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### Food security

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**Food Security: Opportunities and  
Responsibilities  
Or: the Illusion of the Exclusive Actor**

Valedictory Lecture

**by Caspar Schweigman**

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# **Food Security: Opportunities and Responsibilities**

## **Or: the Illusion of the Exclusive Actor**

### **Introduction**

My view on food security has been strongly influenced by my activities in the field of development co-operation. Therefore, I want to start my lecture with a short review of some of these activities.

In Operations Research, my field of specialization, mathematical models are used to simulate decision processes. They are applied in almost all sectors of economic life, for instance for the planning of industrial processes, medical services in hospitals, military operations and transport. I started to apply Operations Research techniques to study problems of development in the 1970s, when I was a lecturer at the Mathematics Department of the University of Dar es Salaam in Tanzania. In those days the view that development equaled modernization was still influential. Transfer of capital and technology was to speed up the process of modernization. Operations Research was a typical example of such a modern technology. I focused my attention on agriculture, the backbone of Tanzania's economy, and in particular on problems of small-scale farmers. Together with my students, who nearly all came from rural areas, I applied<sup>1</sup> Operations Research techniques to study the farming in the students' home villages. The results were discussed in class. It was an eye-opener for the students that mathematics could be used to study the farming practices of their parents. The Operations Research models served as a "tool of analysis" to better comprehend the complex farming systems and to discuss possibilities of improvement.

Later, when I was appointed in Groningen, I became very involved in co-operation with universities in developing countries, in particular with the Faculty of Economic and Management Sciences of the University of Ouagadougou. During the first years of this long term collaboration, the Dutch partners helped reorient the curricula from a pure theoretical approach, as existed in France, towards a proper balance between theory and practice. Although the faculty presently faces many problems, the interrelation between theory and the daily problems of Burkina Faso in teaching and research remains

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<sup>1</sup> See Schweigman, 1979.

a strong point. I also helped set up international research programmes on food security in West Africa. In the seventies the Sahelian countries in West Africa had been hit by serious droughts and famines. Food security in these countries, therefore, became an important item on national and international agenda's. How to cope with risks due to uncertain rainfall became a central topic in our research projects. Most projects were interdisciplinary in nature. The agents financing these programmes emphasized again and again that the research should not only be of academic value, but also of relevance to policy makers. I worked together with researchers of both universities and national agricultural research institutes. They carried out extensive field research. The set up, progress and results of the research were intensively discussed with stakeholders. In many cases, methods of Operations Research played an important role in structuring the analysis.

Inspired by the experiences of my professional life, I want to discuss today food security in Africa. The stagnation of food production in Africa will be the main issue. Various actors play a role, such as individual farmers, farmers' organisations, merchants, non-governmental organizations, governments and international organisations. I will comment on the role of some of these actors in the past, paying particular attention to their aspirations. I will show that aspirations that are too ambitious often lead to the exclusion of others actors and to failures. The phenomenon of exclusion of other actors will be a continuous thread in my lecture, hence the sub-title " the Illusion of the Exclusive Actor".

I will divide the text below in three parts. First I will examine the role of various actors by reviewing food security issues in Africa in a historical context. In the second section I will discuss the actual food security situation in some rural areas in Burkina Faso. In the last section on "opportunities and responsibilities", I will draw some conclusions.

## **1. Food Security in Africa in a historical context**

### *Period of decolonization*

After the Second World War, many African nations became independent. Economically, these young nations and their inexperienced governments depended in many respects on the former colonial powers and other industrialized countries. 'Experts' from Europe and the USA were important in designing development policies. In those years, the view that the western 'advanced' economies with their high levels of mass consumption and advanced technology were model for less developed economies received much support<sup>2</sup>.

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<sup>2</sup> See Rostow, 1961.

In the debate on development, the term food security was rarely used. The debate was centred on industrialisation. It was widely believed, “that industrialization was the unique key to development and that the industrial sector, as the advanced sector, would pull with it the backward agricultural sector”<sup>3</sup>. In their first plans, the newly independent states strongly emphasized the industrial sector. These industrialization policies became a failure, however. The targets were set much too high, and could not be reached due to a lack of technical know-how and skilled manpower. Indeed, the industrial development was very disappointing<sup>4</sup> and many young developing countries had to fall back upon the agricultural sector for economic survival.

In the 1960s the role of the agricultural sector became increasingly important. The governments of developing countries took initiatives to boost the production of export crops in order to generate income for the state. A proper balance had to be found between the production of cash crops for export and food crops for own consumption. In the 1960s and 1970s almost all developing countries wanted to be self-sufficient in food production. There were convincing reasons for that. The young nations wanted to be independent, not only politically, but also economically. Food was a vital good. If they had to rely on foreign countries for food, this would restrict their political independence.

### *Green Revolution*

The importance of food production also became an issue of great international concern. In the 1960s and 1970s initiatives were taken to carry out agricultural research on an international scale. In these years, several international research institutes were established in order to develop improved technologies to increase agricultural production. An example is the International Rice Research Institute (IRRI) on the Philippines, established in 1960 with strong support of the Ford and Rockefeller Foundations. New, so-called high-yielding varieties were developed. They usually required high levels of inputs. The introduction of these high-yielding varieties was welcomed as the ‘Green Revolution’. In several Asian countries, the Green Revolution was a success<sup>5</sup>. In sub-Saharan Africa the

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<sup>3</sup> See Thorbecke, 1969, p. 3; see also Bakker, 1992, p.1. These views were particularly popular in the 1950s and early 60s. Soon after, the views were criticized. It was claimed that a strong agricultural sector was a prerequisite for industrial development. Only the agricultural sector could generate a financial surplus to invest in industry in developing countries.

<sup>4</sup> Some developing countries recognized the failure of the ambitious industrialization policy at a fairly early state, e.g. Tanzania. In the well known Arusha Declaration of 1967, which was a landmark in Tanzania’s early development, the main headlines were “we have put too much emphasis on industries” and “agriculture is the basis of development”. See Nyerere, 1968, 231-250.

<sup>5</sup> In India and Indonesia, for instance, introduction of high-yielding varieties in combination with appropriate fertilizer and water inputs resulted in an impressive increase in rice output over the last three decades. See e.g. Parikh et al., 1993, and Ellis, 1993. Many people were

results were less promising. Rates of adoption of high-yielding varieties were low. For crops like millet, sorghum and cassava, which are main food crops in many regions of Africa, high yielding varieties did not prove successful. Moreover, in many African countries the supply of agricultural inputs was not adequate<sup>6</sup>, and a proper infrastructure for agricultural research, extension services and planning was lacking. In fact, the growth of agricultural output during the last 25 years in Sub Saharan Africa has stagnated. The growth of the food production lags behind the demographic growth. Moreover, the export of cash crops has not been a motor for industrial development in Africa<sup>7</sup>.

### *The state as the main actor*

There have been many debates on why agricultural growth stagnated in Africa. Important causes were certainly the food policies by national governments. During the 1970s and 1980s, the political spectrum of regimes in Africa varied widely. Some regimes were based on Marxism-Leninism, e.g. the Dergue regime of Mengistu Haile Mariam in Ethiopia, and the FRELIMO regime in Mozambique that came to power immediately after independence in 1975. Other regimes were inspired by variants of socialism, e.g. the African Socialism of Nyerere<sup>8</sup> in Tanzania. Some countries in West Africa, such as Ivory Coast and Togo, remained under the strong influence of the former colonial power (France). Independent of the ideological colour of the regimes, the governments in almost all African countries appropriated a central role in the field of food policies. There were many reasons for that. As in the colonial days, the governments wanted farmers to supply food to the urban centres. Moreover, they wanted to extract a surplus from the farmers in order to finance infrastructure, the government's administration and welfare services. In many countries, food was produced by peasants, who lived scattered all over the country. They applied traditional methods of cultivation, with land, labour and

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critical about the Green Revolution, contending that it would make the rich farmers richer and poor farmers poorer. Although the use of improved seeds, fertilizer, water and pesticides requires considerable investments, the experiences in India and Indonesia show that many farmers have benefited. On the whole, therefore, the Green Revolution in these countries may be considered to be successful. For a critical review of the Green Revolution, see e.g. Lipton et al., 1989, and Hazell et al., 1991.

<sup>6</sup> In some African countries, e.g. in Zimbabwe during the years after independence and in the 1980s, a "green revolution" took place in the household production of maize. Yields were more than doubled due to improved varieties and investments by the government in infrastructure and supply of inputs. Unfortunately, the system was not financially sustainable. "Nevertheless", according to IFPRI/USAID, "a key lesson from Zimbabwe's experience is that a green revolution can occur in Africa, if smallholder farmers face the right incentives". See IFPRI/USAID, 2002, p. 15, see also Byerlee and Eicher, 1997.

<sup>7</sup> In the last thirty years the Sub-Saharan's agricultural export earnings remained almost the same (whereas in south Asia, they were tripled), see IFPRI/USAID, 2002, p. 13.

<sup>8</sup> See e.g. Nyerere, 1968.

rainfall being the main inputs. Production levels were accordingly low. The governments wanted to change these traditional farming systems. It was necessary to increase agricultural production and to introduce improved modes of production. How to do that, was a main question in the offices of the Ministries of Agriculture and funding agencies like the World Bank. And it is still a main question, as will be seen in this paper.

In the early days of independence, different approaches were adopted. Some implied *radical changes*, such as the establishment of large state farms on which the work had to be done by wage labourers. This would facilitate the introduction of new agricultural methods, investment in equipment, access to markets, and the large farms could benefit from an economy of scale. Although in the beginning some state farms were successful, for instance sisal estates, many of them failed. The enforced establishment of co-operatives was another radical approach. A well-known example is the villagization programme in Tanzania in the late 1960s and early 1970s as part of the Ujamaa policy<sup>9</sup> of Nyerere. It aimed at a transformation of rural areas into Ujamaa villages, wherein all political and economic activities would be collectively organized. People were to live together in a village, so that it would be easier to send children to school, and to organize water supply and other facilities. Communal organization of work would make farming more efficient, and a better use would be made of the results of agricultural research and extension services. The mobilization of peasants to set up such communities was a high priority for the government. Large campaigns were launched. The reactions were mixed. The strongest opposition was directed against the communal farming. Since the farmers' response was disappointing, the government changed its policy. Villagization was made compulsory, all people had to move into a registered village. It was one of the largest settlement operations in Africa. It involved millions of people. Although the state-owned press and radio did not give publicity to incidents and resistance, it was revealed later that strong pressure and even violence had been used to enforce the villagization. The creation of Ujamaa villages became a failure. Within a couple of years the requirement that work was to be done collectively, was dropped. Even the name Ujamaa village was not longer used.

The term 'socialism from above', which has often been used as a paraphrase for Ujamaa policies, reflects the main contradiction of ujamaa. Originally, the Ujamaa policy was supposed to be based on the initiatives of the farmers themselves. Self-help and mutual co-operation were the key words. The role of the government was to support such initiatives. Gradually, the initiatives were

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<sup>9</sup> For a review and analysis of the failed Ujamaa policies in Tanzania, see Schweigman (2001).



taken by the government. Ujamaa became a process from above. The government wanted to 'educate' the advantages of communal activities. In retrospect, one may be surprised that this contradiction did not raise more discussion in Tanzania. This may be due to the lack of democracy. Although in the writings of Nyerere and official documents democracy is often mentioned ('true socialism cannot exist without democracy'<sup>10</sup>), no publication was clear about the issue of what democracy really meant in the Tanzanian one-party system. The participation of the people themselves in introducing Ujamaa villages was never properly discussed in the public media, which were in the hands of the government. Top-down approaches replaced bottom-up approaches. The state became the exclusive actor.

A second approach to introduce new methods of cultivation, applied in most African countries, was *less radical*. It envisaged a gradual improvement of practice on existing farms. It was acknowledged that the farmers wanted to stick to their family based farming systems<sup>11</sup>, on land inherited from their forefathers. The main problem was how the government could reach the individual farmers in an efficient way. Transfer of technology became the key concept. At agricultural experimental stations, agronomists tested new technologies. After successful trials, extension officers tried to introduce the innovations to the farmers. Sometimes field tests at the farm level were also carried out. Most of the time such a transfer of technology did not work out well. The approach was too much top down and the role of the experts as exclusive actors was increasingly challenged. It was realized that the farmers' conditions and local knowledge should be taken as a starting point. 'Farmers participation' became a key word. In section 2 about Burkina Faso, such farmers' participation will be a central issue.

During the 1960s and the 70s the governments of most African countries wanted to have a firm control on the food market, to satisfy consumers in the urban centres and to be sure that the farmers would produce enough food. Governments were the main actors on the national food markets and they imposed official prices, both for consumers and producers. National marketing boards were installed, which bought from farmers via intermediaries<sup>12</sup> and

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<sup>10</sup> See Arusha Declaration, 1967, p. 234, in Nyerere, 1968.

<sup>11</sup> There is limited literature on the comparison between the efficiency of large estate farms and small holder farms in Africa under comparable external conditions. According to a study by IFPRI/USAID, where reference is made to Lele and Agwal, 1989, "the efficiency of large farms quickly eroded once smallholder farms were permitted access to the same support services as those available to large farms". See IFPRI/USAID, 2002, p. 25. The conclusion can only hold if no large mechanical equipment is involved.

<sup>12</sup> The intermediaries were governmental departments in the regions, governmentally controlled cooperatives, or merchants authorized by the government. See e.g. Bryceson, 1999, p. 25 –27, Bassolet, 2000, p. 10-12.

subsequently sold to consumers, at fixed producer and consumer prices. In most African countries the management of these large organisations was not successful. Farmers were not paid in time, transport was delayed, etc. The price policies were also problematic. Since consumer prices were set low and levies had to be paid to governmentally controlled intermediaries, the farmers received a price that was too low. This discouraged<sup>13</sup> farmers to invest in improved technology in order to increase production. So also in this case, the government was not successful as the exclusive actor on the food market.

### *Structural Adjustment Programmes*

In the 1980s and 90s the ideas on the exclusive role of the state changed. By accepting the Structural Adjustment Programmes<sup>14</sup>, recommended or rather imposed by the IMF and the World Bank, in most developing countries the role of the state in the food market was severely reduced: markets were liberalized, marketing boards dismantled, and prices were no longer fixed by the government. The role of national governments was restricted to creating optimal conditions (infrastructure, transparent rules and regulations etc.) for a private market, to keeping a food safety stock and to organizing food aid. According to neo-liberal thinking, the free food market would reduce marketing costs, decrease consumer prices and increase producer prices, allowing farmers to invest in agriculture and to improve productivity. Many developing countries are now in the transition process to the free market.

### *Food availability and access to food*

In 1986 the World Bank introduced a definition of food security, which has since then been widely used. Food security refers to ‘access by all people at all times to enough food for an active and healthy life’<sup>15</sup>. I would like to specifically draw your attention to the use of the term “access to”. In the 1970s, food security was associated with the availability and production of food. When, as a reaction to some calamitous droughts and famines in Africa, the first United Nations World Food Conference was held in Rome in 1974, the main occupation was the supply of food<sup>16</sup>. The recommendations of the conference focused on raising domestic production in order to achieve self-sufficiency, and

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<sup>13</sup> The centrally governed policies were usually defended as protection against private traders, who in dysfunctional markets would ask excessive prices. In fact, the alleged market failures were replaced by government failures. See e.g. Lutz et al., 1999, p.144.

<sup>14</sup> A large number of developing countries accepted the Structural Adjustment Programmes in order to be able to obtain loans by the Bretton Wood institutions under favourable conditions.

<sup>15</sup> In 1996, during the World Food Summit a refined version of this definition was adopted: ‘Food security, at the individual, household, national, regional and global levels, exists when all peoples at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life’. See FAO, 1996, World Food Plan of Action, point 1.

<sup>16</sup> See e.g. Sijm, 1997, p. 7.

the creation of national and international safety-stocks. The shift in the international debate from its emphasis on ‘availability of food’ to ‘access to food’ is in large part due to the influence of Amartya Sen, who in the 1970s started to study causes of famines. Sen carried out a detailed study of the Great Bengal Famine of 1943<sup>17</sup>, which had a death toll of about 3 million people. He scrutinized data on food production, stocks and imports; and information about victims and the role of the Bengal, Indian and British government. These governments had claimed that the famine was caused by a shortage of food (rice and wheat). Sen showed that during the famine period there was no shortage of food in the region. The famine made so many victims, because people had no access to food due to a failing distribution system, high food prices, and a lack of purchasing power. The worst affected groups were, amongst others, fishermen, transport workers, agricultural labourers, and low paid workers in various professions. Sen concludes that work programmes and other methods to increase the purchasing power of the people could have been a proper answer to help to prevent the famine. Sen and others also analyzed the famine in Ethiopia of 1972 – 1974, on the basis of existing reports and publications<sup>18</sup>. They concluded that on the national level during this period there was enough food for the whole country.

These results show that access to food rather than food availability is of importance in an analysis of food security. Access to food implies the use of means to acquire food. Sen developed his “entitlements approach”<sup>19</sup> as a theory to analyse these means. In studying food security, Sen’s approach calls for studies on disaggregate group or household levels.

### *Democracy*

In his recent book *Development as Freedom*, published in 1999, Sen states that famines have not occurred in democratic countries. Famines have occurred<sup>20</sup> in colonial territories, in one-party states (for instance, the greatest recorded famine in history, which took place in China between 1958 and 1960 after the failure of the “Great Leap Forward”; the famines in the 1970s in Cambodia, in the 1990s in North Korea), and in countries under a military dictatorship (as in Ethiopia during the Dergue regime, in Somalia and Sudan). Most authoritarian rulers are not interested in taking measures to avert famines. Democratic governments, with a free press and political rights, are exposed to public criticism. These governments are accountable for actions they may, or may have not, taken to

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<sup>17</sup> See Sen, 1981, Ch. 6.

<sup>18</sup> See Sen, 1981, Ch. 7.

<sup>19</sup> See Sen, 1981, Ch. 1, see also Sen, 1984, p.497, and Devereux, 1993, chapter 6 on the entitlement approach.

<sup>20</sup> See Sen, 1999, p. 16, and Ch. 6 about *The Importance of Democracy*. See also Interview with Amartya Sen in *Challenge*, Jan.- Febr. 2000, p. 22 –31.

prevent famines. In view of the need for electoral support and their political survival these governments have to take action in case of a threat of famine. On a national level, freedom of speech, independent media and a strong civil society controlling the government's policies are therefore important weapons against famine.

After this short review, I want to discuss an example of the food security situation in Africa. Estimates by the World Bank and the FAO show that, although Africa is rapidly urbanizing, in Sub-Saharan Africa the rural population is, and in the near future will be, the most vulnerable group<sup>21</sup>, in terms of food security. I will therefore deal with rural people: farmers and their families.

## **2. Food security on the Central Plateau in Burkina Faso.**

I will briefly describe the situation in the northern part<sup>22</sup> of the densely populated Central Plateau in Burkina Faso. It is one of the poorest and most vulnerable regions of the world. The Mossi are the most important ethnic group in the region. Farmers apply traditional methods of agriculture. The main inputs are labour and land, and productivity is low. Farmers and their families try to be self-reliant in food production. They apply various strategies<sup>23</sup> to cope with risks due to uncertain rainfall. Since many years, pressure on the land has been high; for two reasons. The growth of the rural population on the Central Plateau requires more land for new young farmers. Secondly, due to decreasing yield levels, individual farmers are forced to extend their land<sup>24</sup>. They cultivate as much as land as possible in order to produce enough for their families. Since most fertile land is already in use, farmers turn to marginal, less fertile land.

In the past, cultivated land was left fallow during a number of years to restore soil fertility. Due to land shortage fallow periods have been shortened, sometimes even vanished, resulting in decreasing soil fertility and deteriorating soil conditions. In the long term this is not a good strategy, but in the short term farmers often have no choice in order to survive.

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<sup>21</sup> See Cohen, 2001, p11.

<sup>22</sup> In particular the provinces Yatenga, Bam and Sanmatenga.

<sup>23</sup> For example by growing different varieties, by both late and early planting and other ways of "diversification", and by keeping livestock as a financial reserve for a situation when crops fail. See e.g. Maatman, 2000.

<sup>24</sup> The tendency to extend the cultivated area rather than intensify agriculture seems to contradict Boserup's thesis that population pressure will lead to intensification. Even the introduction of animal traction on the Central Plateau contributed to extension rather than to intensification.

There is another reason why soil conditions on the Central Plateau are poor: rainfall. During the (only) rainfall season, from June to October/November, rains can be very heavy. On the slopes of the land, the water may run very fast, carrying away fertile top-soils and vegetation. Moreover, the water does not infiltrate into the soils. The consequences have been disastrous. Thousands of hectares have been lost due to erosion. Moreover, the water table in the region decreased at a fast rate. That many trees and brushwood were cut to provide wood for fuel strongly aggravated the environmental degradation.

The low productivity levels and the deteriorating soil conditions are the main causes of the vulnerable food security situation on the Central Plateau.

### *Fighting erosion.*

Since a long time, initiatives have been taken to fight soil degradation in the region. In the early 1960s, a large anti-erosion project, financed by the European Development Fund, was designed and executed by European firms. On a huge area of 120.000 of hectares long ditches were dug. The ditches were to deviate the runoff water to prevent erosion, or were designed to improve infiltration. The huge project was very expensive. The local population was not involved in the preparation and setting up of the project, and was not willing to maintain the ditches of the white people. The project became a notorious failure<sup>25</sup> of exclusive actors, who did not take into account the views of the local population.

During the 1970s, another large project was carried out on the Central Plateau, financed by i.a. the World Bank. This time, the project was in hands of national authorities<sup>26</sup> and its execution was left to regional departments. The project focused on the construction of earthen dikes<sup>27</sup> to control the water runoff. Although lessons were learned from the 1960s and an attempt was made to involve the villagers, the approach was still basically top-down. Technically, the dikes were not always well designed. Moreover, their main purpose was to deviate the water to prevent erosion, whereas the farmers needed the deviated water, especially during poor rainfall years. Many dikes were therefore destroyed by the villagers and later abandoned<sup>28</sup>.

A breakthrough occurred in the 1980s, and particularly in the 1990s. Improved technical measures to control water runoff against erosion and to improve infiltration were introduced, in particular stone bunds, see Fig.1. The stone

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<sup>25</sup> For a review of the project, called GERES (Groupement Européen de Restauration des Sols), see Marchal, 1979, Reij, 1983, p. 21-23.

<sup>26</sup> The “Fond de Développement Rural” with headquarters in Ouagadougou was responsible for the monitoring and financial management of the project.

<sup>27</sup> About 40 to 50 cm high and at the base one meter wide.

<sup>28</sup> For a review of the project, see Reij 1983, 24-27.

bunds have to be located on contour lines of the farmers' fields. They can be constructed in several ways: rows of stones may be combined with ditches, and their size, as well as the distances between the rows, depends on the slopes. The stones are often unavailable locally and have to be transported over long distances.



*Fig 1: Rock bunds on the Central Plateau in Burkina Faso*  
*Source: Reij et al., 2003.*

Measures to improve soil fertility refer to the use of organic matter, for instance animal manure, compost and plant residues. Specifically, the improved methods of *zai* are to be mentioned. *Zai*, which literally means “water pocket”, is an intensive technique<sup>29</sup>, where holes are dug of a depth of 10 to 15 cm and a diameter of 15 to 20 cm. These planting pits are filled<sup>30</sup> with organic manure. Traditionally, *zai* is used to regenerate eroded fields. *Zai* is illustrated in Fig.2. The digging of the *zai* – holes and the supply of organic manure require a lot of labour, but it can be done at times when the farmers are not too busy, before the

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<sup>29</sup> For a more detailed description of *zai*, see e.g. Kaboré et al., 1994, Maatman et al., 1998, Reij, 1983, Reij et al. 2003.

<sup>30</sup> In the 1970s, an illiterate farmer from the Yatenga region, Yacouba Sawadogo, started to experiment with the traditional *zai*-planting pits by varying the size and putting manure in them. He even created an Association for the Promotion of *zai* and organized ‘*zai* markets’, where farmers could exchange their experiences with *zai*, see Reij and Tchawa, 1999, p.5.

period of planting. During the last two decades rock bunds and *zai* have been applied on a large scale in the northern provinces of the Central Plateau. Keeping livestock to produce manure, preparing compost and mulching the soil with plant residues can be done by individual farmers and their families. Projects, like the construction of rock bunds and the regeneration of degraded land by the application of *zai*, however, usually require communal efforts, which in turn requires farmers' or village organisations to be in place. Most of such projects are supported by either governmental or local or international non-governmental organisations. They can only collaborate with farmers' organisations and not with individual farmers.



*Figure 2: Zai (water-pocket) on the Central Plateau in Burkina Faso*  
*Source: Reij et al., 2003.*

### *Farmers' organisations*

One of the most important reasons for the breakthrough in the application of water- and soil management techniques was the organisation and participation of farmers. In 1966, Burkina Faso had created in all its eleven regions so-called Organizations for Regional Development<sup>31</sup>. They created village organisations, since 1974 formalized as *Groupements Villageois*. They aimed in particular at facilitating the dissemination of agricultural innovations. At present, you will

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<sup>31</sup> Organismes Régionaux de Développement, ORDs. Extension of new agricultural technology was their first pre-occupation. Their mission was later extended to general development activities, like literacy campaigns, construction of infrastructure etc. Each region was divided in districts and sub-districts, each sub-district containing 6 à 8 villages.

find Groupements Villageois in the majority of the 8000 villages in Burkina Faso. Some of them were established by the villagers themselves, but the links with governmental structures are usually strong. Various national and regional projects, e.g. on forestry, were channelled by way of Groupements Villageois.

In 1961, Bernard Lédéa Ouédraogo, a former teacher, joined the government as trainer of rural youth in agriculture. In 1967, he left his job from one day to another. In a later interview<sup>32</sup>, he gave this explanation:

“I was responsible for the training of the rural extension workers, and young farmers who had some kind of formal schooling. It was also my responsibility to supervise the “official” village groups organized by the government (and not by the farmers themselves). I did my best to help these groups, but I failed. So I tried to find out why I had not succeeded. What had happened?

The rural extension workers would arrive in a village, and the only concern of the officially organized farmers was to take advantage of the donkeys, bullocks, carts, hoes, and other materials we would make available to them. There was nothing else behind this demeaning form of assistance, no vision, no global conception of development or of the rural world, no doctrine or philosophy. There had been no prior efforts at conscious raising. It was normal that in such a situation the farmers had but one concern: prime the state “pump” for all it was worth and cheat the extension workers”.

B.L. Ouédraogo started to think of a completely new approach. He was inspired by the activities of some indigenous leaders in Yatenga. They struck different notes: participation, individual initiative and responsibility. As a sociologist, Ouédraogo started a study of the village organisation in the Mossi society. The birth of new village organisations, called *Groupements Naam*, was the result. Naam is a well-known term in Mossi society. It refers to groups of youngsters, who in the traditional Mossi society had to carry out useful tasks for the village. Without intervention by adults, they had to organize the work themselves, equality, solidarity and joint responsibility being leading principles. Such principles also became the base<sup>33</sup> of the new village organisations Groupements Naam. The first six years, Ouédraogo met a lot of obstruction, in particular from government circles<sup>34</sup>, but finally he managed to develop the Naam movement into the largest peasant movement in West Africa, if not in the whole of Africa. At present, there are about 4.700 Groupements Naam in Burkina Faso<sup>35</sup>, the

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<sup>32</sup> See Pradervand, 1989, p.19.

<sup>33</sup> This is remarkable, since the Mossi society is extremely hierarchic.

<sup>34</sup> See Pradervand, 1989, p. 20-21.

<sup>35</sup> See Ouédraogo, B.L., 1989, p. 206.



majority of which are found in the Northern part of the central Plateau. The Naam movement is well structured<sup>36</sup>, several Groupements Naam form a Union and on a national level the Unions make up the Fédération des Unions de Groupements Naam. The Naam movement extended to other countries in Africa<sup>37</sup> as well. The new organisations were particularly active in communal water and soil management projects, like the construction of stone bunds and *zai*. The Naam movement of the 1980s and 90s is often seen as a success story. Ouédraogo received several prestigious international prizes. Its success was to a large extent due to the parallel foundation of the Non-Governmental Organization *Six-S*. The name *Six-S* means in French: Se Servir de la Saison Sèche en Savane et au Sahel. The name is revealing, it refers to the use of time during the dry season, when the farmers are not involved in agriculture, are under-employed and can spend their time to activities like the construction of *zai* and rock bunds, as discussed above. *Six-S* supported Groupements Naam or farmers' organisations, which had adopted similar approaches as Naam. The support consisted of training activities<sup>38</sup>, developing the negotiating power of farmers' representatives and funding of projects. *Six-S* was run by local farmers' representatives. Ouédraogo was and still is the President of *Six-S*. The Groupements Naam and the NGO *Six-S* attracted a large number of donors, both foreign governments<sup>39</sup>, non-governmental organisations and international organisations.

Such developments and, in general, the changing ideas about farmers' participation and the shift in emphasis on "participative learning" rather than on "transfer of technology", had an impact on the government's policies in Burkina Faso. One can think of, for example, the national agricultural research institute<sup>40</sup>, which in the 1980s established interdisciplinary research teams in various regions of the country. They work together with farmers, and try to make interactive learning a reality. Although their impact can only be limited due to the vast region covered, and a lack of resources, their role can still be pivotal.

#### *Assessment of the impact of the application of water and soil conservation methods*

Recently, the results of a thorough study<sup>41</sup> assessing the impact of the application of water and soil conservation methods in the northern part of the

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<sup>36</sup> For a description of the Naam Movement, see Ouédraogo, B.L., 1989, Ouédraogo, B.L., 1990, Pradervand 1989, p. 20-23, see also Adam, 1993, p. 178 - 184

<sup>37</sup> E.g. Mali, Senegal, Niger and Togo.

<sup>38</sup> "Training in action" and "chantiers- écoles" became key concepts.

<sup>39</sup> Since the beginning, through the Swiss Development Cooperation department DDA, the Swiss government has been one of the most important backers of *Six-S*.

<sup>40</sup> Institut National de l' Environnement et de Recherches Agricoles INERA.

<sup>41</sup> See Reij and Thiombiano, 2003.

Central Plateau during the years 1980 – 2001 were published. Most of these methods consist of the construction of stone bunds and the application of *zai*. The methods were implemented through large public regional development programmes<sup>42</sup>, in which often Groupements Villageois were involved, or through private projects by farmers' organisations supported by NGOs, such as Groupements Naam and *Six-S*. Water and soil conservation methods were applied on about 150.000 hectares, almost 35 to 40% of all the cultivated area. Thousands of hectares of degraded land have been regained. The authors show, on the basis of both quantitative evidence and farmers' opinions, that the application of the water and soil conservation methods has increased yields of the main cereal crops sorghum and millet. This has contributed to an improvement of food security in the region. It was also observed that improvements in water and soil management allowed many farmers to diversify their production, allowing them to grow vegetables for sale. The farmers in the regions invest more and more in livestock in order to produce manure for fertilisation of the fields. The water tables in the region have risen. The authors conclude that the results are impressive<sup>43</sup>. Meanwhile, they emphasize that this is not the end of the story. A lot of land still lacks water and soil conservation structures, and the quality of all land has to be further developed. The productivity needs to be urgently increased in order to meet the demand for food.

The positive experiences with the application of water and soil conservation methods on the Central Plateau in Burkina Faso, show that successful results can be attained, as soon as various actors do not behave like exclusive actors, but acknowledge each other's specific role.

### **3. Opportunities and Responsibilities**

The state has been the most prominent actor with exclusive claims. Whatever the motivations were, political ideology or economic dogmas, governments appropriated a central role. During many years, farmers were denied a say. By doing so, the farmers were deprived of a basic freedom: to participate in discussions, negotiations and the process of decision making about their own

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<sup>42</sup> The methods were introduced as part of long term regional programmes, such as Projet Agroforestier, the PEDI project (Programmation et Exécution de Développement Intégré) and the project CES/AGF (Conservation de l' Eau et des Sols / Agroforesterie), on about 100.000 hectares; and as result of other initiatives e.g. by farmers' organizations supported by NGOs on about 50.000 hectares. See Reij et al., 2003, p.12.

<sup>43</sup> It is interesting that they even recommend to regain degraded non-arable land by means of water conservation structures, in order to regenerate grazing land for cattle, see Reij et al., 2003, p.77.

future. Such a freedom determines to a large extent the quality of life, and is an end in itself. This concurs with Sen's well-known thesis that substantive freedoms are both ends and means of development.

Farmers' participation has become a catchword. It is a complex issue<sup>44</sup> though. Farmers' participation needs organization. In this lecture the Naam movement in Burkina Faso served as an example of such an organization. It has had a strong impact. Similar to many enterprises, however, it runs the risk of becoming the victim of its own success. It is significant that internet searches on the Naam movement result in references to success stories only. The organisation runs the risk to develop into a bastion, organized in a top-down manner<sup>45</sup>, and so even itself to become an exclusive actor. Consider the following, written in a recent World Bank study about rural decentralisation in Burkina Faso<sup>46</sup>:

"... there was also a notable absence of collaboration among the local organizations in Yatenga, even within the same village. For example, there was no coordination between Groupements Villageois and Groupements Naam even though both groups were undertaking similar projects in the village, usually with external state or NGO partners. At the same time, each of the groups tended to be exclusive in their membership patterns. In fact, researchers noted several village groups creating more than one organization with the same people to solve the same problem. This was explained as necessary because 'each outside partner wanted their own groupement'".

It is unfortunate that there is a lack of transparency concerning the Naam's positive and negative experiences. For outsiders it is an intriguing question to which extent the ideas of equality, solidarity and joint responsibility of the original Naam groups of youngsters, for example, were adopted by the Mossi farmers with their extreme hierarchic structures.

Many people and organisations expect a lot from farmers' participation. However, although farmers' participation is necessary for agricultural development, it is not sufficient. Other actors may be equally important. This is manifest on the Central Plateau in Burkina Faso. In spite of the massive application of water and conservation methods, food production levels are still very low in this region. The farmers' fertilization efforts are limited to organic material. It is well known, however, that restoration and maintenance of soil fertility and higher production levels can only be attained, if mineral fertilizers will be applied as well<sup>47</sup>. In Burkina Faso, as in other West African countries,

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<sup>44</sup> See for a review of debates on farmers' participation e.g. Musch, 2001; see also Uphoff, 1993.

<sup>45</sup> See e.g. Atampugre, 1996.

<sup>46</sup> See Donnelly et al., 2001, p. 11.

<sup>47</sup> The efficiency of the application of chemical fertilizers depends to a large extent on the optimal use of organic resources. Yield levels are a function of both organic and chemical fertilizer inputs, see for instance De Ridder et al., 1990.

however, a fertilizer market is lacking<sup>48</sup>. Whether it will be economically feasible for the farmers to apply fertilizers will depend on many factors, the possibility to produce an agricultural surplus for sale, the efficiency of the fertilizer markets, the quality of the fertilizers, prices, and many other factors.

The introduction of Structural Adjustment Programmes, with their strong emphasis on the market, has severely reduced the role of governments. Without under-estimating the serious social disruptions, caused by the cuts in governmental expenditures, it has to be acknowledged that the new way of thinking has blown a new wind through the affected economies. Farmers, traders, transporters, retailers seem to make maximal use of the new possibilities. For instance, on the Central Plateau in Burkina Faso, the introduction of water management methods has also resulted in the construction of a large number of small water reservoirs to be used for drinking water for cattle. Every inch of the borders is used to cultivate vegetables, which are often sold in urban centres.

Of course, governments have still an important role to play. I do particularly refer to extension services and agricultural research. On the Central Plateau in Burkina Faso, the farmers can not do without.

### *Conclusions*

I have reached my conclusions. It is not nature, which has to be blamed for the stagnation of food production in Africa. Enough evidence has been presented to justify the conclusion that “the illusion of the exclusive actor” is the most important reason of the stagnation. Opportunities for increased food security and sustainable agricultural development depend on a proper interaction between the various actors. This is certainly not a discovery, but it is the heart of the matter. This highly required interaction can be different from one region to another, from one stage of development to another, and will be of a complex nature. Opportunities can only be created if this complexity is taken into account.

We have seen in the previous sections, that the exclusive role of actors was almost always accompanied by a lack of public discussion. It is certain that, on all levels, an environment of openness and transparency is the best breeding ground for initiatives that can create new opportunities.

At the end of my lecture, I will make a few remarks on responsibilities. I will limit myself to the responsibility of academic people. In the past, serious mistakes have been made due to easy generalisations about the blessings of the state or the market. The consequences have been grave. Academic people have to warn for such generalisations. Academic contributions to development are

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<sup>48</sup> The fertilizer supply for cash crops like cotton, is well organized and channeled through governmental organisations or parastatals.

required on a theoretical and on an applied level. On a theoretical level, new theories have to be developed, which are adapted to complex situations existing in developing countries. At an applied level, researchers have to interact with actors in practice. We know already a term for that: *participative learning*.

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## References

- Adam, H.M., 1993, *Building Capacity in the Countryside: The Role of Sahelian Voluntary Development Organizations*, in: Field, 1993, Ch 8, 172-204.
- Atampugre, N., 1996, *Au-delà des lignes de pierres. L'impact social d'un projet de Conservation des Eaux et du Sol dans le Sahel*. Oxfam, United Kingdom and Ireland.
- Bakker, E.J., 1992, *Rainfall and Risk in India's Agriculture; an ex-ante evaluation of rainfall insurance*, PhD thesis, University of Groningen.
- Bassolet, B.T., 2000, *Libéralisation du Marché Céréalière du Burkina Faso; une Analyse Néo-institutionnelle de son Organisation et de son Efficacité Temporelle et Spatiale*, PhD thesis, University of Groningen, The Netherlands.
- Berck, P., Bigman, D. (ed.), 1993, *Food Security and Food Inventories in Developing Countries*, CAB International.
- Bindraban, P.S., Keulen H. Van, Kuyvenhoven, A., Rabbinge, R., Uithol, P.W.J. 1999, *Food security at different scales: demographic, biophysical and socio-economic conditions*, Quantitative Approaches in Systems Analysis No 21.
- Bryceson, D., Seppälä, P., Tapio-Biström, M-L., 1999, *Maize Marketing Policies in Tanzania, 1939-1998; from Basic Needs to Markets Basics*, in: Van der Laan et al., 1999, 19-42.
- Byerlee, D., Eicher, C.K. (ed.), 1997, *Africa's emerging maize revolution*, L. Rienner, Boulder, Colorado.
- Cranenburgh, O. van, 1990, *The Widening Gyre: The Tanzanian One-Party State and Policy Towards Rural Co-operatives*, Eburron Publishers, Delft.
- De Ridder, N., Van Keulen, H., 1990, *Some aspects of the role of organic matter in sustainable intensified arable farming systems in the West-African semi-arid-tropics (SAT)*, Fertilizer Research 26, 299-310.
- Devereux, S., 1993, *Theories of Famine*, Harvester Wheatsleaf.
- Devereux, S., Maxwell, S. (eds.), 2001, *Food Security in Sub-Saharan Africa*, ITDG Publishers, London.
- Donnelly-Roark, P., Ouédraogo, K., Ye Xiao, 2001, *Can Local Institutions Reduce Poverty? Rural Decentralization in Burkina Faso*, World Bank, Policy Research Paper N0. 2677.
- Drèze, J., Sen, A., 1989, *Hunger and Public Action*. Oxford: Clarendon Press.
- Eicher, C.K., 1990, *Africa's Food Battles*. In C.K. Eicher, Staatz, J.M. (eds.) *Agricultural Development in the Third World*. Baltimore: John Hopkins University Press, 503-530.
- Ellis, F., 1993, *Food Security and Stabilization of Rice Prices in Indonesia*. In: Berck et al., 1993, 261-277.
- FAO, 1998, *Assessment of the World Food Security Situation*. Committee on World Food Security, Twenty-fourth Session, 2-5 June 1998, Food and agricultural Organization, Rome.

- FAO, 1996, *Rome Declaration on World Food Security and World Food Summit Plan of Action*.
- Fédération Nationale des Groupements Naam, Burkina Faso, 2002, <http://www.sosfaim.be/pays-projets/Burkina/naam.htm>
- Field, J.O. (ed.), 1993, *The Challenge of Famine; Recent Experience, Lessons Learned*, Kumarian Press, Connecticut.
- Hart, K., 1982, *The political economy of West African agriculture*. Cambridge University Press, USA.
- Hazell, P.B.R., Ramasamy, C., 1991, *The Green Revolution reconsidered; the Impact of High Yielding Varieties in South India*, John Hopkins, Baltimore.
- Hyden, G, 1989, *Food Security, Local Institutions and the State: Two Tanzanian Case Studies*, Paper presented at the Second Annual Hunger Research Briefing and Exchange, Brown University, 5-8 April, 1989.
- IFPRI/USAID, 2002, *Cutting Hunger in Africa through Smallholder-led Agricultural Growth*, International Food Policy Research Institute IFPRI/ United States Agency for International Development USAID; distributed at the World Summit on Sustainable Development, Johannesburg 2002.
- Janvry, A.. de, Sadoulet, E., 1993, *New ideas of poverty alleviation in the 1990s*, in Berck and Bigman (eds.) *Food security and inventories in developing countries*. CAB International, Oxford.
- Klaasse Bos, a., Lutz, C., Van Tilburg, A., 1999, *Food Grain Marketing in Burkina Faso; the Challenge of Food Security*, in: van der Laan et al., 1999, 67 – 86.
- Korten, D.C., 1987, Third Generation NGO Strategies: A Key to People-Centered Development, *World Development* 15, Supplement: 145-159
- Lele, U., Agarwal, M., 1989, *Smallholder and Large Scale Agriculture in Africa: Are There Tradeoffs Between Growth and Equity*, MADIA discussion paper No. 6, World Bank, Washington.
- Lipton, M., Longhurst, R., 1989, *New Seeds and Poor People*, Unwin and Hyman, London. Lipton, M., 1968, *The theory of the Optimizing Peasant*, *Journal of Development Studies*, vol. 4, No. 3, 327-351
- Lutz, C., Maatman, A., Schweigman, C., *Striving for food security in vulnerable rural regions: The case of semi-arid West Africa*, in Bindraban 1999, Chapter 12, p. 139 - 152.
- Maatman, A., Van Reuler, H., 1999, *Farming systems research and the development on integrated nutrient management systems: linking input/output market- and technology development*, in Renard et al., 1999.
- Maatman, A., 2000, “*Si le fleuve se tord, que le crocodile se torde*”. *Une analyse des systèmes agraires de la région Nord-Ouest du Burkina Faso à l'aide des modèles de programmation mathématique*. PhD thesis, University of Groningen.
- Maatman, A., Schweigman, C., Ruijs, A., 1996, *A study of farming systems on the Central Plateau in Burkina Faso: application of linear programming*,

- Volume II. International Research Programme SADAOC. INERA/RSP Zone Nord-Ouest, Burkina Faso. University of Ouagadougou, Burkina Faso. University of Groningen, the Netherlands.
- Maatman, A., Sawadogo, H., Schweigman, C., Ouédraogo, A.A., 1998, *Application of zaï and rock bunds in the north-west region of Burkina Faso: study of its impact on household level by using a stochastic linear programming model*, Netherlands Journal for Agricultural Sciences, Vol. 46, No 1, p. 123-136.
- Maatman, A., Schweigman, C., Ruijs, A., Van der Vlerk, M., 2002, *Modeling Farmers' Response to Uncertain Rainfall in Burkina Faso: a Stochastic Programming Approach*, Operations Research, Vol. 50, Number 3, pp. 399-414.
- Mabogunje, A.L. 1990 *Agrarian responses to outmigration in Sub-Saharan Africa*. Population and Development Review, Vol. 15, pp. 324-342.
- Marchal, J.Y., 1979, *L' espace des techniciens et celui des paysans; histoire d' un périmètre anti-érosif en Haute-Volta* in: ORSTOM, 1979, *Maîtrise de l' espace agraire et développement en Afrique tropicale*, Paris, 245-252.
- Nyerere, J.K., 1968, *Freedom and Socialism*, Oxford University Press.
- Ouédraogo, B.L., 1998, *L'expérience des Groupements Naam dans la lutte contre la désertification au Yatenga*, in Rossi et al., 1998
- Ouédraogo, B.L., 1990, *West African Villagers Fight Hunger*, African Farmer 3, April 1990, 46-47.
- Parick, K.S., Mahendra Dev, S., Deshpande, S., 1993, *Technology and Agricultural Development in India*, in Berck et al., 1993, 305-322.
- Pottier, J. 1999, *Anthropology of food: the social dynamics of food security*, Polity Press, Cambridge.
- Pradervand, P., 1989, *Listening to Africa; Developing Africa from the Grassroots*, Praeger
- Ravallion, M., 1987 *Markets and Famines*. Oxford: Clarendon Press.
- Reardon, T, Matlon, P. & C. Delgado 1988, *Coping with household-level food insecurity in drought affected areas of Burkina Faso*, World Development, Vol. 16, No. 9, pp 1065-1074.
- Reardon, T. , Matlon, P., 1989, *Seasonal food insecurity and vulnerability in drought-affected regions of Burkina Faso* In Sahn D.E. (ed.), *Seasonal variability in Third World agriculture: the consequences for food security*. The Johns Hopkins University Press.
- Reardon, T., C. Delgado, Matlon, P., 1992 *Determinants and Effects of Income Diversification Amongst Farm Households in Burkina Faso*. Journal of Development Studies, vol. 28, no. 2, pp 264-296.
- Reij, C., 1983, *L'évolution de la lutte anti-érosive en Haute Volta depuis l' indépendance vers une plus grande participation de la population*, Institute of Environmental Studies, Free University, Amsterdam.



- Reij, C.P., Tchawa, P., 1999, *Creating Partnerships for Innovation in African Agriculture; the Approach of Indigenous Soil and Water Conservation in Africa, phase II*, in: *Interactive North-South Research for Development with special attention for Natural resources Management*, 1999, published by the Royal Netherlands Academy of Arts and Sciences, Amsterdam.
- Reij, C.P., Scoones, I., Toulmin, C. (eds.), 1996, *Sustaining the soil: indigenous soil and water conservation in Africa*. Earthscan, London, England
- Reij, C. P., Thiombiano, T., 2003, *Développement Rural et Environnement au Burkina Faso: la réhabilitation de la capacité productive des terroirs sur la partie nord du Plateau Central entre 1980 et 2001; Rapport de Synthèse*, Conseil National pour l' Environnement et le Développement Durable, Ouagadougou, Burkina Faso.
- Renard, G., Krieg, S., Lawrence, P., Van Oppen, M. (eds.), 1999, *Farmers and scientists in a changing environment: assessing research in West Africa*, Margraf Verlag, Weikersheim, Germany
- Rossi, G., Delville, P.L., Narbeburu, D., 1998, *Sociétés rurales et environnement: gestion des ressources et dynamiques sociales au Sud*, Karthala, Regard, Gret.
- Rostow, W.W., 1961, *The stages of economic growth; a non-communist manifesto*.
- Saul, M. 1987, *La dynamique de la commercialisation des céréales au Burkina Faso*. University of Michigan and University of Wisconsin, USA.
- Sanders, J.H., Shapiro, B.I., Ramaswamy, S. 1996, *The economics of agricultural technology in semi-arid Sub-Saharan Africa*. The Johns Hopkins University Press, Baltimore, USA.
- Schweigman, C., 1979, *Doing Mathematics in a Developing Country; linear programming with applications in Tanzania*, Tanzania Publishing House, Dar es Salaam.
- Schweigman, C., 1985, *Operations Research Problems in Agriculture in Developing Countries*, Tanzania Publishing House, Dar es Salaam, and Khartoum University Press, Khartoum, Sudan.
- Schweigman, C., 1994, *Mathematical modelling and development related research*, in: Harts-Broekhuis, A., O. Verkoren (eds.), 1994, *No easy way out. Essays on third world development in honour of Jan Hinderink*, p. 114-120
- Schweigman, C., 2001, *Ujamaa: a Phantom*, in: *African Renaissance and Ubuntu Philosophy*. Special Issue, QUEST, an African Journal of Philosophy, Vol. XV, No. 1-2, 2001.
- Sen A., 1981, *Poverty and Famines, An Essay on Entitlement and Deprivation*. Oxford: Clarendon Press.
- Sen, A., 1984, *Resources, Values an Development*, Harvard University Press.
- Sen, A., 1999, *Development as Freedom*, Knopf, New York

- Sijm, J., 1997, *Food Security and Policy Interventions in Sub-Saharan Africa. Lessons from the Past Two Decades*. Erasmus University Rotterdam, Tinbergen Institute Research Series, no. 166, Rotterdam.
- SIX-S (Se Servir de la Saison Sèche en Savane et au Sahel), <http://iisd1.iisd.ca/50comm/commdb/desc/d12.htm>
- Stoorvogel, J.J., Smaling, E.M.A., 1990, *Assessment of soil nutrient depletion in Sub-Saharan Africa: 1983 – 2000*. Report no. 28, the Winand Centre, the Netherlands.
- Thorbecke, E., 1969, *The role of agriculture in economic development*, Universities-National Bureau conference series no 21, National Bureau for Economic Research, New York.
- Toulmin, C., 1995, *Tracking through drought: options for destocking and restocking*. In Scoones, I. (ed.) *Living with uncertainty: new directions in pastoral development in Africa*. Intermediate Technology Publications, UK.
- Van der Laan, H.L., Dijkstra, T., Van Tilburg, A. (Eds.), 1999, *Agricultural Marketing in Tropical Africa; Contributions from The Netherlands*, African Studies Centre Leiden, Research Series 15 / 1999. Ashgate Publishing Limited.
- World Bank, 1986, *Poverty and Hunger, Issues and Options for Food Security in Developing Countries*. Baltimore, John Hopkins Press.
- Yonli, E., 1997, *Stratégies Paysannes en Matière de Sécurité Alimentaire et de Commercialisation Céréalière: le rôle des banques de céréales dans le nord du Plateau Central du Burkina Faso*. PhD. Dissertation, University of Groningen, The Netherlands.