Challenges **2010**, *1*, 5-26; doi:10.3390/challe10100005

OPEN ACCESS

challenges

ISSN 2078-1547

www.mdpi.com/journal/challenges

Article

Paths to Attaining Food Security: The Case of Cameroon

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Received: 20 June 2010; in revised form: 16 July 2010 / Accepted: 16 July 2010 / Published: 3 August 2010

Abstract: This paper sets out to develop a framework for characterizing agricultural growth orientations. We identify four main components in the global food system (technology, institutions, people, and natural resources). Based on the extent to which any two of these components are important in driving the growth of agriculture, we distinguish four main orientations of agricultural growth: local food, high resource-technology driven, guided technology driven, and right-to-food growth orientations. Given the social and environmental challenges that agricultural growth has to meet in Cameroon, we argue that the local food orientation and guided technology-driven orientation offer better opportunities for meeting the problem of food security in this country.

Keywords: agricultural growth; food security; Cameroon; agricultural development; sustainability

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1. Introduction

The attainment of global food security is described as a situation in which all people, at all times, have access to adequate, affordable, safe and nutritious food to meet their dietary requirements and

food preferences for a productive and healthy life [1]. Since the 1980s, many indicators of a healthy global food system seem to either have pointed to a stagnant system or are no longer as promising as in the two previous decades [2,3]. For many developing countries (with the exception of China), these indicators include food availability, accessibility and utilization [4,5]. While food availability refers to the physical presence of food where it is needed, food accessibility is the means by which people acquire the food they need and food utilization refers to the way in which people make use of food [6,7].

Food security is presently being undermined by a number of challenges such as rapidly growing demand and changes in consumption patterns, competition for agricultural lands for other uses, the effects of global environmental change, serious degradation of agricultural soil, erosion of the genetic base of agricultural biodiversity, water scarcity [8-10], poor governance and others. The 2007–2008 world food crisis tested the resilience of the global food system and revealed deficiencies in its capacity to efficiently adjust to and absorb shocks that show many signs of growing in the future [11-13].

Prescriptions for meeting these challenges are varied. They range from the need to increase productivity through the development and diffusion of different forms of technologies for fighting pests, weeds, withstanding drought and tolerating salinity to the urge for more open agricultural markets [11,14]. They also include an integrated system for meeting challenges of soil degradation, loss of biodiversity, efficiency in agricultural water and energy use. Generating and sustaining agricultural growth is seen as an important element in reaching and sustaining food security especially in developing parts of the world [15,16].

The process by which agricultural growth is generated has been investigated and debated extensively. The importance of natural resources in contributing to agricultural growth is emphasized by the Malthusian school of thought. The Malthusians see agricultural growth as an extractive process, which depletes natural resources to fuel its expansion and whose future is bound to be limited by the finite nature of these resources. This theory is challenged by studies of traditional communities in Africa which hold that agricultural growth can be driven by increases in population growth [17]. The intensification of agriculture resulting from increased demand and limited land entails the development and use of better tools, techniques and organization of production—hence an increase in the mobilization and use of capital. The resulting increase in output may even permit innovation in technologies that improve long-term sustainability of resources, contrary to Malthusian views [18]. Studies in the Ivory Coast show that Boserupian and Malthusian processes do not necessarily contrast each other, but rather coexist in processes of agricultural productivity growth [19]. However, in the early stages of agricultural growth, Malthusian processes may engender demographic pressure on resources and population migration while Boserupian processes induce innovation after a critical population density is attained [19]. Using econometric substantiation on the relationship between institutions, human capital, and agricultural productivity growth in developed and developing countries, other studies find no evidence that political institutions will necessarily cause growth in agricultural productivity. Instead, human capital accumulation emerges as an important factor in driving the process [20].

There typically are overlapping objectives to be attained by promoting growth in agriculture, hence paths to agricultural growth are rarely rigid. They may change over time as global institutions, regions, national governments and communities attempt to make use of different resources within their reach to

attain agricultural growth objectives. To sieve through this complexity, this study identifies four major components of the global food system: agricultural technology, agricultural institutions, people (as labor, consumers and decision-makers), and natural resources used for agricultural production. We distinguish and characterize different agricultural growth orientations as a framework for understanding agricultural growth based on the dominant components which drive each process. Such classification and characterization contributes to the understanding of the strengths, weaknesses, and opportunities of different agricultural growth paths towards attaining global food security.

The framework developed can be readily associated to dominant economic paradigms (local food can be associated to green socialists, high resource-technology driven growth to neo-classical economics, guided technology-driven growth to Keynesian economics, and people-focused growth to institutionalism). However, it may be misleading to assume that agricultural development will necessarily align with the dominant economic growth paradigm of each country or region. This can be illustrated with two examples:

1. After independence, most countries in sub-Saharan Africa opted for development with a touch of socialism – described in some cases as "statism" [21-23]. The ruling parties and nature of socio-economic reforms reflected this. Some examples include Julius Nyerere in Tanzania, Kwame Nkrumah in Ghana, and Ahmadou Ahidjo in Cameroon. In Cameroon, the government's development strategy was organized into five-year development plans (reminiscent of the Stalinist development plans in the Soviet Union). While other sectors of development came under strong state control, agriculture was largely taken from colonial control and handed to individuals with little governmental support and intervention [24]. Government support and intervention only started after the first two five-year development plans when it became clear that the agricultural sector had been performing very poorly. Hence, while Cameroon pursued a strong, centralized and planned economy in the 1960s, agriculture did not "benefit" from such centralized state control and planning.
2. OECD countries are primarily countries with free market economies. However, these countries have for a very long time been providing subsidies to their farmers in different forms. These subsidies have been instrumental in determining key characteristics of agriculture in these countries. This has been the case with the Farm Bill in the United States since the Dust Storms of the 1920s [25,26]. The Common Agricultural Policy (CAP) in European countries is blamed for high agricultural production costs, wastefulness and environmental destruction [27]. I can be argued that state support to agriculture in the OECD is not compatible with free market principles. Hence the agricultural sector in the OECD countries is not necessarily operating on the free market principles which characterize the general economic development paradigm of the OECD.

For policy, sustainability analysis and planning, it is therefore helpful to examine agricultural development without the veil of the dominant economic paradigm. This framework should also contribute to expanding knowledge on the issues of sustainability in agriculture with respect to different growth orientations pursued by different regions.

2. Major Components of the Food System and Their Categorization

A number of components are necessary to permit agricultural production and growth (see the column titled "Components" in Table 1). For the purpose of simplicity, these components have been summarized into four major groups shown under "Simplified" in the last column (Table 1). The extent to which each of these components may be used in achieving agricultural development and increasing food production varies from place to place and even from time to time. Each agricultural growth effort tends to draw on two of the components more than the others in achieving increases in food production. Agricultural development in the United States for example has been driven by high inputs of technology and natural resources. The first and major impetus for the growth of modern US agriculture came after the invention of the industrial process of synthetically fixing agricultural macro-nutrients (particularly nitrogen through the Haber-Bosch process) and making it cheaply available to farmers [25]. Other technological breakthroughs that supported this process was the development of antibiotics (for animal breeding) and different forms of fast, cheap and efficient communication technologies. Besides technology, massive projects of exploiting water, an important natural resource to agriculture made it possible for some relatively dry regions to be cultivated [25]. In much of sub-Saharan Africa, the development of agriculture after independence and before the Structural Adjustment Programmes was driven by state institutions and the need to provide the food needs of populations through massive government support schemes. Before the Structural Adjustment Programmes in the early 1990s in Cameroon, state institutions were active at all levels of agricultural production—from subsidizing and distributing fertilizers to negotiation sales of agricultural produce [24]. The agricultural growth effort therefore drew on the support of state institutions and the need to meet the socio-economic needs of its populations.

It is therefore possible to identify agricultural development typologies based on the combination of components of food production that are predominantly employed in increasing agricultural production and growth.

Table 1. Simplification of components of agricultural production.

Component	Purpose	Simplified
Tools	Improves the productivity of land and the efficiency of labor, thereby permitting the growth of agricultural output [28].	***Agricultural technology***
Techniques	Improves the productivity of land. Optimizes the use of factors of production, thereby providing an opportunity for increasing resource use efficiency and attaining sustainability [29]. Determine the type of agricultural production system – enables transformation of agriculture to more intensive systems [30].	
Capital	Funds the acquisition of factors of agricultural production. Permits the transformation of agriculture to more intensive forms [29,31].	
Formal institutions	Provide an enabling framework for agricultural production by defining rules and laws governing the production environment and overseeing their enforcement [32]. Create or recognize tenurial systems which affect the ecological resilience and sustainability of agriculture [33].	***Agricultural institutions***

Table 1. *Cont.*

Informal institutions	Define and allocate individual and group rights to particular community resources vital for agricultural production at local level [34], for example, water, cultivation land, pasture land, forests, *etc.*	
Agricultural workers	Provides labor for agricultural production [17]. Are innovators of tools, techniques, and other anthropogenic resources of food production [25,35].	***People as labor*, *decision makers and consumers***
Consumers	Renders agriculture economically viable [25]. Their consumption of agricultural produce provides profits that can be used to improve the quality and quantity of tools, techniques, capital, and governance [35,30].	
Decision-makers	Design and implement policy regarding the combination of factors of agricultural production, food crop production types, agricultural production systems, *etc.* [27,32].	
Land	Provides the basis for all primary agricultural occupations – crop production, animal husbandry, fisheries, poultry, and forestry. Provides space for agricultural production [36]. Derived through conversion from other uses, deforestation, reclamation, *etc.*	***Natural resources***
Natural resources	Provides the physical resources required for food production such as water, nutrients, climate, biodiversity [37,38].	

2.1. Agricultural Technology

Agricultural technology encompasses tools (farming implements, and machinery), techniques (thrash and burn, shifting cultivation, intensive farming, organic farming, and conventional farming), modes of organization of farming (small-scale, plantation, collective, urban agriculture, community supported agriculture, ecological or biological agriculture, integrated farming, and factory farming), and farming systems (monocultures, intercropping, polycultures, and agroforestry). Technology also refers to the methods and resources employed in different farming systems to improve agricultural outputs in quantity or quality like the use of pesticides for pest control, herbicide for weed control, fertilizers to upgrade the level of soil nutrients, hybrids and genetically modified breeds in plants and animals. In animal husbandry, it also includes type of feeding (commercial formulated feed against local prepared feed), method of harvesting, type of milking system *etc.* The functions and importance of capital makes it a very important factor of production. Capital can be used to provide raw materials, tools, wages, land, *etc.* It also forms the basis for investment, technical progress, trade, credit, transport and the efficiency of all other factors of production [29,31]. While acknowledging this broad-scale potential uses of capital, we classify it as one of the main components under agricultural technology for simplification (Table 1).

2.2. Agricultural Institutions

These include both formal and informal institutions. Formal institutions are arrangements governed by a pre-decided legal arrangement in the form of formal norms that are mainly national, regional or international in scope. These include national organizations such as agricultural schools and universities, state ministries of agriculture and affiliated institutions. They also include regional agricultural institutions such as the African Development Bank and global or international agricultural

development bodies like the Food and Agricultural Organization (FAO) of the United Nations Organization, the International Fund for Agricultural Development (IFAD), the World Bank, the World Food Programme (WFP), and the Consultative Group on International Agricultural Research (CGIAR). Informal institutions (typically grassroots organizations which are very local in character) can emerge out of the spontaneous needs of communities and the society. Grassroots organizations may include local farming groups and cooperatives as well as local governmental or non-governmental organizations which have the main objective of agriculture development.

2.3. People as Labor, Decision-Makers and Consumers

People here refer to both individuals and groups, working in agricultural production (labor), distributors (wholesalers and retailers), decision-makers and consumers. Those working in the agricultural sector include landless agricultural laborers either attached to or working for other farmers, small cultivators, medium and large-scale farmers as well as all those involved at different levels of the agricultural production chain [39,40]. As decision-makers, people elected into public office or using their votes can influence the path of agricultural development as well as be influenced by the type of agricultural development affecting the food they eat [30]. In a bid to make and maximize profits in production, producers adopt a variety of strategies and identify consumers for their products. Consumers therefore stand in an influential position in this courtship—being able to decide which products should be produced, how they should be produced, conditions under which they should be produced, and others [25]. People therefore constitute an important component in the food production system.

2.4. Natural Resources

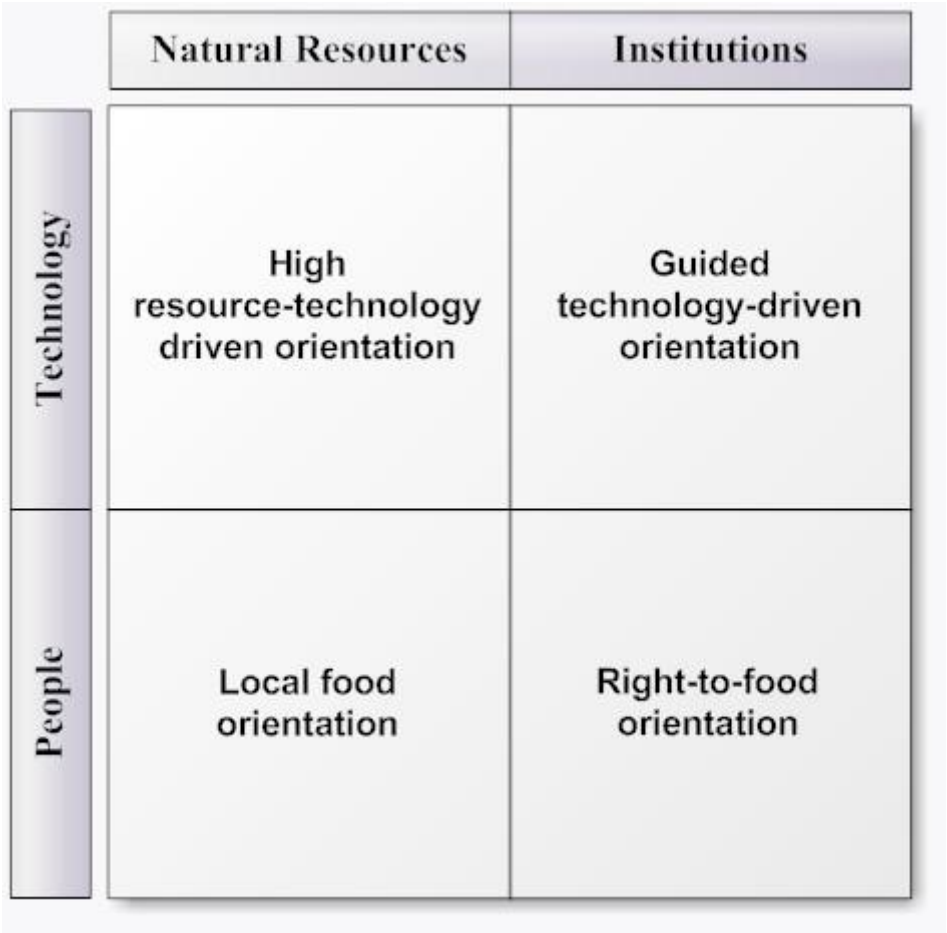
Natural resources are used in the production of agricultural end products. These include the land as space and the seat of all terrestrial agricultural activities. Land embodies the soil which has chemical, physical and biological characteristics that determine the quantity and productivity of agricultural inputs. Air is a source of nutrients and above-soil growth space for terrestrial based plants as well as a medium of gaseous exchange. Agricultural water from different sources is an indispensable resource for the growth of plants and hence for the development of agriculture. Natural resources also encompass biodiversity which is important as a gene bank for agriculture and serves different purposes like pest control, biogeochemical cycling, and others.

3. Optional Paths to Agricultural Development

Agricultural growth is seen to be an important development approach for less developed countries [8,41,42]. It is deemed to be the superior path to development for regions in an unfavorable environment for expanded global trade and finance, better than either export-led growth or industry-led import substitution development [39]. Developing countries with relatively high growth rates in agricultural value added have therefore tended to have comparatively high GDP growth rates given the high contribution of agriculture to their economies [16,39]. Paths to attaining agricultural development are driven by government policy. Such policy is guided by a vision of the structure and characteristics

of the possible food production system. Such paths can therefore change as the vision of government policy for the food production system changes. Nevertheless, at any given moment, it is possible to discern dominant agricultural growth orientations of different nations and regions based on their use of the main components of agricultural production. This framework (Figure 1) distinguishes different paths to growth based on important agricultural production components used to fuel food production.

Figure 1. The Agricultural Growth Orientation framework.



3.1. Local Food Orientation

This path of agricultural growth seeks to empower local communities to manage the process of food production (Figure 1). It strives to build more locally-based, self-reliant food economies and gives community control over production, processing, distribution, and consumption of food. This agricultural development orientation is seen as a means of attaining sustainability in the economic, social and environmental sector through a bottom-up approach [43]. There is greater balance in the role played by both males and females in agricultural production, management as well as in harvesting [44].

This is the pattern of agricultural growth that may be supported by the social greens who see global capitalism (and large-scale industrial production) as a system which thrives on the unfair exploitation of labor, women, indigenous people, the poor and the environment, and promotes unequal patterns of consumption and economic growth [45,46]. The local food movement and food patriotism movements

are inspired by this model of agricultural growth. The path of local food self-sufficiency has come to be seen as an alternative to the global corporate models where producers and consumers are separated through a chain of processors, transporters and retailers [25]. It is seen as a means for local producers to take control of many of the ills afflicting today's corporate food production systems such as the fall in quality, over-production, unfair (and sometimes illegal) exploitation of labor, loss of traditional small and medium-scale family farming units, etc [47,48]. This orientation of agricultural growth is gaining momentum today in many parts of the world. In parts of the developed world where industrial agriculture has for a long time been acknowledged for making food plentiful and cheap, people are gradually finding out that they have been alienated to their sources of food [48,49]. Besides this, the frequency of food safety scares attributed to industrial farming have prompted many to advocate for and support the growth of small-scale producers, hence the emergence of family farms, local produce markets and others [45]. In many parts of the developing world, falling prices of export crops and disillusionment with the structural adjustment programs is raising questions regarding the future security of food supplies and causing many small and medium-scale farmers to dedicate more of their resources to food production of locally consumable produce [43,50].

Advocates of this model of growth argue that the system assures and safeguards local and indigenous systems, promotes ecological justice, and ensures safety of our food system [38,43,45,51,52]. However, critics see this form of agricultural development as an attempt to roll back civilization and return to less efficient forms of food production, an elitist conceptualization of food production that cannot meet the needs of food security for the growing population of the world [53]. One difficulty in moving back from industrial agriculture to local food crop production may be that societies have become so highly integrated and dependent upon one another. Foreign tastes and consumption patterns have undoubtedly been entrenched in some cultures, and some societies have become specialized in the non-agricultural sector for a variety of reasons and presently rely to a large extent on imported food.

3.2. High Resource-Technology Driven Orientation

This growth path relies on massive technological inputs as a means of encouraging agricultural development and attaining food security. The objective is to use technology in exploiting natural (land, air, water, and biological) resources for agricultural production (Figure 1). High output and profit maximization is the goal. It is expected that the entire food production chain (from seed selection to retail outlets) should be organized to make use of the ease of exploitation of natural resources and the convenient use of all forms of technology, hence the argument for agricultural transnational corporations (TNCs) [25,54,55]. High energy and technology inputs as well as massive outputs from large industrial complexes are seen as the means to take advantage of economies of scale. To achieve this, small farms have been merged into larger ones and agricultural intensification has been undertaken to increase efficient use of inputs at minimum cost [25,55]. Increasing yields per hectare takes priority over environmental impact and social quality in this agricultural growth path.

Here, agricultural growth is built firmly on neo-classical economic theories [50]. It is seen that market failures and poor government policies are to be blamed for poverty and weak growth in different sectors of the economy. To achieve growth within this path, it is argued that increased output

of agricultural goods is supposed to be the guiding principle, market and policy failures corrected, market-based incentives and voluntary corporate greening encouraged [25]. Unlike the confined geographical focus of the local food orientation, this path holds that agricultural growth and food self-sufficiency is best pursued in the context of a globalized economy [45,50]. This growth path has been associated with many of the agricultural growth projects advanced and supported by organizations like the World Bank in the last two decades in many developing countries [25,50,56].

In much of the developed world, the high resource-technology driven agricultural growth orientation still occupies an important place in food production [25,54]. Even though it has led to an era in which food has been more plentiful, of higher quality, safer, more convenient and more diverse [31,57], the systems that have supported this model of food production are under severe strain and some of them are beginning to break down [25]. In parts of the developing world and some transition economies, the need to increase gross domestic production, provide employment and meet local food needs is pushing them to embrace the high resource-technology growth path. This need is reinforced by the constant demand of agricultural enterprises from industrialized countries that are looking to set up production in many of these developing countries where environmental legislation, labor laws and food safety standards are low [58].

Industrialized agriculture that is supported by high resources- and technology-driven growth is credited for the massive increase of global agricultural output since the Green Revolution [25,31]. This has been closely associated with a fall in prices which has made more food to be available to more people at cheaper prices than at any other time in human history [31,59]. Critics associate this agricultural growth path with a fall in food quality, outbreaks of food-borne diseases, environmental neglect, and unsustainable use of resources that has occurred over the years [45,60]. Critics also charge this path of agricultural growth for the little regard and accounting for environmental and social externalities [38,45,50,61]. Questions have been raised about the concentration of power on food production and distribution issues in the hands of TNCs as well as their corporate accountability [62].

3.3. Guided Technology-Driven Growth Orientation

This growth path accepts and promotes the use of high levels of technology to develop agriculture with sufficient institutional oversight (Figure 1). It accepts the reasoning that technology could be an effective and efficient means of overcoming many of the natural constraints to high-yield agriculture while at the same time buying into the concerns over leaving one of mankind's most important needs in the hands of an unguided technological growth path [45]. By favoring agricultural technology development for the public good, this growth path strives to engage the public sector as the main source of breakthroughs in agricultural innovations.

Built on Keynesian economics theories, this growth path is a hybrid of institutional and bioenvironmental ideas of growth. The stagnation or sluggish growth of agriculture is seen to be a result of weak institutions and insufficient global cooperation, hence enhancing global opportunities for collaboration can be a means of achieving global agricultural development and food security. This implies that the existence of strong global institutions with strong sets of norms, and regimes which assure the development and transfer of appropriate technologies and funds for agricultural production are indispensable. From the bioenvironmentalist perspective, unchecked agricultural growth may lead

to over-production and the unsustainable use of natural resources [54]. A new global economy with institutionally-guided limits to drivers of unsustainable production (corporate greed, lack of environmental accounting in the prevailing economics of production) and consumption (high population growth, overconsumption) is therefore needed to ensure a future for the resources that make agricultural production necessary [54,62]. National and international governance of the food system should offer some level of regulation to safeguard against potentially negative socio-economic and ecological consequences of a globalized food system based on a high resources and technology-driven orientation [16,54,62]. This agricultural growth orientation used to be popular in many newly-independent African countries between the 1960s and the 1990s. In the United States and Great Britain, this was the dominant orientation of agricultural growth before the administrations of Ronald Reagan and the Margaret Thatcher, respectively [25].

Post-colonial economies in Africa and the rest of the colonized world had a significant proportion of governmental participation in the production of goods and services [63]. In the agricultural sector, the government was the guarantor of public access to the necessary technology and services that made production possible and profitable in such economically and politically fragile new-born states. The structural adjustment programs of the World Bank and the International Monetary Fund prohibited governmental involvement in the agricultural sector in favor of a system open to free competition in a global market [63]. In the developed world, state involvement in propping up agriculture has had a long history. In the United States, it began as a measure to face the challenges imposed on agricultural production by the dust storms of the 1920s [25]. Today, it continues to be practiced and supported in a number of ways, disguised in the name of "agricultural subsidies". Even though studies have found these subsidies to give OECD countries an unfair advantage on the global marketplace [26,64] and to be counter-productive to many efforts towards meeting many of the Millennium Development Goals, they persist in the OECD member states.

With this growth orientation, the public can benefit more directly from developments of better technologies. This is because in this growth orientation, public institutions that participate in and guide the direction of technological development strive to safeguard the public good [65]. Strong global institutions can eventually build better state capacities to appreciate and meet the challenges of agricultural development at their respective scales. Strong institutions may also be an appropriate framework for enforcing the precautionary principle while developing global agriculture. Critics argue on the other hand that public interference may limit the freedom of experimenting with potentially beneficial, radically new technologies. It is also thought that the public sector does not have the high level of profit motivation that drives rapid high end innovation breakthroughs found in the private sector.

3.4. Right-to-Food Growth Orientation

The right-to-food growth orientation seeks to enforce the concept of a human right to food [1,45,67]. It borrows from the *Local Food* orientation to see the empowering of local communities to manage their own food production resources and production processes as a means towards attaining food security (Figure 1). However, it goes a step further to advocate a proactive approach towards meeting food deficits through measures like the distribution of food aid, creating community food banks and

other food schemes to enable the poor and needy have access to food. This growth orientation acknowledges that nature is heterogeneous and offers certain areas more opportunity to produce and meet their food needs than others [57] but strong public institutions are need to be present to ensure that the right of the "unfortunate" to food is upheld.

This growth orientation is therefore based on a hybrid of the institutionalism and social greens schools of thought. The ills of the growth of large-scale agriculture (accelerated exploitation of natural resources, intergenerational ecological injustice, social and economic injustice, and the erosion of local customs and ways of life) can be solved by strong global institutions. Here, global institutions have the role of reversing the *status quo* of global agricultural capitalism by restoring local community autonomy in food production and empowering the voices that have been marginalized in the global marketplace, where they neither have the resources to put in as sellers or the income to buy from as consumers. More importantly, global institutions should uphold the notion of a human right-to-food. This means ensuring that those driven to food insecurity (either by the unfair global economic and agricultural production landscape, natural disasters, political strife, or other calamities) have access to food [66]. This agricultural growth path is evidenced through the effort of institutions working with food aid such as the World Food Program, Action Aid, OXFAM, and Bread for the World.

The world agricultural system like the world economic system has produced a duality in which those with a surplus of food exist alongside those in dire need [25,51]. With a future global food system poised to face some of its greatest challenges yet from the outcomes of global environmental changes [9], there is reason to believe that the number of those in need of food assistance may increase from its present figure of about one billion [11]. A right-to-food growth orientation in which the role of institutions is not limited to providing access to resources of production but rather includes proactive measures at providing food aid and agricultural assistance to the very needy may therefore become more essential [1,11].

The importance of the right-to-food growth orientation is dictated by the many problems affecting the global food system in recent years such as hindrances to production resulting from political strife, food production failures from environmental catastrophes, and others [66,67]. Proponents argue that a right-to-food growth orientation is needed so that global institutions can meet the needs of the poor and hungry by moving surplus food to food-deficit regions of the world [68]. Global institutions are also needed to put a human face on the practice of agriculture which has been turned to an almost exclusively economic enterprise. Critics argue that hunger and food deprivation are the products of institutional interventions in the market and that free open markets, specialization, and technology will make food available where it is needed [69]. Food aid has the potential of becoming a disincentive to local agricultural production either by pulling farmers away from working on their own fields or leading to a fall in prices of food in local markets [7,70]. Besides undermining the local food economy, food aid is unreliable; its provision by the international community (especially by donor governments) may be dependent on many political and strategic considerations and not simply the humanitarian demand to help [57,71].

4. Agricultural Growth Orientations and Issues of Sustainability

The challenge of sustainability is being responded to by some governments, communities and businesses at multiple scales and sectors [72]. Sustainability of agricultural production and growth is essential, given its importance as an economic activity with many social and environmental consequences [9,42]. It has been debated whether agricultural growth should pursue "weak" sustainability where trade-offs can be made between the environmental, social and economic dimensions of sustainability or "strong" sustainability where such trade-offs are not permitted or are restricted [72,73].

Unlike other sustainable development issues, agriculture is special in that its practice may affect vital natural resources of the earth on which its growth depends. These resources, termed 'critical natural capital' are elements of the biosphere (vital ecosystems, biodiversity, our climate, underground water) that cannot be traded off within the context of "weak" sustainability [72,73]. Strong sustainability may therefore be seen as a more acceptable path to agricultural growth and sustainable food security. However, decision-makers do allow trade-offs and give the economy greater importance above other dimensions of sustainability resulting in a continuous degradation of the natural environment and the attainment of development that does not achieve the desired goals of equity [72]. The need for achieving agricultural growth while addressing all dimensions of sustainability is imperative, the absence of which will lead to a degradation of life support systems to levels that would reduce the numbers of hungry and poor [59,74].

Elements and methods for quantifying and qualifying the sustainability of agricultural production have been developed and debated [59,75-77]. One of the latest debates centers on the process by which eco-efficiency in agriculture can be attained. Achieving eco-efficiency, which implies obtaining higher levels of quantity and quality of agricultural production using fewer inputs is taken to be the cornerstone of achieving sustainability in agricultural production and growth [37,78]. The underlying principle of more efficiently using fewer economic and natural resources to produce increased amounts of outputs is however being seen as limiting. It does not address the social, economic and environmental criteria which determine other important food production related factors such as the uptake of technology, hunger reduction and environmental externalities [78]. The underlying message remains clear in the debate and discussions that agricultural sustainability embraces the holistic perspective in identifying challenges, measuring gains, assessing opportunities, and understanding threats in agricultural production.

The challenge of agriculture in the next decade will be to sustainably produce more food from less land through more efficient use of natural resources and with minimum impact on the environment [8-11]. To meet this challenge, "sustainable intensification" is urged as an approach which minimizes the environmental impacts of agriculture associated with intensive production systems while improving yields per unit land to levels superior to those of extensive agricultural systems [8,9,38]. Science, particularly biological science-based approaches, is seen as an important tool that may be used to meet the challenge of sustainable food production in the next four decades [9,59,79]. Other technologies can permit the more sustainable use of resources in agriculture, giving rise to higher water use efficiencies, more sustainable nutrient management, optimal use of available agricultural land and others [79,80].

5. Ideal Growth Orientations for Attaining Sustainable Agricultural Growth in Cameroon

In sub-Saharan Africa, agriculture remains the backbone of most economies [42,81]. The management of agriculture is therefore critical in determining the attainment of sustainable futures for a number of sectors in the region. These include the attainment of food security, the exploitation and use of natural resources, environmental pollution, adaptation to climate change, biodiversity management and other aspects of sustainable development [10,80,82].

5.1. Cameroon's Agricultural Evolution 1894–Present

In Cameroon, agriculture has for long been a prioritized economic sector. In 2008, it contributed more than 41% of the GDP and presently employs more than 70% of the country's population [83,84]. Before the economic crisis of the late 1980s, development in Cameroon was managed through a series of five-year development plans. Being a prioritized sector, Cameroon's agricultural sector was managed both directly through several state-owned agro-industries, rural corporations and settlements and indirectly through a variety of support programs [24]. The character of Cameroon's agriculture today is the outcome of an evolution which can be divided into four major phases which followed the beginning of the German colonial period in 1894 [24]:

a) Colonial period agricultural policies under the Germans (1894–1916), French (1916–1960) and British (1916–1961) focused on the development of large European-owned plantations with a strong emphasis on the production of export crops. In later years, a dualism between European-owned plantations and small-scale peasant production units will be encouraged to boost the scale of production.
b) After independence in the early 1960s, agricultural growth was seen as a development tool and the peasantry was given more production autonomy. Government intervention and support through research, extension and the provision of inputs was very limited. The result was dismal: a poorly-trained and guided peasantry where production increases were a result of increase in area under cultivation and not increases in yield per unit area cultivated.
c) In the 1970s, the government was spurred by the poor performance of the peasant-controlled agricultural sector and the movement of most nations towards greater intervention in agriculture to revise its relationship with the agricultural sector. It increased its intervention in decision-making, expenditure in agricultural research, extension and input subsidization among many other things. Government efforts were supported by donor financing and the leap in agricultural output reflected the effort.
d) In the 1980s, it became clear that government intervention was plagued by misallocation of resources at different levels, over-centralization of decision-making, bureaucracy, and other ills which begged for a reform of the sector. The Structural Adjustment Programmes of the World Bank were put into effect to reform the sector. The aims, implementation and outcome of these reforms have benefited from investigations at different levels, both in the case of Cameroon [24,42] and for other parts of the developing world [50,56].

Investment and decision-making in Cameroon's agriculture has therefore changed hands from colonial administrators to farmers, then to the state. Today, agriculture is largely back in the hands of the farmers with very limited state intervention at all levels. Now, however, the context within which farmers practice agriculture is different from the 1960s and brings with it correspondingly different challenges and opportunities. These challenges include among others global environmental challenges such as climate change, land degradation, water availability for agriculture; the effects of HIV and AIDS on agricultural production; trade restrictions from important potential foreign markets and stiff competition with imported agricultural produce, among others. Cameroon's population has increased three-fold from 5.5 million in 1961 to 19.9 million in 2010 [2]. This, coupled with the increase in purchasing power provides a viable market for agricultural produce (especially basic food crops) within the country. Increased purchasing power and urbanization also brings about and increase in demand for high energy agricultural goods whose production can be exploited as an economic opportunity. Increased demand for high energy agricultural produce can also lead to the overexploitation of scarce natural resources as well as environmental pollution.

There has been a recovery in agricultural performance in a number of countries in Africa (notably Cameroon, Ghana and Mali) over the last two decades [85]. This recovery is attributed to increasing per capita incomes which have boosted domestic demand for agricultural produce and prompted major re-orientations of macroeconomic and agricultural sector policies. It is also attributed to policies which target low inflation and reductions in government and trade deficits that have encouraged investment in these sectors [24,85]. Agriculture in Cameroon however continues to face a number of challenges. The main challenges are:

a) Low capital intensity in agriculture which translates to low productivity [2,10].
b) Environmental challenges of soil degradation, decreasing precipitation, loss of agricultural biodiversity and climate change [83,86].
c) Challenges of global magnitude such as the increase in input cost resulting from increases in the cost of raw materials like oil, trade barriers of traditionally importing countries, and others [64,84].
d) Limited funding for agricultural research and development [83,84].
e) Limited access to capital and investment credits for small-scale farmers who form the majority of food producers [83,84,87].

5.2. Objectives for Attaining Sustainable Agricultural Growth in Cameroon and Ideal Growth Orientations

Maintaining growth in the agricultural sector in Cameroon is essential, given its social and economic importance for the country [85,86]. However, the above-mentioned challenges beg for a sustainable path towards attaining or sustaining this growth [10]. The need to achieve food security in most regions is tightly coupled with the drive to attain a reasonable degree of food self-sufficiency. This explains why many nations will strive to produce as much of their own food as possible, irrespective of whether this makes economic sense or not. Before the Structural Adjustment Programmes (SAP) of the late 1980s and early 1990s in sub-Saharan Africa, Cameroon actively pursued a policy of achieving the twin objectives of food self-sufficiency and security [50]. The SAPs

discouraged such policies on economic grounds leaving nations increasingly dependent on food from other nations. The weakness of this policy was laid bare by the food price crisis of late 2008 to early 2009 [13,49].

The local food orientation is a justified agricultural growth orientation for Cameroon for a number of reasons. This growth orientation has the potential of putting production choices and decisions in the hands of consumers. This is necessary for developing and maintaining a sustainable foundation for the management of the natural resources that are so critical for agricultural production in this region. This choice for Cameroon is also supported by five main reasons [43,44,48]:

a) The local food orientation encourages the development of agriculture at local level. This promotes the provision of staple food crops for small-scale farming populations in most developing countries and can therefore be a key for the world's food security;
b) The local food orientation in Cameroon can incorporate practices such as intercropping and agro-forestry which conserve biodiversity and represent models of agricultural sustainability;
c) The development of local food production systems can serve in conserving agricultural genetic resources. Conserving such agricultural biodiversity is important for the future of sustainable agriculture;
d) Local food production systems can serve the purpose of sequestering atmospheric carbon and release less greenhouse gases than industrial agriculture.

A guided technology-driven orientation is also essential for achieving sustainable agriculture in Cameroon. The complex challenges facing her agricultural growth demands a concerted effort on the part of state and other international policy-making bodies in providing an enabling social, political and economic framework for the growth of agriculture [14,15,85]. Such bodies should also ensure that while striving to achieve the noble goal of attaining food self-sufficiency, the environment, livelihoods, cultures and traditions are safeguarded [10,42,61]. In summary, state policies are required to channel appropriate resources to stimulate the desired growth. A guided technology-driven path to agricultural growth can therefore be pursued hand-in-hand with a local food orientation. In other words, to achieve a functional and viable local food system, the Cameroon government with the help from international organizations may support agriculture by investing in and improving infrastructure, increasing access to credit resources for local farmers and farming groups, conducting and disseminating the outputs of research as well as ensuring the transfer of appropriate technology to support agriculture [10]. The state should also provide training programs to improve the farm and risk management skills of farmers [81,87]. Appropriate government and regional policies can develop access to local markets and integrate regional markets which may enhance the economic capacity of small-scale farmers.

Although the high resource-technology driven orientation may be an appropriate path of growth for agriculture in the developed countries, it might not be suitable in Cameroon or other countries in sub-Saharan Africa. The region is constrained by the massive economic and natural resources required to fuel this agricultural growth option [84,87]. Also, concerns over the environmental cost of pursuing this path to economic growth make it less ideal in a world already burdened with challenging global environmental concerns [59]. The right-to-food orientation may also not be desirable mainly because of its limited potential in stimulating a drive towards attaining food self-sufficiency. The role

international food-aid communities play in providing food should ideally be limited to helping victims of natural and human catastrophes. Available resources should at the earliest opportunity be used to empower local residents to produce as much of their own food as possible in post-catastrophe situations.

6. Conflicts in Paths to Agricultural Development

Historically, agricultural development has proven to be a near-indispensable prerequisite for economic and social development worldwide [9]. By increasing productivity, access to food, higher incomes, savings and further investments, the growth of agriculture has served as a stimulus to the development of other industrial sectors in many parts of the world. Paths to agricultural development have evolved to be different as societies find themselves at different stages of economic growth and contexts of development.

Modern science, technology, subsidies and an enabling socio-political and economic framework made a revolution in agriculture in the developed world possible [9,31]. The outcome was surplus production which made more food available to more people than in any other time in history [25,31]. The downside to this high resource-technology driven growth has been a fall in the social and economic values of agricultural production for millions of smaller farmers and a fall in the health benefits of most of our produce. The local food orientation is being touted as an answer to the problems arising from the modernization and industrialization of the global food system. This agricultural development orientation is also seen as a strategy to engage the potentials of the vast majority of rural producers (who otherwise would not be able to compete with large-scale commercial producers) into contributing to meeting global food security challenge. While acknowledging that the community-based approach to agricultural development may have numerous advantages, some of its weaknesses must be appreciated. An over-optimistic expectation of the community-based approach to sustainable development is based on flawed assumptions about community-environment linkages [88].

In standard economic doctrine, regulation is seen as a burden that imposes additional cost above the necessary minimum to any effort of economic production [89]. However, appropriate regulations may lead to innovative responses that may change the production process in the direction of better resource deployment and material utilization as well as the search for better uses of by-products [89]. In the global agricultural system, this will imply a more judicious use of scarce natural resources, greater attention to issues of agricultural pollution, and waste minimization [38,59]. Over the last century, growing awareness of the social environmental problems associated with the growth of modern agricultural production have given rise to institutions at different levels and scales aimed at addressing some of these problems. While institutions can - and to some extent have - contributed to shaping agriculture through programs like technology development and transfer to needy areas, agricultural biodiversity conservation, and negotiation of market access for producers, *etc.*, critics hold the view that many multinational institutions have been co-opted to serve the interests of rich and powerful societies [45].

7. Conclusion

Globally, indicators of growth in agricultural production and food security are no longer as reassuring as they were prior to the 1980s. There are reasons to worry that some of these trends may continue if proper attention and effort is not paid to them. In order to meet the challenges of food production in the future, the world has to understand the components and orientation of growth in its agricultural sector. Based on the importance of different components in the growth effort of agriculture, four main agricultural growth orientations can be identified: a local food orientation, that seeks to empower local communities and peoples to manage their processes of food production; a high resource-technology driven orientation, that strives to employ large amounts of technology and natural resources to spur agricultural development; a guided technology-driven orientation, in which the use of technological innovation is seen as an essential tool for achieving agricultural development, but institutional efforts are necessary to ensure that achievements of technological breakthroughs are used also for the public good; and a right-to-food growth orientation, in which institutions are active in assuring that people and not simply economics is at the centre of agricultural development efforts. Because these growth paths have overlapping objectives, clearly defining and understanding the strengths and weaknesses of each growth orientation offers a clearer appreciation of the challenges facing agricultural growth efforts where such orientations may be dominant. Nonetheless, among these growth orientations, this study argues for the local food orientation and the guided technology-driven growth orientation as the most effective growth preferences for the attainment of sustainable food production and food security in Cameroon.

Acknowledgements

The initial draft of this paper benefited from the kind criticism of Anne Jerneck at the Lund University Centre for Sustainability Studies. We also received valuable inputs from two anonymous reviewers. The English language was checked by Erin Kenzie. We sincerely thank you all for these contributions.

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