mainly focused on the production of more food as the answer to world hunger (agricultural expansion, intensification and use of biotechnology), without the integration of the other components of the food system (Lang & Barling 2012: 314-315 & 319). Lang and Barling (2012: 315) state the dominant policy thinking underpinning the modernist food system as follows:

> This proposed that a combination of science and technology, plus capital investment, would enable food production to increase and, if accompanied by better distribution and reduced waste (itself alterable by management, science and technology), this would bring down food prices and enable improved access and affordability. This approach had been championed by the FAO from its inception and would be delivered by raising production via an incremental combination of better management of land, agriculture, technology, requisite investment and aids to efficiency. This productionist policy paradigm was forged by liberal and humanitarian belief that human effort could keep the Malthusian problem at bay: More people could be fed, food could be more affordable, population growth need not be a problem, and farmers could have better livelihoods.

This approach, however, is beset by the following challenges: It is focused on large-scale monoculture leading to biodiversity loss; it is highly energy and capital-intensive (fossil fuel reliance and marginalisation of smallholder farmers); and it entails vertical integration, global concentration and economic consolidation as reflected in the corporate capture of the global food systems (Schneider 2013: 2; University of Michigan 2009: 11; American Dietetic Association 2007: 9; Gupta 2004: 411; Feenstra 2002: 100). Further, despite increasing global food production, it has generated natural resource, environmental and biodiversity degradation; socio-economic emasculation of smallholder farmers; poor health outcomes leading to an explosion of non-communicable diseases; the spiritual and cultural disconnection of a people and their sources of food sustenance; and created a large population of global citizens unable to afford the available food (FAO 2014: 10-11 & 20; Feenstra 2002: 100; Moscatelli et al 2016: 104 & 106-107).

The above challenges have raised questions about the sustainability of the modernist food systems, and whether there are alternative modes of production/consumption that are environmentally sound, socio-economically viable, healthy, culturally and spiritually acceptable and have the ability to feed the growing global population while maintaining production resources for future generations (Feenstra 2002: 100; Marsden & Morley 2014: 1; Darnhofer et al 2010: 186-188; Lang & Barling 2012: 316). One of the alternatives that have come up to respond to the above challenge is the advocacy for the design and development of sustainable food systems.

The ZHC-WG defines sustainable food systems as 'a food system that delivers food and nutrition security for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised' (ZHC-WG 2015: 1). According to the ZHC-WG, sustainability has three dimensions – environmental/ecological, economic and social (ZHC-WG 2015: 1). The UK's Sustainable Development Commission (UK-SDC) (2009: 10), on the other hand, argues that a genuinely sustainable food system is

> where the core goal is to feed everyone sustainably, equitably and healthily; which addresses needs for availability, affordability and accessibility; which is diverse, ecologically sound and resilient; and which builds the capabilities and skills necessary for future generations.

A further elaboration on the definition of sustainable food systems is provided by ERA-Net SUSFOOD project who define it

> as a food system that supports food security, makes optimal use of natural and human resources and respects biodiversity and ecosystems for present and future generations, is culturally acceptable and accessible, environmentally sound and economically fair and viable, and provides the consumer with nutritionally adequate, safe, healthy and affordable food (quoted in Capone et al 2014: 14).

It is thus clear from these definitions that a sustainable food system must be environmentally and ecologically sound,[12] socially acceptable[13] and economically viable[14] through its entire systems of production, processing, exchange and consumption (American Dietetic Association 2007: 16; ZHC-WG 2015: 1; Schneider 2013: 7).

Lang and Barling juxtapose the old modernist food system thinking and this new sustainability outlook to food systems as follows:

Focus	'Old' food security analysis	'Emerging' sustainable food analysis
Core concern	Under-production	Mismatch of production, consumption and policy
Route to food security	Produce more	Redesign food system for sustainability, defined by multiple criteria: social, environmental and economic
Analysis of 2007-08 food crisis	A sudden crisis caused by external shocks (eg banking and oil price crises) then exacerbated by national tariffs and export controls	A long-running failure coming to a head exposing new complex combination of factors straining an already stretched food system; a forewarning of a possible coming 'perfect storm'
Preferred action	Improved coordination amongst international food bodies; better information exchange on national production levels and food stocks	Begin long-term reorientation of food production, supply and consumption patterns better to align environment, health and inter- and intra-society inequalities; rebuild buffer stocks as safety net
Conception of Health	Malnutrition and hunger	A wide range of non-communicable diseases (NCDs), including malnutrition
Environmental concerns	Primarily on farm	Throughout food production, supply, consumption and waste management chain

12 This requires the utilisation of inputs in a manner that conserves, regenerates and enhances natural resources, protects biodiversity and minimises negative environmental impacts.

13 This requires that food systems equitably respond to prevailing poverty and inequality in access to food and other production resources, ensure social justice to smallholder farmers and farm workers, enhance the production of safe, healthy and nutritious foods that are culturally acceptable and accessible to all, including future generations.

14 Economic viability requires that food systems provide livelihoods that support families through fair prices, good working conditions and fair national and international trade; contribute to economic development; and, is not concentrated in the hands of a few corporations.

Where waste lies	At farm and distribution	Throughout the system, particularly consumption
Consumer issues	Under-consumption	Over-, under- and mal-consumption
Energy focus	Land use for energy generation	Carbon emissions through food chains
Geographical hotspots	Low-income developing countries	Global (markets are distorted by high-income countries)
Economic approach	Generate efficient supply	Need to internalise full costs
Role of science	Agricultural Research and Development, mainly life sciences	Social as well as natural sciences covering the entirety of the food system
Locus of power	Mainly government but also commercial interests	Concerned about split between private governance (commerce) and government; international institutions and regimes; global governance

Source: Lang and Barling (2012: 316-317).

It is clear from the above elaboration that a sustainable food systems approach looks at the entirety of the food system with the aim of its reformulation and re-orientation to better utilise natural and human resources at all levels to enhance sustainability. It recognises that if the challenges of undernutrition, overnutrition and micronutrient deficiencies are to be comprehensively and holistically tackled, a sustainable food system must effectively respond to the three challenges of food security – production/supply, consumption/wastage and governance – in an integrated manner. It calls for the internalisation of ecosystem costs in the pricing of food produce to ensure that costs to the environment and biodiversity are taken into account at all levels of production, supply and consumption so as to engender better ecosystem stewardship. It also calls for fair trade in agricultural produce so as to reform market distortions and bolster food entitlements for all sectors of global society, especially smallholder farmers and farm labourers. Lastly, it takes into account human health and well-being, affirming the responsibility of sustainable food systems to produce safe, healthy and nutritious food that is physically and economically accessible to all sectors of the society.

Chase and Grubinger in Figure 2 below elaborate the benefits to society in designing and developing sustainable food systems.

Figure 2: Benefits of sustainable food systems, Source: Chase and Grubinger 2014: 5

The food systems approach thus provides the necessary tools to respond to all the challenges of food security that have been elaborated in section 2 above, which is the production/supply, consumption/wastage and the governance dimensions. The next level of analysis is the place of law and policy in the design and development of sustainable food systems.

4 What is the role of law and policy in the development of sustainable food systems?

4.1 The global and national legal and policy challenges to sustainable food systems

The current conventional food system is a creature of the current international and national legal and policy frameworks, especially agricultural, land, water and trade laws and policies. These prevailing legal and policy positions have presented obstacles in the adoption and development of alternative more sustainable food systems (Westley et al 2011: 767). At the national level, this is reflected in the current disjointed frameworks for the management of the diverse production resources such as land, water, environment and biodiversity that would benefit from a more holistic, systemic and integrated management to enhance local production, food diversity and rural livelihoods. It is further exemplified

by policy failures to adopt a food systems approach that integrates the food system challenges of production, supply, exchange and consumption as critical components in the achievement of food security. Further, national and local urban planning laws, policies and regulations have prohibited urban agriculture that has the potential to supplement urban food consumption and ensure household access to diverse and fresh foods (Hamilton 2011: 12-13).

National laws and policies have also failed to integrate national health, food, nutrition and environmental policies, leading to food-induced health crises like the explosion of obesity and related cardiovascular and cancerous diseases (Reisch et al 2013: 2 & 7). Lastly, national trade policies that prioritise agricultural production of raw materials for export at the expense of food production for local consumption have also been detrimental to overall national food security (De Schutter 2011: 13-14; Gonzalez 2011: 503-504 & 507). This is due to the volatility of the world market for agricultural raw materials; agricultural market protectionism by developed countries; the increasing international food prices; and the declining balance of trade for agricultural commodities in relation to manufactured goods (De Schutter 2011: 10; Gonzalez 2011: 502 & 507; Thompson & Scoones 2009: 3). It is critical that states, especially developing countries, focus on food production for domestic consumption and empower smallholder farmers through increased public investment in agriculture to enhance national food self-reliance (De Schutter 2011: 13-14).

The transformation of these laws and policies is critical for the creation of the necessary framework for sustainable food systems. The basis for the transformation of these laws can be the international human rights framework that entrenches the rights to self-determination, food, water, health, human dignity, social justice and environmental rights (Gonzalez 2011: 517-518; Gonzalez 2006: 374 & 377). These rights are already entrenched in international human rights instruments ratified by many states,[15] and have been affirmed in several soft law instruments adopted by states and further incorporated into national constitutions and legislation. The ratification and incorporation of these rights engender state obligations to respect, protect, promote and fulfill these rights. It has been affirmed that these rights are the primary responsibility of states, and that if there is conflict between them and any other state obligation, these rights reign supreme (De Schutter 2011: 2). Olivier de Schutter, the then UN Special Rapporteur on the Right to Food, stated this as follows (De Schutter 2011: 7):

> Food security programmes should be assessed on their capacity to contribute to the realization of the right to food. Whether new policies distort markets should be a secondary consideration and accorded much less weight in political decision-making.

The transformation of national laws and policies to enhance the development of sustainable food systems that have the capacity to

15 Universal Declaration on Human Rights, art 25; International Covenant on Economic, Social and Cultural Rights (ICESCR), arts 1, 11, 12; Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), art 12(2); Convention on the Rights of the Child, arts 24(2) and 27(3); Convention on the Rights of Persons with Disability, arts 25 and 28, among others.

guarantee the realisation of the entrenched rights thus is a primary obligation of states. This is affirmed by article 2(1) as read with article 11(2)(a) of the International Covenant on Economic, Social and Cultural Rights (ICESCR), which requires states

> to improve methods of production, conservation and distribution of food by developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilisation of natural resources.

The legal and policy transformation for sustainable food systems guarantees the development of a system of production, exchange and consumption that achieves the most efficient utilisation of natural resources as required by ICESCR. States, therefore, as a priority must adopt these legal and policy reforms to ensure the development of sustainable food systems at the national level.

The other basis for the transformation of national laws and policies to develop sustainable food systems are the Sustainable Development Goals (SDGs) as reflected in the UN Agenda 2030 Framework. The SDGs have been embraced by almost all nations as the new paradigm for international development. Sustainable food production and consumption (SCP) – the core of sustainable food systems – has been recognised in the context of the SDGs as a critical policy agenda for addressing the current ecological crises, enhancing human well-being and achieving sustainable socio-economic development (Akenji & Bengsston 2014: 513-516). This is because SCP effectively integrates all the dimensions of sustainability (economic, social and environmental), requiring states to adopt a systems approach in responding to these dimensions – the very approach recommended in the development of sustainable food systems (Akenji & Bengsston 2014: 519 & 522). Therefore, in order to realise the SDGs, states must adopt legal and policy frameworks that adequately respond to the economic, social and cultural factors that facilitate and constrain food consumption and production patterns (Akenji & Bengsston 2014: 516). This will contribute to the effective realisation of the SDGs requiring states to reduce hunger, poverty and inequality; to enhance good health and well-being; to ensure responsible production and consumption; as well as to mitigate the impacts of climate change.

Hawkes and Popkin affirm the need for the transformation of the current conventional global food system in order to realise the SDGs, especially those targeting nutrition and nutrition-related non-communicable diseases (Hawkes & Popkin 2015: 144-145). They call for multiple actions at multiple levels to achieve the necessary transformation of the current food systems, a transformation that is only possible through inclusive and expansive legal and policy frameworks. As discussed in this article, the alternative system to the current conventional food system that is capable of achieving all the food-related components of the SDGs is the sustainable food systems. The commitment to the SDGs thus provides a critical basis for legal and policy reforms for the adoption and development of sustainable food systems at the national and local levels.

The framework of rights and obligations entrenched in the international human rights framework as well as the commitments in the SDGs provide states with the necessary legal and policy space to adopt transformative laws, policies and practices that enhance the development of sustainable food systems. However, despite these available frameworks, many states

continue to face challenges due to the lack of political will at the national level as well as the constrained policy space resulting from global agricultural, trade, economic, investment and intellectual property laws, policies and practices, as elaborated below.

Global agricultural laws and policies, focused exclusively on increasing production, have encouraged industrial agriculture that entails massive monoculture, fossil fuel-intensive heavy mechanisation and the use of synthetic fertilisers and pesticides for agricultural production (Gonzalez 2011: 495 & 505-506; Czarnezki 2011: 266). Although successful in increasing per capita food production outputs, these policies created challenges of poverty, equity and social justice as they benefited the affluent large commercial farmers to the detriment of poor smallholder farmers, especially those in developing countries (Gonzalez 2006: 359-361; Thompson & Scoones 2009: 5). It also created other challenges such as the loss of plant-genetic diversity, the pollution of water sources, land degradation, increased GHG emissions and the production of unhealthy or contaminated foods that have negatively impacted on human and animal health (Gonzalez 2011: 495-496 & 505-506; Thompson & Scoones 2009: 5). Despite these adverse impacts, these agricultural policies still enjoy wide support in the global scientific and policy arena, with efforts being put in place to launch 'a New Green Revolution for Africa' irrespective of the expected detrimental impact on biodiversity and ecological conservation (Thompson & Scoones 2009: 5).

International trade and economic laws, policies and agreements that champion trade liberalisation of developing countries' markets – coupled with agricultural production and export subsidisation policies and practices of developed nations – have encouraged the dumping of highly-processed, cheap and unhealthy foods on the world markets or in developing countries as food aid (De Schutter 2011: 4-14; Gonzalez 2006: 345-347 & 362-368; Thompson & Scoones 2009: 3). This has generated adverse market competition against unsubsidised smallholder farmers in developing countries, limiting production capabilities, reducing food self-sufficiency and encouraging overreliance on the international food market for national food security (Gonzalez 2011: 506-507). Further, international trade, economic, investment and intellectual property laws, policies and agreements that constrain national policy and regulatory space for purposes of enhancing trade and investment have encouraged vertical food chain integration and consolidation creating large monopolistic global food corporations (Ahmed 2006: 140-141 & 153-159; De Schutter 2011: 3: Gonzalez 2011: 493 & 509-510; Thompson & Scoones 2009: 3). The consolidation has generated political and economic power for these multinational food corporations and loosened their accountability to national governments and consumers (Swinburn et al 2015: 2; Reisch et al 2013: 11). Attempted reforms of trade policies at the World Trade Organisation (WTO) have generally failed to tackle the agricultural trade-distorting practices of these multinational corporations, with the effect that their quasi-monopoly powers in the global food system have derailed efforts to create sustainable food systems in the global south (Gonzalez 2011: 510). If the transformation of food systems to sustainability is to be realised, the growing influence in public policy making of these food conglomerations at the global and national level has to be curtailed and effective/enforceable accountability mechanisms

established to tame their adverse practices at the global and national levels (Swinburn et al 2015: 4).

Further, regional (European Union (EU)) and national (United States of America) trade-distorting energy policies that subsidise biofuel production (tax concessions, credits and direct support) have led to competition for land, water and other natural resources with food production, reducing available food and feed for human and animal consumption (Gonzalez 2011: 520-521; Thompson & Scoones 2009: 4). This competition has increased food prices while displacing smallholder farmers from their land due to international land grabs for biofuel production (FAO 2008: 3-4). Due to the integrated nature of the global food chain, these legal and policy frameworks impact directly and indirectly on, and determine the sustainability of, food systems at the national level. If sustainable food systems are to be developed at the national level, there is, therefore, an urgent need for the reformation and transformation of these global legal and policy frameworks in an inclusive, multidisciplinary and multi-sectoral manner to integrate the different processes of the food system to enhance food production, processing and consumption in an economic, social and environmentally sustainable manner (De Schutter 2011: 3).

4.2 Suggested national legal and policy reforms for sustainable food systems

As stated above, the development of sustainable food systems requires legal and policy reforms that adopt an integrated systems approach that is inclusive of all the role players in the food system. A systems approach in itself is not prescriptive as to the exact form and nature of legal and policy reforms that must be put in place to ensure sustainable food systems. This is due to the place-based nature of food systems as well as the incompleteness of knowledge and unpredictability of responses on food systems (Thompson & Scoones 2009: 2-3). The framework for the transformation of laws and policies for the development of sustainable food systems must thus be interdisciplinary and cross-sectional, ensuring the equal and inclusive participation of all the stakeholders in the food system (Thompson & Scoones 2009: 3 & 7).

The role of law and policy in the realisation of sustainable food systems, therefore, is the adoption of a reflexive, multidisciplinary and cross-sectoral dialogical framework of measurable integrated and holistic guiding standards that determine acceptable conduct and action in the food chain to achieve specific sustainability goals (Premanandh 2011: 2711; Westley et al 2011: 767). This can be done through the creation of facilitative legal and institutional frameworks that achieves the following:

- clearly defining the meaning, scope and goals to be achieved in the adoption of sustainable food practices (Hamilton 2011: 427);
- recognising the rights and responsibilities of different actors in the food systems (Hamilton 2011: 427-428); and
- providing incentives or subsidies for sustainable food practices as well as the provision of infrastructure and services to enhance sustainability (FAO 2014: 35; Westley et al 2011: 769).

If laws and policies are to create the necessary framework for sustainable food systems, they must adopt a food systems perspective that integrates and transforms the entire food value chain to enhance sustainability (Lang

& Barling 2012: 317). This would require that the legal framework interconnects the interrelated production sphere with its environmental, natural resources and ecosystem impacts; exchange sphere with its energy economic and socio-cultural impacts; and the consumption sphere with its public health and wastage impacts (Lang & Barling 2012: 317).

Transformative laws and policies, if integrated and holistic, can play a critical role in influencing the key determinants of sustainability so as to create the requisite enabling environment for sustainable food systems. They can create an incentive and reward system for the adoption of sustainable production, supply, exchange and consumption patterns, or develop regulation, taxes and subsidy regimes to enhance the sustainability of food systems, especially at the local and national levels (FAO 2014: 34; Herrero & Thornton 2013: 20880). The ZHC-WG (2015: 2) detail the potential for transformative laws and policies creating sustainable food systems as follows:

> Policy measures for sustainable food systems should increase agricultural productivity and gender- sensitive agriculture production, enhance climate resilience, reduce greenhouse gas emissions from agriculture and related land use change, improve nutrition, strengthen value chains and improve market access.

In the food system processes of production, processing, exchange and consumption, the key determinants are land, water, environment, biodiversity, labour and trade. The management of these determinants must be based on a system-wide multi-dimensional and integrated approach at all the levels of the food system (Moscatelli et al 2016: 109-110; ZHC-WG 15: 2). This is to facilitate collaboration between all the sub-systems of the food system and to ensure that adopted sustainability programmes in the different sub-systems are compatible (FAO 2014: 34). For example, the creation of predicable land and water tenure systems through integrated land and water laws and policies have the capacity to increase investment in land and encourage the adoption of sustainable long-term agricultural practices that would increase agricultural productivity, enhance ecosystem and biodiversity conservation and improve household livelihoods (FAO 2014: 26). This is affirmed by the FAO as follows (FAO 2014: 30):

> Promoting and improving people's ownership of the natural resources they need and use, through appropriate rights recognition and allocation policies, and their full participation in decisions on their management, will contribute to the efficient use, conservation and protection of natural resources.

Equitable integrated land and water tenure systems especially should enable access to land and water for prior marginalised groups such as women, who have the capacity to enhance agricultural production while conserving land, water, biodiversity and the environment (FAO 2014: 26).

Land and water integration laws and policies on their own cannot achieve the desired sustainability outcomes. Farms must be integrated with the markets through the adoption of fair trade policies that enable farmers to get fair prices for their products. Policy incentives such as 'local production for local consumption' or direct government procurement from smallholder farmers for school, hospital and prison feeding programmes can go a long way towards creating the necessary links between producers

and consumers. This would result in increased agricultural production and incomes as well as better health outcomes (FAO 2014: 27).

Law and policy should especially develop built-in resilience structures to cushion food system resources and participants from adverse shocks and stressors so as to enhance long-term sustainability (FAO 2014: 28). Some of the shocks and stressors, which may have an adverse impact on food systems, include climate variability, extreme weather, market volatility and political instability or civil strife. Taking into account these shocks and stressors, some of the resilience structures that can be built into laws and policies include mixed farming with a diversity of crops and livestock; the use of technology to create drought/pest/disease resistant varieties and breeds; climate change adaptation measures; social safety nets; better exchange and consumption governance; as well as favourable or subsidised access to credit and insurance (FAO 2014: 28). The adoption of these laws and policies and their diverse but integrated mechanisms will require multi-disciplinary and cross-sectoral cooperation and participation by all stakeholders in the food system, a critical factor in the development of sustainable food systems.

5 Conclusion

Food plays a critical role in human life for sustenance, nutrition, cultural expression and socio-economic development. Despite the importance of food, many people in the world continue to face food-related challenges such as undernutrition, overnutrition and nutrient deficiencies. Adopting a holistic food systems approach, the food security challenges can be discerned in three dimensions: production/supply; consumption/wastage; and governance. Responding to these challenges and ensuring long-term availability, accessibility, acceptability and adaptability of food require that an alternative food system be adopted, with this article advocating the adoption of localised agro-ecological food systems that have been recognised as being sustainable in the long term. Adopting this approach requires the cooperation and active participation of all the stakeholders in the food system, with law and policy, as mechanisms for the ordering of society, playing a critical role in creating the necessary buy-in for the development of sustainable food systems. The article thus calls for the reformation and transformation of the legal and policy frameworks on the management of land, water, environment, biodiversity, labour and trade so as to create an integrated and holistic food system-wide framework for the management of the entire food chain to enhance the realisation of economic, social and environmental sustainability in the food system.

References

Ackerman R, Farahani P & Grunow M 'Quality, safety and sustainability in food production: A review of quantitative operation management approaches and challenges' (2010) 32 *OR Spectrum* 863

Ahmed M 'Monocultures of the law: Legal sameness in the restructuring of global agriculture' (2006) 11 *Drake Journal of Agricultural Law* 140

Aiking H & De Boer J 'Food sustainability: Diverging interpretations' (2004) 106 *British Food Journal* 359

Akenji L & Bengsston M 'Making sustainable consumption and production the core of sustainable development goals' (2014) 6 *Sustainability* 513

Allouche J 'The sustainability and resilience of global water and food systems: Political analysis of the interplay between security, resource scarcity, political systems and global trade' (2010) *Food Policy* 1-6, doi:10.1016/j.foodpol.2010.11.013

Belahsen R 'Nutrition transition and food sustainability' (2014) 73 *Proceedings of the Nutrition Society* 385

Blay-Palmer A 'Imagining sustainable food systems' in A Blay-Palmer (ed) *Imagining sustainable food systems: Theory and practice* (2010) Ashgate Publishing Ltd 3

Capone R et al 'Food system sustainability and food security: Connecting the dots' (2014) 2 *Journal of Food Security* 13

Chase L & Grubinger V 'Introduction to food systems' in L Chase & V Grubinger *Food, farms and communities: Exploring food systems* (2014) New Hampshire University Press 1

Czarnezki J 'Food, law and the environment: Informational and structural changes for sustainable food systems' (2011) 31 *Utah Environmental Law Review* 263

Darnhofer I, Fairweather J & Moller H 'Assessing a farm's sustainability: Insights from resilience thinking' (2010) 8 *International Journal of Agricultural Sustainability* 186

Ericksen P 'Conceptualising food systems for global environmental change research' (2008) 18 *Global Environmental Change* 234

FAO 2018 'The state of food security and nutrition in the world 2018: Building climate resilience for food security and nutrition' 1, available at http://www.fao.org/3/19553EN/i9553en.pdf (last visited 20 September 2018)

Food and Agricultural Organisation (FAO) 'Building a common vision for sustainable food and agriculture: Principles and approaches' (2014) 1-50, available at http://www.fao.org/3/a-i3940e.pdf (last visited 6 November 2017)

Feenstra G 'Creating space for sustainable food systems: Lessons from the field' (2002) 19 *Journal of Agriculture and Human Values* 100

Garnett T et al 'Sustainable intensification in agriculture: Premises and policies' (2016) 30 *Science* 1

Garnett T 'Food sustainability: Problems, perspectives and solutions' (2013) 72 *Proceedings of the Nutrition Society* 29

Goggins G & Rau H 'Beyond calorie counting: Assessing the sustainability of food provided for public consumption' (2015) 1-27, available at http://www.sciencedirect.com/science/article/pii/S0959652615007647 (last visited 10 October 2017)

Gonzalez C 'Climate change, food security and agrobiodiversity: Towards a just, resilient and sustainable food system' (2011) 22 *Fordham Environmental Law Review* 493

Gonzalez C 'Markets, monoculture and malnutrition: Agricultural trade policy through an environmental justice lens' (2006) 14 *Michigan State Journal of International Law* 345

Grubinger V et al 'A proposal for a food systems spire of excellence at the University of Vermont' (January 2010) 1-16, available at https://www.uvm.edu/~tri/pdf/TRI-Food.pdf (last visited 23 October 2017)

Grunert K 'Sustainability in the food sector: A consumer behaviour perspective' (2011) 2 *International Journal on Food System Dynamics* 207

Gupta J 'Global sustainable food governance and hunger: Traps and tragedies' (2004) 106 *British Food Journal* 406

Hamilton N 'The role of law in promoting sustainable agriculture: Reflections on ten years of experience in the United States' (1998) 3 *Drake Journal of Agricultural Law* 423

Hawkes C & Popkin B 'Can the sustainable development goals reduce the burden of nutrition-related non-communicable diseases without truly addressing food system reforms?' (2015) 13 *BMC Medicine* 143

Heller M & Keoleian G 'Assessing the sustainability of the US food system: A life-cycle perspective' (2003) 76 *Agricultural Systems* 1007

Helms M 'Food sustainability, food security and the environment' (2004) 106 *British Food Journal* 380

Herrero M et al 'Smart investment in sustainable food production: Revisiting mixed crop-livestock systems' (2010) 327 *Science* 822

Herrero M & Thornton P 'Livestock and global change: Emerging issues for sustainable food systems' (2013) 110 *PNAS* 20878-20881

Hodas D 'The role of law in defining sustainable development: NEPA reconsidered' (1998) 3 *Widener Law Symposium Journal* 1

Lang T & Barling D 'Food security and food sustainability: Reformulating the debate' (2012) 178 *The Geographical Journal* 313

Johns T & Sthapit R 'Biocultural diversity in the sustainability of developing-country food systems' (2004) 25 *Food and Nutrition Bulletin* 143

Kearney J 'Food consumption trends and drivers' (2010) 365 *Philosophical Transactions of the Royal Society* 2793

Kirschenmann F 'Farming, food and health' (2006) 1-5, available at https://www.leopold.iastate.edu/files/pubs-and-papers/2006-08-food-farming-and-health.pdf (last visited 6 November 2017)

Koc M 'Sustainability: A tool for food system reforms?' in A Blay-Palmer (ed) *Imagining sustainable food systems: Theory and practice* (2010) Ashgate Publishing Ltd 37

Marsden T & Morley A 'Current food questions and their scholarly challenges: Creating and framing a sustainable food paradigm' in T Marsden & A Morley (eds) *Sustainable food systems: Building a new paradigm* (2014) Routledge 1

Marsden T 'Towards a real sustainable agri-food security and food policy: Beyond the ecological fallacies?' (2012) 83(1) *The Political Quarterly* 139-145.

Moldan B, Janouskova S & Hak T 'How to understand and measure environmental sustainability: Indicators and targets' (2012) 17 *Ecological Indicators* 4

Moscatelli S et al 'Towards sustainable food systems: A holistic, interdisciplinary and systemic approach' (2016) 1 *AGROFOR International Journal* 103

Premanandh J 'Factors affecting food security and contribution of modern technologies to food sustainability' (2011) 91 *Journal of the Science of Food and Agriculture* 2707

Rao N & Rogers P 'Assessment of agricultural sustainability' (2006) 91 *Current Science* 439

Rasul G 'Managing the food, water and energy nexus for achieving the sustainable development goals in South Asia' (2016) 18 *Environmental Development* 14

Reisch L et al 'Sustainable food consumption: An overview of contemporary issues and policies' (2013) 9 *Sustainability: Science, practice and policy* 1

Roy R & Chan N 'An assessment of agricultural sustainability indicators in Bangladesh: Review and synthesis' (2012) 32 *Environmentalist* 99

Schneider S 'A reconsideration of agricultural law: A call for the law of food, farming and sustainability' (2010) 34 *William and Mary Environmental Law and Policy Review* 935

Schneider S 'Food, farming and sustainability: Perspectives on US Agricultural Production' University of Arkansas School of Law Research Paper 14-14 (2013) 1-15, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2343350 (last visited 20 October 2017)

Swinburn B et al 'Strengthening of accountability systems to create healthy food environments and reduce global obesity' (2015) *The Lancet* 2, available at http://dx.doi.org/10.1016/S0140-6736(14)61747-5 (last visited 2 December 2017)

Tai S 'The rise of US food sustainability litigation' (2011) 1-73, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1937781 (last visited 10 October 2017)

Thompson H, Berrang-Ford L & Ford J 'Climate change and food security in sub-Saharan Africa: A systematic literature review' (2010) 2 *Sustainability* 2719

Thompson J & Scoones I 'Addressing the dynamics of agri-food systems: An emerging agenda for social science research' (2009) *Environmental Science Policy* 1, doi:10.1016/j.envsci.2009.03.001

United Nations Conference on Environment and Development (UNCED) 'The Rio Declaration on Environment and Development' (1992), available at http://www.unesco.org/education/pdf/RIO_E.PDF (last visited 10 October 2017)

University of Michigan 'Building a community-based sustainable food systems: Case studies and recommendations' (2009) 1-120, available at http://closup.umich.edu/publications/misc/Community-Based-Sustainable-Food-Systems.pdf (last visited 20 October 2017)

Westley F et al 'Tipping towards sustainability: Emerging pathways of transformation' (2011) 40 *AMBIO* 762

WHO 2018 'Obesity and overweight: Key facts', available at http://www.who.int/news-room/factsheets/detail/obesity-and-overweight (last visited 20 September 2018)

Wognum P et al 'Systems for sustainability and transparency of food supply chains: Current status and challenges' (2011) 25 *Journal of Advanced Engineering Informatics* 65

World Commission on Environment and Development (WCED) 'Our common future – From one earth to one world' (1987), available at http://www.un-documents.net/our-common-future.pdf (last visited 10 October 2017)

Zero Hunger Challenge Working Group, Compendium Final Report 'All food systems are sustainable' (2015) 1-7, available at http://www.un.org/en/issues/food/taskforce/pdf/All%20food%20systems%20are%20sustainable.pdf (last visited 23 October 2017)