MENDEL UNIVERSITY IN BRNO

Faculty of regional development and international studies

Food security problems in West Africa - case study Mali and Senegal

Bachelor Thesis

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Abstract

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The aim of this thesis is to analyze the food security problems in West Africa together with further analysis of Mali and Senegal. Furthemore, this thesis provides an insight into geographic positions, agricultural development and overall hunger situations of chosen areas as these all named aspects have both direct and indirect impacts on food security. To measure the food security in chosen regions two different indexes were used in order to ensure maximal accuracy of the analyzed criteria (the Global Hunger Index and the Global Food Security Index). Moreover, the thesis analyzes main geographic and demographic challenges in the region and their correlations wtih food security issues. Next, different regional organizations and policies focused on the development of the areas are described. Based on the theoretical and analytical research and results of the thesis, recommendations for sustainable development and improvement of food security are eventually provided.

Keywords: Food security, Mali, Senegal, West Africa, hunger, urbanization

Abstrakt

STROLENÝ, M. *Problémy potravinové bezpečnosti v západní Africe - případová studie Mali a Senegalu.*
Bakalářská práce. Brno, 2016.

Cílem této práce je analyzovat problémy potravinové bezpečnosti v západní Africe s hlubší analýzou Mali a Senegalu. Dále, tato práce poskytuje pohled na geografické pozice, rozvoj zemědělství a celkové situace hladu v daných lokalitách, neboť tyto jmenované aspekty mají jak přímé, tak nepřímé dopady na potravinovou bezpečnost. Za účelem měření potravinové bezpečnosti a zajištění maximální přesnosti měřených kritérií byly využity dva odlišné indexy (Světový Index Hladu a Světový Index Potravinové Bezpečnosti). Navíc, tato práce rovněž analyzuje hlavní geografické a demografické problémy a jejich korelace s potravinovou bezpečností. Následně jsou popsány vybrané regionální organizace a politiky na rozvoj daných oblastí. Na základě teoretického a analytického výzkumu této práce jsou nakonec poskytnuta doporučení na celkové zlepšení a rozvoj analyzovaných oblastí.

Klíčová slova: Potravinová bezpečnost, Mali, Senegal, Západní Afrika, hlad, urbanizace

Declaration

I declare that I carried out this thesis: "*Food security in West Africa - case study Mali and Senegal"*

independently, and only with the cited sources, literature and other professional sources.

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In Brno ....

Martin Strolený

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List of abbreviations

AAFEX	Association Afrique Agro Export
AAGR	Average Annual Growth Rate
CILSS	Comité permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Permanent Interstates Committee for Drought Control in the Sahel)
CFA	Franc des Colonies Francaises d'Afrique (Franc of French African Colonies)
CM	Child Mortality
CST	Child Stunting
CWA	Child Wasting
ECOWAP	Economic Community of West Africa Agricultural Policy
ECOWAS	Economic Community of West Africa
FAO	Food and Agriculture Organization
GFSI	Global Food Security Index
GHI	Global Hunger Index
GNI	Gross National Income
HDI	Human Development Index
ICPD	International Conference on Population and Development
IFPRI	International Food Research Policy Institute
MDG	Millennium Development Goals
ONG	Non-governmental Organization
PNIA	Programme National d'Investissement Agricole (National Agricultural Investment Programme)
PPP	Purchasing Power Parity
PRACAS	Programme d'Accélération de la Cadence de l'Agriculture Sénégalaise (Acceleration Program of the Cadence of the Senegalese Agriculture)
PUN	Population Undernourishment
RAIP	Regional Agricultural Investment Programme
TFR	Total Fertility Rate
UEMOA	Union économique et monétaire ouest-africaine (West African Economic and Monetary Union)
UN	United Nations
USD	United States Dollars
WHO	World Health Organization

Content

Introduction

The topic of hunger has lately become discussed significantly, because as the world population increases the need for more food, infrastructure, housing possibilities, work and other basic items rises as well. Furthermore, due to the rapid increase of the world population and climatic changes developing countries have difficulties in combating hunger-linked issues.

Western Africa has one of the greatest resources of natural riches, yet it is still one of the poorest regions of the world. At the same time, this part of the world counts one of the highest numbers of inhabitants. Contemporary this region suffers from many geographic, socioeconomic and demographic problems. Even though countries of West Africa have achieved improvements in terms of reducing the ongoing problems, child malnutrition, undernourishment and food insecurity remain enormous challenges. Residents of West Africa, particularly women and children, suffer from many micronutrient deficiencies (for instance these are Vitamin A, iodine and iron). In addition to that this region embodies a significantly high fertility rate. Nevertheless, high children mortality rate caused mainly by hunger and limited access to adequate sanitation facilities is common in this area as well. Interestingly enough also obesity-connected health problems have occurred in this area.

Among other things Western Africa also has to face challenges of poverty, hunger, malnutrition, overpopulation, rapid urbanization, migration and diseases. The last named has been given much more attention with the outbreak of Ebola in 2014. These serious issues make it more difficult to provide sufficient food security to the people in the region.

To ensure sustainable development there is a need to secure effective food security in the territory of West Africa. In my thesis I decided to use two countries Mali and Senegal as case studies which I will further analyze in terms of their agriculture, overall food security and their policies and strategies designed in order to minimalize hunger and food-related problems within their borders. Senegal and Mali are noted among the worst 30 countries according to the Global Hunger Index.

Aim and methodology

The main aim of the bachelor thesis is to propose changes to government nutrition and agriculture policies based on the analysis of the situation and problems of food security in the region of West Africa with main focus on Senegal and Mali. Additionally, agricultural development of the region will be defined along with its potential to combat food security issues. Furthermore, main demographic and geographic challenges of food security will be described and analyzed together with organizations and strategies focused on hunger eradication. Most essentially this thesis will provide main reasons for food insecurity and their correlations in the region and propose several recommendations based on knowledge acquired while completing this work. The bachelor thesis is logically and coherently structured into different chapters and sub-chapters labeled by corresponding numbers.

In the theoretical part I used the method of literature research. This means gathering, processing, and sorting of different data and information. The used data were particularly obtained from publications, articles, books, annual reports and internet sources in English, French and Czech languages. This part will describe and explain terms of food security, Global Hunger Index and agricultural aspect of food security, demography, demographic indicators and urbanization.

In the analytical part I will discuss and analyze the location and overall food security situation in chosen region. To evaluate the food security situation in the region I decided to use the Global Food Security and the Global Hunger Indexes, which are explained in the theoretical part. Using these two different indexes will ensure maximal accuracy of the final results. Consequently, geographic and demographic challenges which aggravate stabilization of the food security situation will be defined. Eventually, countries Senegal and Mali will be analyzed further with aim on evaluation of their food security, agriculture, overall health situation and their policies to combat issues concerning their food security.

The main instruments used for completing the both theoretical and analytical part are methods of induction, deduction, comparison and compilation.

Some data of different sources might differ which I am aware of. There might also be impacts on the data caused by instable political situations in the area and other factors.

1. Theoretical part

Following paragraphs of a theoretical content will consequently explain the terms of food security and how to measure it. Next, the issue of hunger will be described along with methods on how we measure hunger. Eventually, theoretical part provides an insight into demography and some of its main indicators. These topics mentioned above provide crucial understanding for the analysis of food security.

1.1. Food security

Every single being on this planet has its elementary needs and this is not different for mankind. Abraham Harold Maslow (1908–1970) was an american psychologist and cofounder of the so-called humanistic psychology. Most importantly he studied and proposed the hiearchic theory of needs, which are upwardly sorted in a pyramid starting with the so called basic or deficiency needs (e.g. physiological needs, love, security, acknowledgment and self-esteem) up to the so called growth needs (e.g. self-actualization, also called metaneeds).[12] However nowadays even the most elementary physiological needs among which we include hunger and thirst are not met by a significant part of the whole population. Many living in this world have to face the problems of poverty, hunger, diseases, mortality, lack of education and others. Even though all the people of the world should be allowed to have at least access to means that would secure the most elementary needs, the contemporary situation is far from attaining that. That is also why a plan proposed by the United Nations (UN) was created. This model was firstly suggested in September 2000 with 8 main goals that were supposed to be achieved by 2015. After 2015 the plan was renewed and new projects aim at decreasing the prevalence of main issues by 2030. The name of this complex strategy concentrated on the entire planet is The Millenium Development Goals (MDG). As I have already mentioned above, the plan's fundamental parts are 8 primary goals defined as following:

- *To eradicate extreme poverty and hunger:* Globally more than 800 million people live below 1.25 USD per day. Furthemore, 795 million of people are chronically undernourished. MDG tend to decrease these numbers by half.
- *To achieve universal primary education: C*hildren from the poorest households are four times more likely to be out of school than those of richer households. Differences

between rural and urban areas are high. MDG aim at diminishing these differences and providing education for all children.

- *To promote gender equality:* Empowering women, ensuring same possibilities for work and education for women, making sure that women are equal is what this goal tends to achieve.
- *To reduce child mortality:* The child mortality was high in 1990. Approximately 12.7 million of children under five died annually in 1990. Main aim of the MDG is to decrease this number at least by two thirds.
- *To improve maternal health:* Maternal mortality ratio should be decreased by two-thirds.
- *To combat HIV/AIDS, malaria, and other disease:* These diseases are one of the main objectives to be decreased by the MDG. For instance, 3.2 million of people died of HIV in 1990.
- *To ensure environmental sustainability:* Main aim of this goal is to integrate principles of sustainable development into country policies and programs and reverse the loss of environmental resources.
- *To develop a global partnership for development:* Creation of an open market and financial system throught which countries in need could be developed.

The MDG have achieved a lot of accomplishments in every single area they had been focused on. One of the successes was a decline in deaths of children under the age of five from 12.7 million in 1990 to 6.3 million in 2013. Next, within the years of 2001-2013 the occurrence of HIV disease has noticed a significant slump by 38 %. Consquently there was also an achievement in decreasing the number of undernourished children younger than five years by 11 %. Approximately 6.2 million of people were saved from malaria from 1990. The number of 1.9 billion of people living in extremy poverty in 1990 decreased to 836 million by 2015. Majority of these improvements have taken place in West Africa. One of the main instruments to promote positive changes and achieve sustainability and effectivity of applied strategies to reach these goals is providing adequate food security.[17]

1.1.1. Clash of diverse definitions of food security throughout history

Food Security is a significantly complex and complicated topic which is literally hard to define. Indeed, 200 definitons of what food security is have already been presented. In 1974 where global hunger concerns were consequently inreasing, food security was defined

during the World Food Summit as following: *"availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices"*. Nevertheless, in 1983 FAO (Food and Agriculture Organization) found the definiton of 1974 insufficient, because as FAO explained, it is also important to include access of vulnerable people to available supplies. Ergo, attention should be given to the balance between supply and demand side of the food security. This led to a new definition: *"ensuring that all people at all times have both physical and economic access to the basic food that they need"*. In 1986 when the World Bank published its report „Poverty and Hunger" which concentrated on the temporal trends of food insecurity and food-related issues, distinguishment between chronic and temporal food insecurity was introduced. The report reproduced a brand new more complex definition*:"ensuring that all people at all times have both physical and economic access to the basic food that they need"*. Fifteen years later FAO presented an even more complex characteristic of food security. According to the FAO World Food Summit in 1996 „*food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life".* Even though The State of Food Insecurity in 2001 redefined the definition of FAO in 1996, the one of 1996 was approved to be the official and is used most often. The 2001 definition of The State of Food Insecurity was presented as following: *„Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"*.[28]

In other words, on a national level food security describes whether a certain country has enough food to meet elementary needs of its citizens. All citizens should have the same possibility to access food and therefore fulfill their nutritional and physiological needs. The food of a certain country can be either produced or imported. Nevertheless even if there is enough food, there is also a necessity to ensure its safety and healthiness. Food security therefore means that there is access to enough food by every single citizen to be able to live a healthy and productive life.[35]

1.1.2. Pillars of food security

The following subchapter will define the elementary pillars of food security. Food security is usually divided into three or four fundamental parts – food availability, food access, food use (utilization) and food stability.

Food availability is the first pillar and refers to relevant and sufficient amount of food which is ceaselessly available. This pillar is closely linked with and dependant on domestic production, import, food aid and food stocks

Food access is defined as the capability of people to access food mainly dependant on the amount of their resources. This pillar is mutually interconnected with income of population, purchasing power and infrastructure.

Food use (utiliztion) refers to effective and quality implementation of knowledge of nutrition and care, solid hygienical habbits and use of relevant water and sanitation, promotion of food safety and diet quality and diversity.[22]

Food stability deals with the stability of food security, whether it is sustainable or it changes over time. Main causes for instability of food security are usually political and economic factors, price changes or variability of weather.[38]

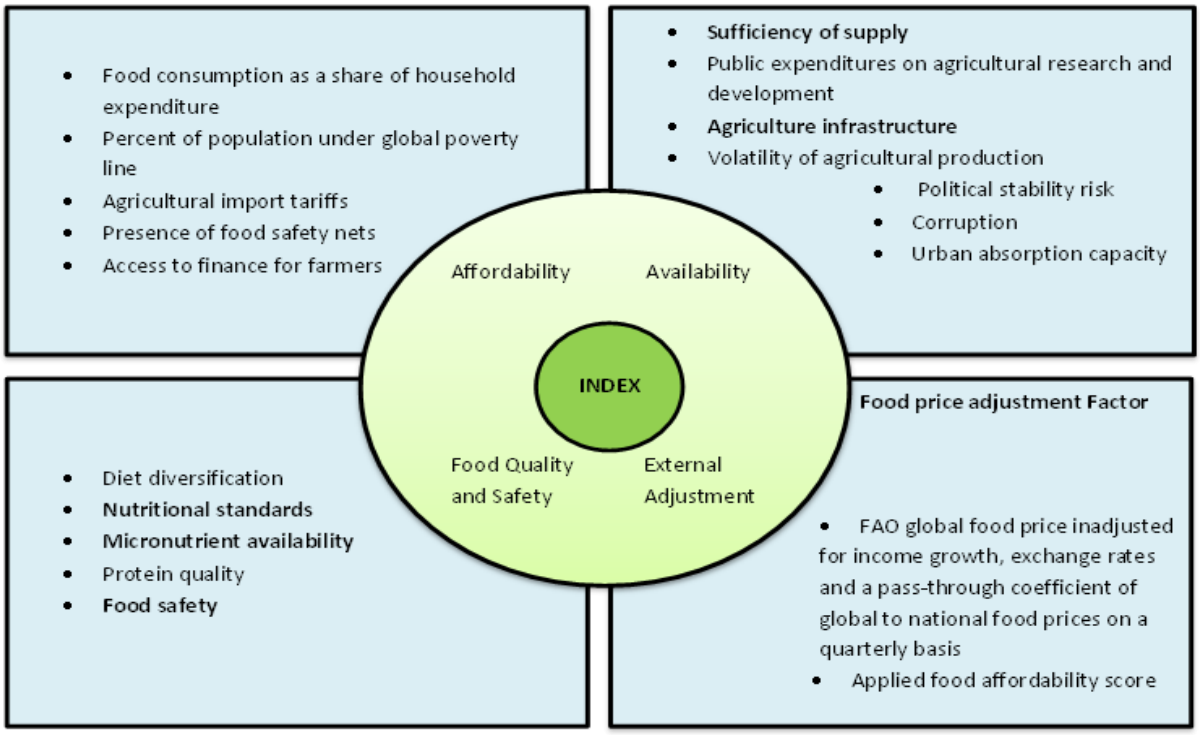
1.1.3. Measuring food security using the Global Food Security Index

The Global Food Security Index (GFSI) is an index, which measures food security in 109 countries according to their relative levels of food security. To assure its accuracy and correctness it uses more than 28 different indicators within the framework of three elementary pillars of food security, which were (under different names) mentioned in the first chapter – Affordability, Availability and Quality and Safety of food.

The GFSI was created in cooperation between two subjects, Economist Intelligence Unit and DuPont[1]. The principal objective of designing such framework is to promote proliferation of knowledge of crucial causes and reasons for food insecurity. Indeed, the GFSI aims at providing a precise well-structured measurement analyzing food security from many different perspectives to spread the awareness of world food security situation.

[1] DuPont is an american conglomerate founded in 1802. Furthemore, it is a transnational company of science, chemistry and biology. DuPont works collaboratively to responsibly develop innovative solutions that employ science and engineering to solve some of the world's greatest challenges.

Figure 1: Global Food Security index



Source: Own work based on http://foodsecurityindex.eiu.com/ data

The whole concept of the GFSI is situated above in the Figure 1. As already mentioned, this framework analyzes three pillars of food security noted in the yellow circle while scanning a wide range of miscellaneous factors, which have both direct and indirect impacts on food security. The analysis of many different aspects and their mutual correlations ensure a complexity and rigorousness of the outcoming results.

The final result is expressed in a number on a scale from 0 to 100. On this scale 0 would indicate no food security while 100 would refer to complete food security. The most food secure countries reaching at least 75 and more are high-income countries and states situated in the US and Europe which commonly embody a sufficient food supply along with a minimal political risk and paradoxically also low spending on food when compared to other expenditures. Conversely, the developing countries (including countries of West Africa) or in other words, the Third World countries epitomize high corruption, low level of protein quality, heavily underdeveloped agricultural infrastructure and low GDP per capita. A closer look at the Table 1. indicates deep discrepancies between high-income countries and countries of West Africa which are low-income and developing.

Table 1: Comparison of West Africa with developed countries in terms of Global Food Security Index

Developed countries			Countries of West Africa		
Rank	Country	Score	Rank	Country	Score
1	United States	89.0	75	Ghana	46.1
2	Singapore	88.2	76	Cote d'Ivoire	46
3	Ireland	85.4	80	Benin	41.7
4	Austria	85.1	80	Senegal	41.7
5	Netherlands	85.0	86	Mali	38.5
6	Switzerland	84.4	91	Nigeria	37.1
7	Canada	84.2	97	Guinea	33.9
8	Germany	83.9	99	Burkina Faso	33.6
9	Australia	83.8	99	Niger	33.6
9	France	83.8	101	Togo	33.4
9	Norway	83.8	106	Sierra Leone	29.0

Source: Own based work on http://foodsecurityindex.eiu.com/ data

As the table significates, there are deep disparities in terms of food security among developed countries and countries lying in West Africa. The best position in terms of GFSI holds Ghana which is 75th with a score of 46.1. Sierra Leone has performed much worse being at the 106th position which is the worst value in the region and 4th worst value in the world. The USA (best score at all) embodies a score three times higher than Sierra Leone (the worst score in West Africa), which refers to the enormous discrepancies between the developed and the developing worlds.[19]

1.1.4. Crucial role of agriculture and policies in food security

Agriculture plays a crucial role in eradicating poverty and hunger-related issues thus improving food security. Throughout the last several years bringing the advancements and progress in agriculture, its technologies and techniques have helped to save many from poverty, hunger and malnutrition. It is the backbone of developing countries. Through effective policies where incomes of farmers are increased, the used technologies are rather modern and environmentally friendly and prices high enough to ensure both affordability and profitability, food security can be ensured.

Africa, and notably Sub-Saharan Africa and West Africa, are the world's most vulnerable regions in regards to food security and its promotion for the citizens. Frequent droughts and crop failures have resulted in long-lasting food insecurity, poverty and malnutrition of many citizens. When food crisis in Africa took place it was subsequently resulting in one million of dead victims in 1985 in Ethiopia, much attention was drawn towards this situation and much help was provided. FAO, IFPRI (International Food Policy Research Institute) and others came to a conclusion that Africa was facing a long-term food issue. Even after many aid-concentrated programs and investments this problem has yet not been fully solved.

Majority of African people depend on agriculture. Agricultural growth is the key to achieving some of the millennium goals, mainly those concerning poverty and hunger. Due to instable weather conditions, frequent climatic changes, inadequate technologies and poor infrastructure, the productivity of agriculture in Africa is rather low even though it has been increasing rapidly in the last twenty years. Therefore there is a need to create a better economic environment where incomes and productivity of smallholders would be increased and thereby promote an agricultural growth in order to ensure better food security. To achieve this, efficient agricultural policies have to be projected and implemented.

Not only climate changes may lead to degradation of soil and natural resources, but also inadequate techniques and methods used in agriculture. As the rural population growths and high costs or inaccessibility of relevant tools are occurred, the soil becomes depleted and thus consequently infertile. Research and innovation are needed to be used by smallholders in order to secure sustainable soil and water management. Effective policy implementation might represent one of the fundamental keys to improvement and development.

The definition of what policy exactly means can be expressed in many different ways. However, we might define it as state interventions and methods aimed to influence some of the economic variables such as prices, incomes, exchange rates and others. Policy is a general term while policies are exact kinds of governmental interventions such as price policy, agricultural policy an income policy and so on.

The objectives of an agricultural policy are miscellaneous. They might be focused on social and political stabilities or increased earnings in export as well as on promoting food security, eradicating malnutrition or securing better food production and its accessibility,

availability and affordability. Every policy has different goals and methods how to reach them and establishing ample food security is very often one of them.[41]

One of such examples of agricultural policy can be the Common Agricultural Policy of West Africa (ECOWAP) which aims at improving the agriculture of West Africa as a whole. This policy is defined by its six basic goals and objectives: improved water management, improved management of other natural resources, sustainable agricultural development at the farm level, developing agricultural supply chains and promoting markets, preventing and managing food crises and other natural disasters and the last objective described as institution building.[90]

To give an example from developed countries in order to be able to make a comparison it is appropriate to present one of the well-known and very important policies that is The Common Agricultural policy which is a set of legislation adopted by the EU (European Union) in order to provide unified agriculture. The ultimate objective is to maintain sustainable agriculture in a living countryside.

Among the main objectives of this policy we include an increase in agricultural productivity by means of technical progress and the rational development of agricultural production, a fair standard of living for the agricultural community, the stabilisation of markets for farm products, food security (e.g. ensuring that there is always a supply of food), and food affordability (e.g. that the price of food is at a level that people can afford).

These goals might be applied anywhere in the world by reason of promoting stable agricultural system and ensuring food security and majority of agricultural policies worldwide aim to achieve the same goals however the ways they try to achieve it might differ due to different locations, economies, and socio-demographic situations.[14]

1.1.5. The food balance sheets

The food balance sheets provide overall basic information about a food supply of a given country in a certain time period while using three different indicators. The first important indicator is the domestic supply of food which takes into consideration the agricultural production, import and changes of supplies. Next essential indicator reflects domestic utilization of food which in other words describes the ways food is used in a certain

area. Food and food products can be used in many different ways, most particularly food is used to feed livestock, as seed, for many food and non-food purposes, to feed people and among other things, many nutritional products are thrown away or destroyed during transport which is also taken into account. The third of these three important indicators is the food consumption per capita where the daily intake of important micro and macronutrients is analyzed, more specifically those are proteins, fats and carbohydrates consumed per person.

Food balance sheets have the important function of analyzing food trends within an area in terms of food supply, changes in overall diet of population and most importantly they show to which extent a certain food supply in a given location is efficient to meet the nutritional needs of its inhabitants. Next they demonstrate the overall food and agricultural situation in a country.

The food balance sheets are useful notably in planning and projecting more effective balance between food demand and supply for the future, setting new agricultural objectives based on results they generated, analyzing efficiency of food and agricultural policies and analyzing the relationship between the food supply and food security problems such as malnutrition, hunger and undernourishment. These statistics are crucial for designing effective policies which would improve the overall situation, and that is why it is one of the main tools to be used when projecting new food and agricultural policies.

The number of crops used for feeding livestock in relation with the total production of crops indicates the degree to which primary sources of food are used as feed for livestock, which is undoubtedly very useful in analyzing and planning livestock and agricultural policies. Import dependency ratio effectively demonstrates the extent to which the population is dependent on import to ensure their nutritional needs. Data which demonstrates per capita details represents eminently significant indicators used for planning the food demand along with other aspects such as income elasticity, predictions of personal expenditures or size of the population.[25]

1.2. Hunger measurement as an integral part of food security analysis

This subchapter will provide different definitions of hunger and its measuring as hunger is an integral part of food security issues. Hunger is described as a painful feeling sensed after a longer period of time without eating. Undernourishment which is closely linked with hunger corresponds to a situation where a certain individual consumes less than 1 800 kilocalories per day which is stated to be the minimum to preserve good health by FAO.

However it is not only the quantity that matters, but also the quality of food and its nutritional properties such as the amount of vitamines, proteins, fats and carbohydrates it contains. Malnutrition is firmly connected with undernourishment but at the same time it can be quite the opposite. By opposite it is meant excessive eating and too high caloric intake that leads to obesity and other health difficulties.[33]

According to Oxford Dictionary hunger can be described in three different ways depending on situation as following:

- the uneasy or painful sensation caused by want of food; craving appetite. Also the exhausted condition caused by want of food
- the want or scarcity of food in a country
- a strong desire or craving[21]

Several diverse forms of hunger are recognized:

- *Undernourishment:* Chronic deficiency of caloric intake, when certain individuals consume less than 1 800 kilocalories per day, which FAO defined as a minimum needed for living a healthy and productive life
- *Malnutrition:* is a physiological condition defined as abnormal, mainly caused by eating inappropriate quantities or types of food. Is closely linked with undernutrition and overnutrition.
- *Micronutrient deficiency*: Is also known as hidden hunger. Its prevalence happens when there is a lack of elementary minerals and vitamines in the daily consumption of certain living beings. Low absorption of vitamines and minerals leads to both mental and physical diseases.
- *Undernutrition:* High deficiencies in macro and micronutrients important for sustaining a healthy life together with physical and mental development of every human being.[37]

Currently there are more than 795 million people who suffer from hunger on a global scale (35 million in West Africa). This basically means that every ninth person of our planet does not have sufficient possibilities and means to secure their food and hence struggle with the serious problem of famine. It is the world problem number one at the moment and it has to be solved. Truth be told, there is enough food to feed every single inhabitant of our planet,

nevertheless there is a need for sufficient policies, strategies and economy to provide adequate food security.[9]

Thomas Malthus (1766-1834), who was an English economist and mathematician, predicted in 1798 that population growth will lead to mass starvation problems, because it will grow geometrically while food production will only keep on arithmetical growth. This means that the number of population will exceed the food production and cause a serious global starvation issue. This world-scale dilemma would lead to decimation of population as it would result in famine, wars and diseases. The population has been growing significantly in the last decades, but thanks to technological inventions, improvements in health and overall development and progress in all scientific areas we have been able to avoid such horrowful predictions. However with the constant increase in the number of world population we have to ask ourselves how long we will be capable of progressing enough to ensure resisting these two-hundred-year old omens.[43]

Hunger and food security are interconnected with poverty. Nowadays there are more than 1.4 billion people living below the absolute poverty line (180 million in West Africa) , which means that they have only 1.25 USD and less to spend per day.[20] In order to measure hunger, Global Hunger Index (GHI) was invented.

The Global Hunger Index was invented in order to measure and analyze hunger on a global, national and regional levels. This index is calculated each year by the IFPRI. Once calculated the GHI demonstrates whether there has been an improvement or deterioration in terms of hunger issues in approximately 120 countries of the world. One of the main objectives of the GHI is to spread knowledge of hunger, its problems and impacts and therefore motivate people to help with its eradication. Among others the GHI helps significantly in terms of action planning for hunger eradication.

Since hunger is a multidimensional issue, the GHI makes the endeavor to measure it by the occurrence of four different problems in a given country or region to achieve the highest possible objectivity and accuracy:

1. *Undernourishment:* The number of people who suffer from undernourishment as a percentage derived from the entire population

2. *Child wasting:* The proportion of children under the age of five who suffer from undernourishment and therefore have lower weight than they ought to have in accordance with their height.
3. *Child stunting:* The number of children under the age of five who suffer from low height due to undernourishment-linked issues.
4. *Child mortality:* The mortality rate of children who have not reached the age of five yet.

Countries are afterwards ranked on a scale from 0 to 100 points. The more points a certain country obtains, the worse the hunger situation is. For example 0 would mean that in the measured area there is no hunger. 100 would therefore indicate absolutely no prevalence of hunger in the observed territory, however, these two examples are highly utopic, because even in the most developed countries of the world there is always at least moderate occurrence of hunger-related issues. The way the GHI is calculated will be subsequently described in subchapter 1.2.1.[31]

1.2.1. Calculation of the Global Hunger Index

First of all the crucial values for the component indicators must be defined and determined. Those are: proportion of undernourishment of population (PUN), prevalence of children under five suffering from wasting (CWA), prevalence of children under five suffering from stunting (CST) and child mortality rate, which is the number of children who die before the age of five (CM). These all variables are expressed in percentage.

In the next step, once obtained and approved variables are being standardized. Every single one of the components is standardized according to thresholds set slightly above the highest country-level values over a certain period of time. For example between 1988-2013 the highest amount of undernourishment was observed to be 76.5 %, so the obtained number was standardized and set slightly higher, at 80 %. For instance, if in a given year a certain country embodied an undernourishment rate of 40 %, the threshold for standardization would be set to 50 %.

In the last step the standardized component are aggregated so that the GHI for each country could be calculated. Undernourishment as well as child mortality forms one third of the GHI. Child stunting along with child wasting each contribute by one sixth to the GHI. Therefore, the final formula used for calculating the GHI is following:

1/3 standardized PUN+1/6 standardized CWA+1/6 standardized CST+1/3 standardized CM =GHI score

1.2.2. The Global Hunger Index severity scale

The severity of hunger is divided in five categories according to number of points calculated by the GHI.

Table 2: Global Hunger Index Severity Scale

GHI Severity Scale				
≤ 9.9 low	10.0-19.9 moderate	20.0-34.9 serious	35.0-49.9 alarming	50.0 ≤ extremely alarming

Source: Own based work on http://ghi.ifpri.org/ data

These categories are low, moderate, serious, alarming and extra alarming according to the scores given countries obtain (see Table 2).[23]

By help of this index we could measure that since 1990 the general hunger situation has improved. Nowadays there are no countries embodying GHI that would extent the extremely alarming limit on the severity scale. Nonetheless, the GHI scores vary among different regions and countries. South Asia and Sub-Saharan Africa are regions with the highest GHI scores. Alarming degrees of the GHI are still recognized in 19 countries contemporary, out of which a majority is situated in Africa. It is no surprise that the countries with high scores of the GHI and therefore suffering from hunger problems are usually under difficult political or social situations and instabilities that lead to conflicts. For instance, the most alarming level of the GHI was calculated in Burundi and Eritrea. [44]

1.3. Demography and demographic indicators

As food security is linked with people, demographic trends have both direct and indirect impacts on it. The term demography has been derived from two greek words: demos (the people) and graphos (to write or draw). The term of demography was firstly used in 1855 by A. Guillard[2]. Demography studies population and its trends. Demopraphic phenomenoms such as fertility, births, deaths, mortality or population changes and their changes are all analyzed by demography.[47]

[2] Achille Guillard (1799-1876) was a French demograph and naturalist.

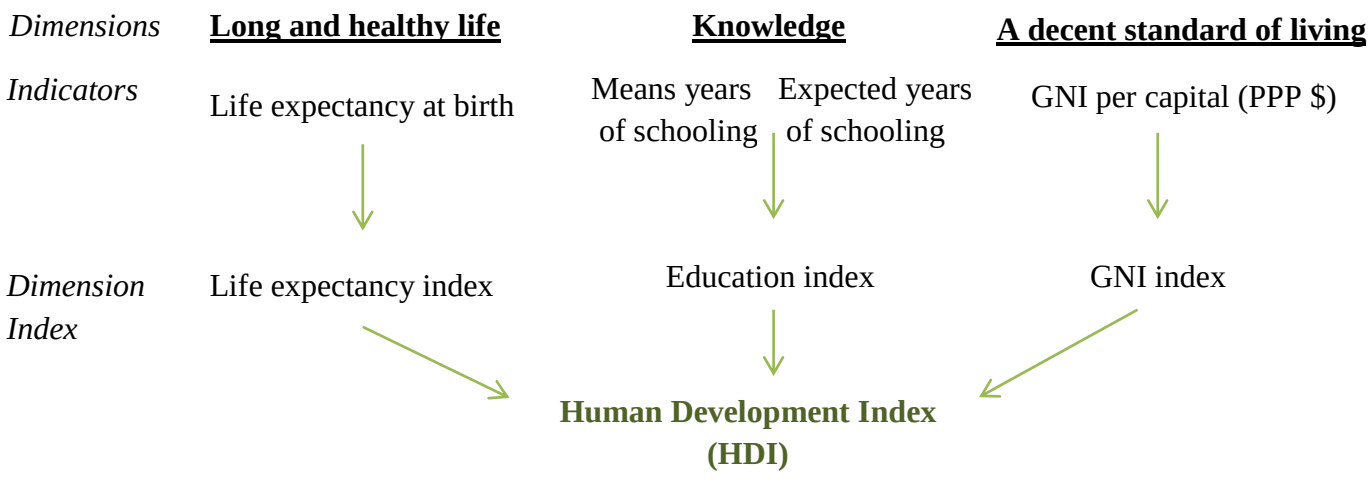
Donald J. Bogue in his book „Principles of Demography“ defined this science as following: *„Demography is the mathematical study of size, composition and special distribution of human populations and of changes overtime in these aspects through the operation of the fice processes of fertility, mortality, migration and social mobility. Although it maintains a continuous descriptive and comparative analysis of trends, in each of these processes and in their net result, its long-run goal is to develop a body of theory to explain the events that it charts and compares“*.[42]

Next some important demoraphic indicators linked with food security problems will be described.

1.3.1. Human Development Index

The Human Development Index (HDI) was invented to measure development not only by the economic growth, but also by the capabilities, skills and education of people. The HDI is a summary of three elementary dimensions of human development: the life expectancy, the quality of life and the knowledge of people and their education. To measure the three aspects, several indicators must be used. In particular, life expectancy at birth is used to calculate the average lenght of life, quality and standard of life is measured by Gross National Income (GNI) and knowledge and education of population is often measured by average of years which adults older than twenty-five and more have spent at school and expected years of education for children who are about to start attending school. The following schema (see Figure 2) demonstrates the correlations between the dimensions of human development used for measuring the HDI.[45]

Figure 2: Human Development Index framework



Source: Own based work based on http://www.hdr.undp.org/ data

1.3.2. Annual population growth rate

Annual population growth indicates the changes in population size within the period of one year and is most frequently expressed as a percentage.[40]

High annual population growth takes usually place in less developed countries with low HDI. More developed countries with high HDI embody rather low annual population growth that might sometimes even result in negative numbers which basically means that the population has decreased. Following Table 3 will demonstrate the correlation between the HDI and annual population growth rate. Low HDI countries represent high population growth rate unlike the developed ones (for comparison of West African countries see Annex 1).

Table 3: Comparison of annual population growth rates according to development (%)

HDI ranking	Country	1990	2000	2010
	Very high HDI	0.7	0.7	0.8
	High HDI	1.8	0.8	0.7
	Medium HDI	2.2	1.7	1.4
	Low HDI	2.8	2.8	2.6

Source: Own based work on http://hdr.undp.org/en/content/average-annual-population-growth-rate data

1.3.3. Child mortality rate

Child mortality rate measures the mortality rate of child under the age of five and is one of the key indicators of child well-being which is closely linked with the overall health and food security. Among other things it reflects social and economic situation of the measured area. An effective reduction of child mortality is an objective of the MDG and has already been partially achieved. The rate was reduced by 49 % as in 1990 the average number of deaths of under-fives was 90 per 1 000 children while in 2013 this number decreased to an average of death children per 1 000 to 46. Thanks to this achievement more than 100 millions children have been saved since 1990. Nonetheless its measurement might be quite difficult, because many developing countries lack important data needed for an accurate estimation.

Every single day there are 17 000 children under five who die in the world. The causes of their deaths could have been prevented if adequate health and food securities had been available. There are deep discrepancies between the developed and developing countries in

regards to child mortality as the child mortality rate amounts to number 12 times higher in developing countries than in the developed ones.[50]

1.3.4. Life expectancy at birth

According to the definiton of the World Health Organization (WHO) the life expectancy at birth is *„Average number of years that a newborn is expected to live if current mortality rates continue to apply.“* This basically means that if the life expectancy of a certain country is 75 a newborn person will most probably reach the age of 75. However there are strong differences between countries of the Third World and the developed ones.[39]

Life expectancy at birth is influenced by sex, location and many other aspects. The average expectancy on a global scale is 65 years (63 for male and 68 for females). However it is needed to be taken into account that life expectancy at birth amounts to higher numbers in high income countries while Sub-Saharan Africa (includes a huge part of West Africa) and South Asia are noted among locations with the lowest life expectancy rates. The average life expectancy of populations living in high income countries amounts to 80 years while in developing and underdeveloped destinations such as Sub-Saharan Africa people are only supposed to live until the age of 55. World Summit for Social Development Programme of Action set a goal that by the year 2000, life expectancy should be higher than 60 in every country of the world, however this was not achieved. Furthermore, International Conference on Population and Development (ICPD) Programme of Action proposed an objective that countries should aim to reach the life expectancy which should be higher than 70 by 2005 and by 2015 it ought to amount to 75 years. Countries with high mortality rates should at least improve their life expectancy to 65 years.[18]

Even though many goals in terms of prolonging the average length of lives have been designed, not many become fully achieved. On the other hand the average life expectation at birth has improved significantly in the last 50 years and keeps improving mainly thanks to technological and medical progresses as well as access to better quality nutrition.[48]

1.3.5. Total fertility rate

Next indicator to be defined is the total fertility rate (TFR) which describes the average number of children that would be born per woman if all women stayed alive during the whole childbearing period of their lives (until the age of 50) and bore children in compliance with a given fertility rate at each state. It is assumed that there is no mortality when counting the TFR.

Again there are great differences between the developed and the developing world. In some of African countries the TFR can amount to 6.76 children born per woman while in the most developed countries the number of born children per woman lies is between 0.90-2.1.[49]

1.3.6. Urbanization

Urbanization is presented in many different ways and has unprecedent impacts on food security in certain regions. That is why I would like to present some of the used definitions proposed by two scientists and authors who where occupied with this ongoing phenomenom. According to Reiss urbanization is process of population concentration in which the ratio of urban people to the total population in a territory increases. His virtual definition is following: „*An increase in the size of the individual points of concentration and in the number of points of urban concentration may occur without an increase in the urbanization of a territory. Only when a larger proportion of the inhaitants in an area come to live in the cities is urbanization said to occur"*[89] Another author Clyde Mitchell explained urbanization as a process where people become urban thus move to cities, change from agriculture to other pursuits common in cities and change their behavioural patterns in order to make them better correspond with cities. The second definition takes into consideration also the sociological aspects of urbanization and hence is more complex.[52]

Speaking globally, currently approximately 54 % of the whole world population live in towns and cities. In the coming future it is discussed that next 2.5 billion people will live in urban areas by 2050 where Nigeria (185 million inhabitants in 2015, presumed 399 million in 2050) situated in West Africa along with China and India will create 37 % of the urban world. The outbreak of massive urbanization will take place parimarily in Africa and Asia. The prediction for a percentage of residents living in cities and towns for the year 2050 was counted to 64 % of West Africa and 66 % of the entire population. There are high differences between individuals who stay in urban areas as about one half of them live in cities which notice around 500 000 inhabitants, on the other side 12.5 % of urban population live in some of our current 28 megacities outreaching the number of 10 million residents. The amount of the so called megacities has tripled in the last 25 years. Several years ago cities with high urban agglomerations could have been found mainly in developed regions, nevertheless, today most of these places are situated in developing countries.

People tend to leave rural areas for the urban ones mainly in order to find better living conditions and opportutinities (push and pull factors). In cities there are better options for jobs, high quality education, solid health care, cultural and political miscellaneousness and transportation linked with overall infrastracture. However many cities are not prepared for such an outbreak of migration. Therefore in many cities this process of urbanization has led to social, enviromental and economic issues. Hence, urbanization directly and indirectly influences the three main pillars of sustainable development: social and economic development along with enviromental protection. These three crucial dimensions of sustainable development can be pejorated by urbanization, when needed infrastructure is not ensured and efficient policies are not implemented. Also rural areas that have high importance are neglected by these procedures and therefore become highly underdeveloped, however potential to fight poverty and food security problems often lies there, because in these places we can find majority of agricultural lands, which produce and provide food.[54]

2. Analytical part

Analytical part will be focused on the analysis of food security in West Africa based on the theoretical research. This chapter consists of several subchapters which are logically coherent and will provide analysis of geography, food security, hunger, geographic and demographic challenges in the region as a whole along with further analysis of Mali and Senegal.

2.1. Geographic definition of West Africa

Africa contains 61 political entities and 54 sovereign countries. Furthermore Africa is divided into 5 fundamental regions: North Africa, West Africa, Central Africa, East Africa and South Africa.

West Africa consists of 16 countries - Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo (see Annex 2). Its land area is about 5 million square kilometers.[30] Its population in 2016 was about 361 million.[86] With the exception of Mauritania, these countries are members of the Economic Community of West African States (ECOWAS).[30]

West Africa is interwined by several rivers among which we can name Senegal, Gambia, Volta and Niger. Behind sandy beaches we can find forrests, swamps and agricultural locations, where maize, sorghum and millet are cultivated. They provide food for both people and animals. Next important agricultural crops cultivated in the area are groundnut, cotton,cocoa and palm oil.[36]

The west part of Africa is significantly influenced by climate changes. Strong degradation of land and inadequate sources of water make it diffucult to settle sustainable agriculture in this region. The region is vulnerable particularly due to climatic and geographic challenges that it has to face. There is a diversity of biogeographical zones due to different climate factors affecting this regions in certain areas. We distinguish the following biogeographical zones in West Africa: rain forest, forest-savanna ecotone, savanna, Sahel and desert.

Since this region is situated in a tropical belt, the temperatures are very high and rather stable during the entire year, however there are some parts where temperature changes rapidly such as the savannah regions of Sudan where the difference between day and night temperature can reach 20°C and more, which happens mainly due to positions of these areas situated close to deserts, where there is a lack of clouds that would keep the temparature high during night. In other parts the average temperature stays moreless the same every month.

In Africa as continent there is not a high occurrence of monsoon rainfalls which bring needed water supplies for a sufficient and effective cultivation of agricultural crops. Nevertheless, this phenomenom occurs, albeit unevenly, in the western region of this continent, because it lies close to the equator, but it is not as useful and positive as it is for example in South-East Asia. Rainfalls in West Africa are very instable and unpredictable and therefore not very favorable for effective soil management. Thus, due to high temperature and and high variability of rainfalls the balance of soil and water is highly insufficient and it causes African soil to dry rapidly. As a result Africa suffers from drought. For instance, the region of Sahel which is situated predominantly in the western region of the continent is flood with drought and infertility of soil which lead to hunger problems and food insecurity.

Moreover there is a lack of water supply in the whole area of African continent. Due to this fact only 4 % of all African soils are irrigated. In general very significant areas of West Africa create rainforest zones. Furthermore, these regions struggle with very high temperatures, aridity and fragility of soils and extremity in precipitation which make this location very vulnerable and prone to nutritional problems, hunger and food insecurity. One of the crops that can adjust these harsh humid tropical conditions is cocoa which is cultivated in the region of West Africa.[76] Coastal countries have better agricultural possibilities because they are situated in the proximity of The Atlantic Ocean and their climate is more agriculturally and ecologically favorable and that is also why majority of trade and business opportunities are situated there.

2.1.1. The geographic issue of Sahel

This area is described as a semi-arid situated between dry Sahara desert and wet climate of tropical African part of southern Sahara vulnerable and prone to many natural changes. The region of Sahel has come through periods of long-lasting drought in the history, notably during the years of 1960–1980. Even though a process of regeneration was partially

successful there is still a lack of water. The area of Sahel as well as the whole area of West Africa depends mainly on agriculture and with the issue of rapid changes in climate it is highly difficult to cultivate needed crops.[5]

In general the climate of Sahel has been always specific for its extreme variability in rainfalls. These changes have impact on the overall security of the region. There is a need to construct solid policies and models to be able to prevent insecurity problems correlated with climatic changes and to be able to predict these changes more efficiently and in advance.[46]

2.2. Agricultural performance in West Africa

West Africa is a region with many natural riches and possibilities and yet it stays one of the poorest regions of the world. Agriculture is the spine of development and economy in the region as the agricultural sector represents 60 % of the labour force and 35 % of the GDP which is a pattern typical for less developed regions. With such high numbers the agricultural sector is presumed to provide food security and broad-based economic growth however there are many challenges that this sector has to face. Some of such challenges are poor lingages between the market and the farmers, limited or no access to seeds and high-quality fertilizers and agricultural technologies and techniques that are old and ineffective. Next we note a lack of information that would spread the awareness of different, newer and more innovative agricultural methods.[55]

Approximately one third of african land is used for agricultural purposes out of which one third serves for agricultural production and the other two thirds are used for pastoral and rangeland purposes. Crop production is usually situated in more favourable areas regarding agro-ecological conditions, population densities, infrastructure and market. Water availability plays an overrearching role in determining production potential. Most crop production takes place in the humid and semi-humid areas. The coastal areas are more suitable for food production as they offer better water resources. In the coastal zones, which are more humid, crops such as coffee, cocoa, rubber or palm oil are cultivated. Next vegetables, mango, maize and pineapples are grown and cropped in the humid area.

On the contrary the semi-arid or arid zones of Sahel are usually used for livestock and cattle. Furthemore, some crops are also cultivated there among which we can name millet, sorghum and irrigated and rainfed rice.

The Middle Belt has a more various production as we can find there oilseeds, maize, cotton, mango, beans and citrus fruits along with abundant pastures resources resulting in production of cattle.[11]

2.2.1. Agricultural production of crops

This subchapter will deal with agricultural production trends of crops. Throughout the past 30 years the region of West Africa experienced an agricultural production growth faster than anywhere else in the rest of the world. If we take into consideration that the average annual global rate of agricultural production growth is 2.2 % and West Africa managed to reach 3.9 % we come to a conclusion that this number is high above average, and thus represents a very positive trend. While experiencing such rapid increase West Africa has tripled its agricultural production over the last 30 years. To support this fact we can look at the statistics where Ghana and Burkina Faso holds 6^{th} and 5^{th} places in regards to agricultural production growth rate when compared to other 136 countries across the world. Next to be named are Mali, Benin, Niger and Nigeria which still belong to the best 25 producers worldwide in regards to their annual growth rate of production. Moreover, the cereal which is the most frequent element of food consumption has grown even faster. Nine West African countries are among world's top 20 producers of cereals in terms of annual growth rate which amounts to 3.8 %. However, the overall agricultural performance has been uneven when comparing different countries of the region. Some of the regional countries did not achieve such success over the last 30 years. Those countries have been often impacted by conflicts and instabilities. Liberia, Mauritania, Cote d'Ivoire, Sierra Leone and Chad have noticed the slowest agricultural growth in the region, however, the last two named have been able to improve their situation and reached a production growth rate even higher than the average one in the region between 2000-2010.

According to FAO the average minimum energy requirement per person is 1800kcal/person/day. In 1980 only food that would correspond to 1661kcal/person/day was available. Nevertheless, in the year 2007 the food available for consumption corresponded to 2397kcal/person/day which is highly above the needed minimum stated by the FAO. Yet there are some countries that depend almost solely on import, or at least, import contributes significantly in the quantity of food available for consumption (Cape Verde, Mauritania and Senegal). Taking into account the net imports across the region the total food energy on average amounted to 2628kcal/person/day in 2007.

Many positive transitions in the agricultural performance have occurred over the last 30 years in the region. The region has been under the pressure of high population and urban growth. As such it has been facing a necessity to improve the overall agricultural production, infrastructure and market. The ongoing demographic processes had forced the region to take steps. In the 1980's a liberalization of agricultural markets took place. Next the franc CFA was devaluated in 1994, the infrastructure has been developing and markets have been expending. These all aspects led to encouragement of the significant changes and achievements in terms of agricultural production.

In the Table 4 it can be seen the overview of agricultural production within different periods of time. Specifically analysis of volume and growth rates of main crops can be made. The total volume expressed in 1 000 metric tonnes was counted in three different time periods from 1987-2009. Annual average growth rate (AAGR) is counted in four different periods from 1980-2009 and is expressed as percentage.[51]

Table 4: Volume and growth rates of major crops in West Africa

	Volume			**Annual Average Growth Rate(AAGR)**				**AAGR per capita**
				1980-89	1990-99	2000-09	1980-09	1980-09
Crop	(1 000 metric tonnes)			(%)				(%)
Total Cereals	29 137	37 642	54 875	8,2	2,7	5,6	3,9	1,2
Millet	8 212	10 549	15 897	6	2,8	5,7	3,5	0,8
Rice, paddy	5 310	6 959	10 091	6,5	2,1	5,7	3,7	1
Sorghum	7 919	10 517	14 363	5,6	4,5	4,3	3,4	0,7
Maize	7 417	9 259	13 986	18,4	1,1	7	5,7	2,9
Roots and Tubers	38 349	88 140	124 495	4,8	6	3,9	6,4	3,6
Yams	13 470	34 287	47 862	4,7	5,6	3,8	6,9	4,1
Cassava	22 521	46 207	64 387	4,7	5,1	4,1	5,7	2,9
Oil palm fruit	9 358	11 758	13 449	1	2,2	1,3	1,9	-0,8
Groundnuts, w.shell	2 628	4 588	6 633	4,3	7,8	4	5	2,3
Fruit (excl. Melons)	10 536	15 500	18 803	2,1	4,2	2,1	2,9	0,2
Sugar Cane	4 347	4 449	5 816	0,5	-0,2	2,2	1	-1,6
Coffee	291	371	192	-1,4	2,1	-7,3	-1,1	-3,6
Cow peas, dry	1 480	2 964	4 728	6,2	5,9	6,5	6,3	3,6
Cocoa beans	1 262	1 883	2 604	5,8	5	3,3	4,6	1,9
Cashew nuts, w. Shell	59	394	1 137	9	22,9	7	16	13
Vegetables and Melons	7 208	11 804	15 779	4,2	5,2	3,3	4,2	1,5
Cotton lint	415	872	650	12,5	7	-3,6	5,7	2,9

Source: Own based work on http://faostat.fao.org/ data

As the Table 4 indicates, the volumes along with the AAGR have augmented in terms of almost every crop except for coffee, sugar cane and oil palm fruit. However the increase in AAGR per capita is not so high mainly due to rapid population growth that was accompanying the expanding trends of agriculture. The agriculture was forced to be improved

as the population has been growing. Even though the agricultural production improvement is undoubtable, the final effect was not that strong as the population has skyrocketed.

Nonetheless, the agricultural production has been able to grow slightly faster than the population growth. The output in almost every product was doubled in 1980-2000. Driven by the urban demand and rising population, the agricultural production has noticed a significant growth trend. The total population employed in agriculture sector decreased from 86 % in 1960 to 50 % in 2010, which along with the increase in overall agricultural productivity indicates amelioration in labor productivity. The annual growth rate of labor productivity has increased from -1.6 % in 1980 to 0.9 % in 2010.

However, as already said, the production growth has embodied unequal characteristics among different countries. For instance, Senegal and Niger have noticed a negative agricultural production trend of -2.2 % and -0.1 %. Senegal is a country of the highest import share (60 %) of the region. Besides, imports account for 20 % of available food in West Africa. Cereals are imported the most, and particularly rice, which accounts for 97 % of all imported cereals. Overall dependence on imports has been rather stable over the last 30 years.[51]

2.2.2. Agricultural production of livestock

The volume and growth rates of cattle were modest. The following Table 5 displays the trends in livestock development of the region. Even though, there has been an increase in every single product of the livestock showed in the table, the average annual growth rate per capita is -0.1 %, which means that every year there is less meat for every single individual. As the crop production growth rate was able to keep up the pace with population growth, meat has embodied less positive trends. Pig meat has experienced the most positive development as it grew by 2 % per capita on average between 1980 -2009.[11]

Table 5: Volume and growth of major livestock products in West Africa

	Volume			Annual Average Growth Rate(AAGR)				AAGR per capita
				1980-89	1990-99	2000-09	1980-09	1980-09
Livestock Product	(1 000 metric tonnes)			(%)				(%)
Total Meat	1 740	2 254	3 166	1,3	3	3,4	2,6	-0,1
Cattle meat	540	727	959	-2,3	3,9	3,8	1,7	-0,9
Goat meat	207	321	462	3,5	5	3	4,3	1,6
Sheep meat	133	215	322	1,6	3,2	3,2	4,3	1,6
Game meat	303	325	392	1,5	1,3	1,3	1,3	-1,3
Poultry meat	295	338	513	4,1	4,9	4,9	2,8	0,1
Pig meat	165	222	338	9	3,9	3,9	4,8	2
Eggs Primary	366	542	776	3,4	3,4	3,4	3,7	1
Total Milk	1 575	2 070	2 971	-0,4	3,8	3,8	2,5	,0,2

Source: Own based work on http://faostat.fao.org data

2.3. Food security overview in West Africa

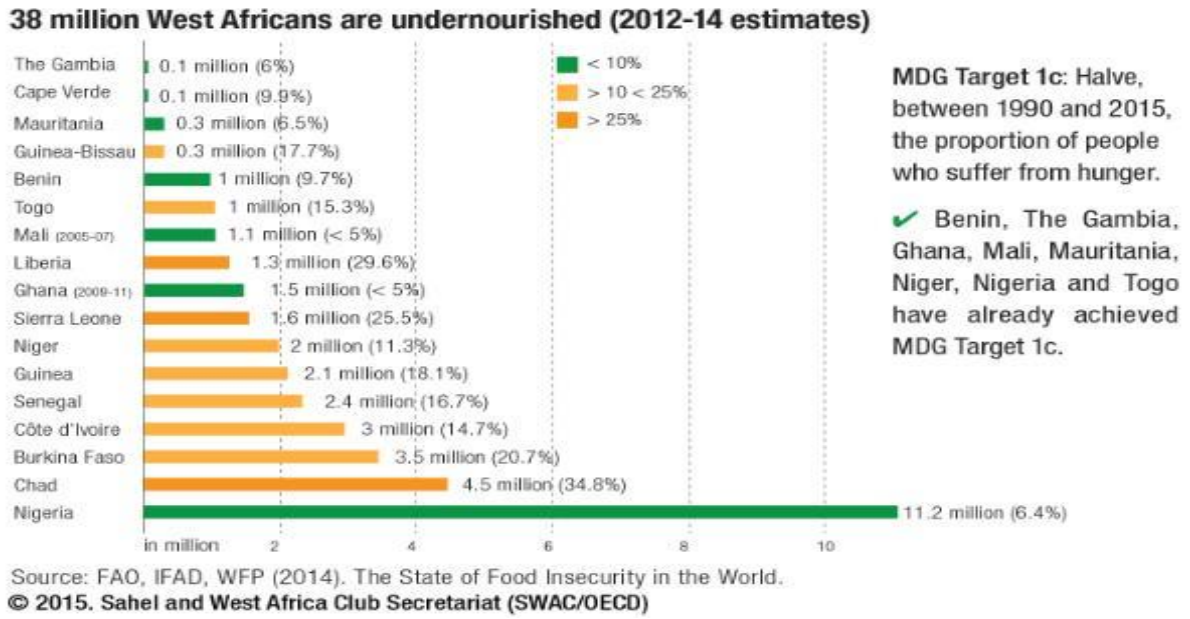
Advancements in agricultural production have had many positive impacts on the food security in the region, however, the situation remains serious. Over the past several decades the territory of West Africa has been going through many rapid transitions in the social and economic environment. These changes are closely linked with food consumption patterns. As there is a high diversity in urban areas and the availability of food has noticed an increase, consequently also the quality of diets and nutritional helthiness have been affected. Thus, throughout those years of many transitions influenced notably by population growth and urbanization, many changes in food consumption of West African countries have occurred. These changes do not always necessarily have to indicate negative patterns, in fact, they can have both positive and negative impacts on the well-being of the population that is being exposed to them. Under-nutrition and micronutrient deficiencies have always been serious issues for all African regions including the west one, but as the food production has augmented, new food-consumption-connected issues turned out. One of them is the current problem which engulfed the entire world – obesity and overeating-related diseases. With the emergement of these significant public health hassles, the West Africa is about to face many new challenges in terms of food security. In December 2015 an analysis revealed that approximately 8.1 million of residents of West Africa faced a food crisis situation out of which 5 millions were situated in Northern Nigeria due to its lack of security resulting in an instable situation. The statistics obtained while completing the analysis also unveiled the genesis of an emergency situation among 910 000 people in the areas of Chad, Niger, Mali and northern Nigeria. The estimations say that during June and August 2016 some 11 million people will inevitably face high food insecurity and 980 000 an emergency situation in this

area which indicates a profond deterioration and literally calls for implementation of appropriate measures.[8] In the next paragraphs we will further analyze the statistics of food security and hunger on the region.

2.3.1. Under-nourishment

Since 1990 undernourishment in West Africa has decreased by 44 %, however, those changes have been happening unevenly across different countries. Despite all those positive changes there are still approximately 38 millions of people who suffer from food-related issues as presented in the Figure 3 situated below. In the Figure 3 the number and percentage of undernourished residents in West Africa within the years 2012-2014 can be analyzed. At the same time it can be observed that 8 of 17 countries which are situated in West Africa have already managed to reach the MDG Target 1c which is to diminish the proportion of people who suffer from hunger between 1990-2015. This accomplishment has been achieved mainly thanks to the fact that currently West Africa belongs in the best agricultural performers. However, even though the agricultural production has risen up, there are still many people in poverty who cannot afford to buy food which is sometimes too expensive. At the same time the population growth was extremely rapid and therefore the final effect of such agricultural expansions has not improved the situation as significantly as needed, since there are still millions of people suffering from food insecurity problems.[1]

Figure 3: Prevalence of undernourishment in West Africa



Source: http://www.oecd.org/swac-expo-milano/westafrica/

2.3.2. Stunting and wasting of children

Despite much advancement in the overall agricultural situation in West Africa the levels of malnutrition and under-nutrition of children under five are still high. Specifically, approximately one third of children are stunted and one tenth are wasted. Malnutrition-linked issues persist to be one of the main causes for high child mortality rate, which was for instance enormously elevated at 153 deaths/1 000 children in the sub-region of Sahel.

However West Africa notices high differences among the coastline and Sahelian countries as well as among rural and urban areas. Malnutrition problems devour rural areas twice more than the urban ones. The same ratio is analyzed between the coastal and Sahelian countries, where Sahelian countries notice twice more undernourished children under five, than the coastal ones. 30-40 % of children under five living in Sahelian countries are stunted, while in the coastal ones the rate of stunting amounts to 20-25 %. At the same time wasting has its impacts on 11-14 % of children under five in the region of Sahel and 8-10 % in the coastal region.[56]

2.3.3. Child mortality rate in West Africa

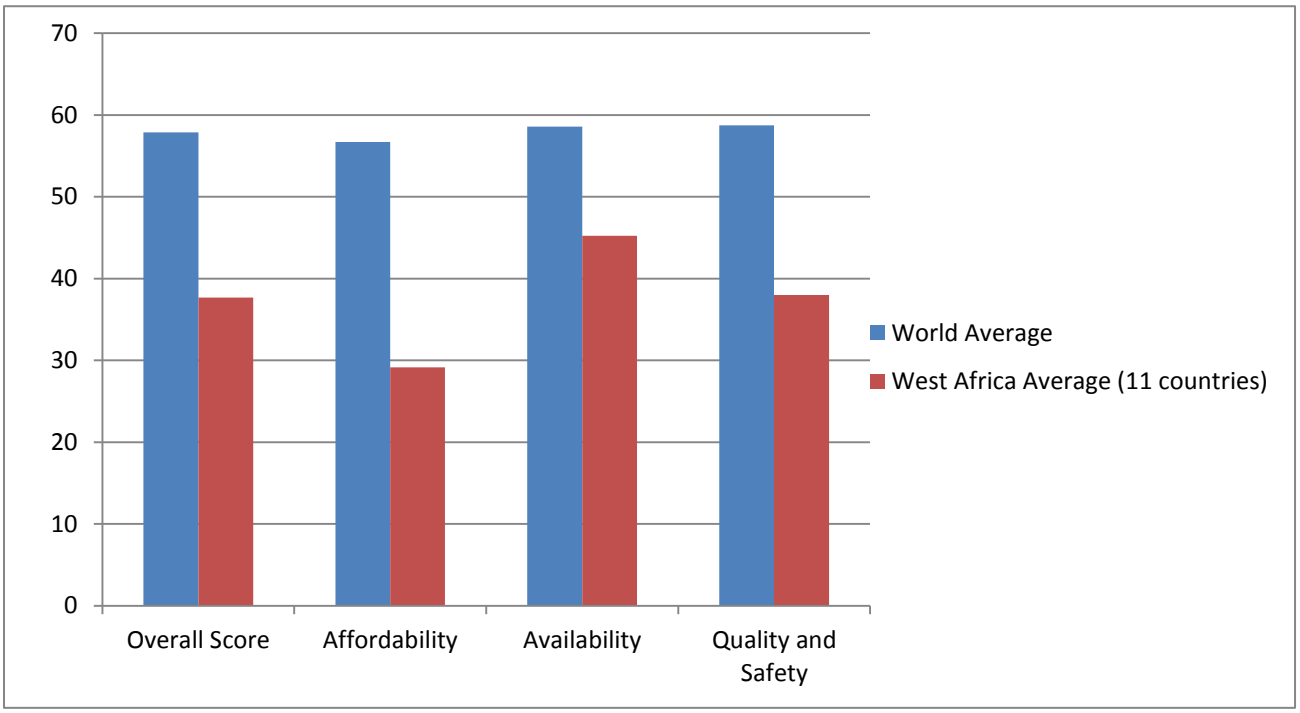
High child mortality defines the low life expectancy rate at birth of West Africa when compared with the rest of the world. Even though the infant or in other words the child mortality has halved since 1970's, it still reaches alarming numbers in some of the countries. The average child mortality rate in developed countries amounts to 5 deaths/1 000 children. While in Sierra Leone, Liberia or Niger this number comes up to 150 per 1 000 which is 30 times more deaths per 1 000 live births than in developed countries. The most convenient situation in West Africa in terms of children mortality occurs in Cape Verde where it amounts to 26 per 1,000 live births, nonetheless it is still far from the rate of developing countries.

15 % of deaths of children under five are caused by perinatal pathologies. Among next main causes we include malaria, diarrhoea, measles and malnutrition.[2]

2.3.4. Global Food Security Index of West Africa

The GFSI provides data over 11 countries of the region of West Africa. Those countries are Benin, Burkina Faso, Guinea, Ghana, Cote d'Ivoire, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. The Figure 4 situated below this text compare the West African and world averages of the overall GFSI along with three main pillars of food security

Figure 4: Comparison of Global Food Security Index of West Africa with the world average



Source: Own based work on http://foodsecurityindex.eiu.com/Index data

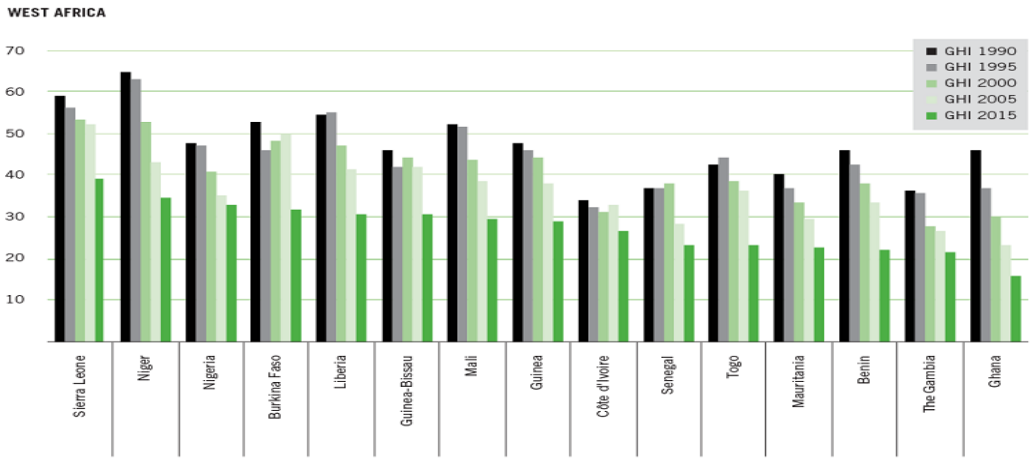
Based on the analysis of the Figure 4 we might come to a conclusion, that food security in West Africa is intensively below average. As the graph indicates, not even in a single category West Africa reaches the average world values. According to these numbers the weakest point of West-African food security is affordability which reaches approximately only a half of the world's one. On the contrary food availability in West Africa appears to attain the highest cipher out of the three measured. Nonetheless, significant shortages in food security of the region might be evaluated when scrutinizing the graph.[57]

2.3.5. Global Hunger Index of West Africa

GHI which is an index published by IFPRI analyzes the trends in undernourishment and hunger as explained in the theoretical part of the thesis. The GHI was alarming in 1990 in every country of West Africa which reflected the overall alarming hunger and food security situation in the region. Since then the situation has improved. The Figure 5 analyzes and represents the GHI over different time periods (1990, 1995, 2000, 2005 and 2015). In the Figure 5 it can easily seen, that out of 15 measured countries, 14 were able to improve their overall hunger situation betwen 1990-2000 except for Senegal. Between the years 2000-2015 every single out of 15 measured countries reached a significant achievement in hunger eradication, since all of them have diminished their GHI's.[44]

„One of the best fighters against hunger over the analyzed years was Ghana. The IFPRI said following: „*Ghana has substantially decreased its GHI scores since 1990. The country reduced child underweight and child mortality by more than 40 percent and slashed the proportion of undernourished from 44 percent in 1990–1992 to less than 5 percent in 2011–2013. Ghana is considered one of the most politically stable countries in Africa south of the Sahara and has invested heavily in agriculture, rural development, education, and health.“*[37]

Figure 5: Global Hunger Index in countries of West Africa



Source: http://ghi.ifpri.org/

Levels of hunger in each measured country of Western Africa according to scores they obtained in the GHI:

- *Alarming*: Sierra Leone (38.9)
- *Serious:* Niger (34.5), Nigeria (32.5), Burkina Faso (31.8), Liberia (30.8), Guinea Bissau (30.3), Mali (29.6), Guinea (28.8), Cote d'Ivoire (26.3), Senegal (23.2), Togo (23), Mauritania (22.6), Benin (21.8), Gambia (21.5)
- *Moderate*: Ghana (15.5 in 2015, 45.7.in 1990)

Even though an undoubtable amelioration in regards to overall hunger situation in West Africa has occurred, the situation remains serious. As an insight into the data provided above can indicate, Sierra Leone embodies an alarming situation according to the GHI severity scale. Next, majority of countries of West Africa have exhibited serious hunger situations on the severity scale. The only country which is close to the average value of the GHI is Ghana, which as cited previously, has been able to recover its hunger conditions that

were catastrophic approximately 20 years ago. This improvement has been achieved mainly as a result of long-lasting investments in every sector including education, economy, health or agriculture.[44]

2.4. Analysis of the consequences of geographic changes

Climate change

The main challenge for ensuring a sustainable food security in West Africa is the climate change. Along with climate change West Africa as well as the entire world has to face the effects of global warming. Under climate change we might imagine high temperatures, shifting seasons, extreme weather events, floods and droughts.[30] These issues have provoked many food-related problems in the past 80 years. In the time of 1930-1960 West Africa experienced a wet period, which was replaced with droughts in 1970-1980. Between the years of 1990-2000 droughts were again substitued by rainfalls. The fluctuating rainfall patterns are caused mainly by inter-tropical convergence zone, where the hot and dry winds meet with humid air masses. The region of Sahel is exposed to rainfalls patterns, that vary by more than 1 000 mm over its distance.[53] The variability of rainfalls in the region is virtually enormous and sometimes reaches between 40-80 %. The highest possibility of risk rests in the areas close or situated in the deserts, notably Sahara and Sahel. The impossibility to predict rainfalls results in the genesis of food insecurity, that may be localised due to climate differences among different areas of the region. As the rainfalls are unpredictable, the region has difficulties in assuring an effective soil management and often suffers from droughts. As these areas lie in the rural zones of the countries, the inhabitants of climatically prone zones tend to move to seemingly more favorable urban areas.[3] Even though there are several models for predicting and measuring climate change and precipitations in West Africa and Sahel, they are highly ineffective. In some of the models the rainy season is appeared 1-2 months before it actually starts. The models also miscount the quantity of precipitations over the year and their overall predictions are highly inaccurate. Only 1.5 % of land of the Sahel region prone to droughts have appropriate meteorological stations.

Facing the high degree of rainfall changes, African rivers and lakes, which represent main source of water, have been shrinking rapidly over the last 50 years. For instance, river streams of Senegal and Gambia Rivers have dropped by 60 % between 1971-1989. As the river basins are shared among the countries, a possible conflict can be launched.[53]

The climate changes have a considerable impact on food security as in some countries, yields dependant on rainfalls can be reduced by more than 50% by 2020. Agricultural production is a key to promote food security, with such a slump many people would be doomed to suffer the problems of malnutrition.[7]

2.5. Demographic and social challenges

The region of West Africa has to face several different demographich challenges wchich worsen the possibilities to ensure food security. In the following paragraphs these challenges will be further descrribed.

Population growth

First of such challenges is the population growth. The population of West Africa was counted to be 317 million inhabitants in 2007.[24] Today West Africa counts 362 million inhabitants.[86] This number means, that West Africa has a 39 % share of the whole population of Sub-saharan Africa. It is also alleged that this number should exceed 500 million of people by the years 2030-2035. The population annual growth rate reached 2.6 % in 2005 and is expected to decrease in the next four decades to 1.2 %, nonetheless West Africa is described as one of the last locations where this population growth decrease has not yet started. Many countries situated in this region have the character of a very accelerating population growth. One of the most fundamental demographic issues of West Africa holds high fertility rate in combination with declining child mortality rate. Even though fertility rate has dropped in the last couple of years by approximately 1.2 child there are still countries such as Mali, Niger, Burkina Faso and Guinea which have not noticed any improvement yet. Generally, while other regions of the globe are experiencing decline in population growth West Africa is still going through high population growth which brings many issues.[24]

The region embodies an age structure where there is a low number of elderly people with high numbers of young residents, which is a result of high fertility rate.[6]

Apart from that West Africa has to face many urban-connected troubles. Especially there has been an unprecedented growth in urban population, while rural areas have been being left and abandoned. These processes have become a real challenge for promoting development in a given area, because it has resulted in many socio-economic, enviromental and political problems. The term used for this phenomenom, when people migrate from rural

to urban areas, albeit sinificantly increase urban population is urbanization. The challenge of urbanization in West Africa will be a topic analyzed the next paragraph.

Urbanization

Urbanization in West Africa has intensified in the last couple of years. However its greatness is very variable and depends on a specific area, because some countries have experienced strong inflows of urban populations(e.g. Senegal with 46 % of urban population) whilst others have been touched by urbanisation less (e.g. Niger with 16 % of urban population). The number of cities in West africa with more than 10 000 residents has increased from 125 in 1950 to 1 000 that we recognize at this moment. The average distance between such urban areas of 10 000 and more inhabitants has decreased from 111 km to 33 km. The average rate of urbanization in the region of West Africa is stated to be 32 %, however this number is strongly influenced by Nigeria, which hosts almost half of the population of the whole area. Seven countries of West Africa reach 40 % (coastal countries) or higher urbanization, while at the same time four countries notice 25 % (Burkina Faso, Mali, Niger which are countries situated in the problematic area of Sahel) or lower rate of urban population. After which last five countries recognize urbanization rate from 25 to 40 %.

Urbanization is becoming a severe issue not only in Africa, but globally. There is need for well-structured implementation of policies and sufficient infrastructure to prevent issues that it might bring. [24]

Diseases

This part of african continent also has to face HIV pandemic, particularly in two countries Nigeria and Cote d'Ivoire.[58] Around 5 million children and adults suffer from HIV in West Africa. The worst situation can be found as indicated in Cote d'Ivoire where the prevalence reaches almost 5 %. Next is Ghana with the prevalence of 2.2 %. In the rest of the countries we count prevalence somewhere between 1.2-1.5 % of the population. In general, HIV epidemic is more serious in urban areas,where the prevalence is at least 1.3 times higher than in rural areas.[26]

Another serious challenge represents the outbreak Ebola Virus Disease (EVD) that occurred in West Africa in 2014. Mainly three countries were affected, Liberia, Sierra Leone and Guinea. The outbreak of this disease had considerable impacts on food availability of the areas.[4] As well the household incomes were affected and thus food became less accessible.

Many agricultural and informal workers noticed slump in their incomes, as the borders became closed, the export opportunities were diminished resulting in the overall decrease in the economic and labor production of those countries. Approximately 200 000 people were added to the 1.5 million people of the area that already suffered from chronic food insecurity.[34]

According to FAO 1 million of people could have faced food insecurity caused by the outbreak of Ebola over the three affected countries. FAO invested 42.5 million USD in helping nearly 1 150 000 people affected by the outbrek of EVD throught its Regional Response Programme focusing on stopping the disease, boosting incomes and production of agriculture, building resilience and reinforcing food security. [4]

Tuberculose represents next issue that West Africa has to face. This is a serious problem mainly in Nigeria where the estimated mortality of turbeculose per 100 000 population reached a number of 97 deaths.[10]

Malnutrition, malaria and persistent diarrhoeia which are next diseases occurring in West Africa are highly connected with food insecurity. Malaria is occurred mainly in Africa (90 % of cases). Nearly 300 000 children under five died in the entire Africa continent due to causes of malaria including many from the West African region.[16]

Low Human Development

Using the statistics provided by the United Nations Development Programme (UNDP) I was able to count that the average HDI in West Africa is 0.487 with an average 169th position out of 188 countries. Which means that on average West-African countries belong to the 19 worst countries in the world regarding the HDI. Niger is the last country out the entire globe holding 188th position, Mali, Sierra Leone, Burkina Faso, Guinea and Gunea-Bissau are noted among 10 worst countries along with Niger. With such numbers, countries of West Africa belong to low human development scale. Only Cape Verde which holds the best position (122nd) along with Ghana (140th) are within medium human development countries.[13]

Life expectency is due to poverty very low as it was counted that on average local residents live until 49 years. This means that majority of citizens of countries that lie in West Africa is under 30 years of age.[58]

2.6. Policies and programs focused on the development of the region

West Africa has focused significantly on the improvement of the food security situation. This fact is supported by the creation of West Africa's „Zero Hunger" goal agenda which was designed under the leadership of the Economic Community of West African States (ECOWAS), the West African Economic and Monetary Union (UEMOA) and and the Permanent Interstate Committee for Drought Control in the Sahel (CILSS). Western Africa developed several initiatives in order to support of food security in the sub-region through cooperation between these three main regional intergovernmental organizations and with support from partners and non-state actors. The Zero Hunger Initiative for West Africa adheres to the UN Secretary General's Zero Hunger Challenge that proclaims that *"hunger can be eliminated in our lifetimes"*. The sub-region is implementing the initiative to unite and encourage all stakeholders to identify their unique niches through which they can effectively contribute to food security goals in the region and to stimulate a dramatic scale-up of collective efforts. The initiative is bringing together state and non-state actors to work together to implement the regional and national agriculture investment plans. It is providing the actors with a common framework for allocating resources, monitoring progress and ensuring accountability.[27]

Economic Community of West African States

ECOWAS is a community established on 28th May 1975 and includes 15 member countries of the region. Its mission is to assure sustainable development in all fields of economic activity, in particular industry, transport, agriculture, natural resources, commerce, energy and others.[29]

The member states of ECOWAS have agreed on implementation of The Regional Agricultural Investment Programme (RAIP) consisting of six main components:

1. The overall improvement of water management consiting of advancement in water irrigation, management of invasive aquatic plants
2. The sustainable management of shared natural resources such as fish and forest resources
3. The sustainable development of farms including effective soil management, promoting better quality support services and propagation of innovative technologies
4. Development of different value chains and product processing along with the promotion of regional, national and international markets

5. Management of food crises and natural catastrophes along with the implementation of early warning systems, insurance against catastrophes and help for countries affected by natural crises and disasters
6. Institutional enhancement, support for the development of agricultural and rural policies together with effective agricultural financing planning, communication and capacity building strategies.[59]

Permanent Interstate Committee for Drought Control in the Sahel

Focused on improving the situation in the countries of Sahel the CILSS was created on 12th Septembre 1973 after long-lasting droughts which affected the region of Sahel. It gathers 13 countries. Among 13 member countries there are 8 coastal countries Benin, Cote d'Ivoire, Gambie, Guinea, Guinée-Bissau, Mauritania, Senegal, Togo, 4 inland countries Burkina Faso, Mali, Niger, Tchad and one island Cape Verde. [66]

This community is focused on national food security strategies, fight against desertification and national strategies for domestic energies. In the framework of its objectives the CILSS now works on three projects. First one is concentrated on the utilisation of alternative sources of energy. Next project which unifies almost 40 ONG's aims at eradication of droughts in the area of 9 countries of CILSS. Third project installed 1 170 adductions of drinkable water in two phases functioning on the basis of solar energy.

In terms of food security the CILSS have stated five objectives:

1. Promotion of durable, diversified, productive and regionally integrated agriculture
2. Sub-regional development and integration of sub-regions into national markets
3. Sustainable development of food security and social facilities in vulnerable zones
4. Improved devices for repeating crises linked with the construction of structural food security
5. Promotion of a sufficient food security governance[32]

West African Economic and Monetary Union

West African Economic and Monetary Union (Union économique et monétaire ouest-africaine) is an organization concentrated on the integration of economies of member states, strenghtening of competition of economic activities in an open market which is competitive in a just and harmonized environment.

Eight countries are members: Benin, Burkina Faso, Cote d'Ivoire, Guinée-Bissau, Mali, Niger, Senegal and Togo.[67]

Zero Hunger Challenge

The Zero Hungher challenge proclaims that *"hunger can be eliminated in our lifetimes"*. The main goals of this initiative are:

- every man, woman and child enjoy their Right to Adequate Food
- women are empowered
- priority is given to family farming
- food systems everywhere are sustainable

This programme indicates that every subject, medias, farmer, businessman, company, organization and institution and others in West Africa should cooperate to eradicate hunger in the region. Its main goal is to encourage every single being in order to fight against poverty and mainly hunger. Social protection, agricultural programmes and assuring nutritional quality and safety represent crucial parts of this agenda.[60]

2.7. Case study - Mali

Mali or the Republic of Mali is a continental landlocked Sahelian country situated in West Africa. Mali is surrounded by seven neighbour countries: Senegal to the west, Ghana along with Cote d'Ivoire to the south, Burkina-Faso to the south-east, Algeria to the north and Mauritania to the north-west.

Majority of the country is exposed to subtropical to arid climate with three periods: hot and dry (from February to June), rainy, humid and mild (from June to November), cool and dry (from Novembrer to February). The climate of Mali is therefore very instable and leads to lenghty droughts and infertility of soils which worsens the overall food security.

Often distinguishment between Northern and Southern Mali is made. Northern Mali is situated close to the Sahara and Sahel deserts and thus is more prone to infertility of soils, droughts and infavorable climatic conditions.[64]

The southern part of Mali is affected by more favorable conditions enabling higher amount of fertile soils and accounting for majority of economic activity. Average population density is profoundly low with only 11.8 people/km^2, nonetheless, while in the north of the country population density can decrease to less than 1 people/km^2, in the south it reaches 50

people/km^2 and more. Even though 61 % of Mali's land lie in the desert area, only 6 % of inhabitants live there. Two rivers Niger and Senegal represent a significant importance for the whole country as they offer transport, fisherie and soil irrigation possibilities.

2.7.1. Population of Mali

Mali's population ammount to 16 955 536 inhabitants estimated in 2015.[61] The population in Mali is poorly educated and follows a rapid-growth trend. Approximately 64 % of Malians are not educated. The average schooling years of adults amount to the value of 2.4 years. Reaching one of the highest fertility rates at all Mali tends to enlarge its population rapidly with the population growth rate at 3 %. More than two thirds of Malians pertain to lower positions in the population age pyramid since they are younger than 24. Due to high number of residents under 24 and a lack of education of women in terms of sexual protection the population of Mali is going to ceaselessly expand. The fact that the majority of people are economically active represents an issue for the economy of the country as there are too many people asking for a post annually.

The population increase is predominant particularly in urban areas. The migration of people from rural to urban area leads to the genesis of urbanization and large cities. For instance Bamako which is the greatest city of the country grew at an annual average of 6.1 % between 1998-2009. At the moment the city of Bamako is five times larger than the next three largest cities together. According to estimates almost one half of the population will live in urban areas by 2030. Bamako provides living to approximately 15 % of the population, yet it shares 40 % of the GDP. This indicates profond disparities between rural and urban areas. Majority of social and economic facilities are situated in the city of Bamako.[65]

2.7.2. Agriculture

Mali is a low income country with GDP at market prices of 12 billion USD.[77] Being among five world poorest countries Mali is strongly dependant on agriculture and gold mining. Exports of agricultural commodities and gold account for 80 % of its revenues. The economic activity is usually situated by the river Niger in the south which provides better conditions than the North of Mali suffering from droughts. Approximately 10 % of Malians live in a nomadic way. In total 80 % of the population of Mali work in agriculture and fishing industries. The government of Mali is focused on subsidying the production of cereals in order to decrease dependance on import of food products and to decrease occurrence of price shocks. Agriculture accounts for 38.5 % of the GDP. The main commodities are cotton, rice, corn, millet, vegetables, peanuts, cattle, sheep and goats.[61]

Agriculture of the country is confronted with drougths from 1970 and rising costs of production. The agriculture of Mali is vulnerable, lack of infrastructure and climate variations make it diffucult to ensure food security.

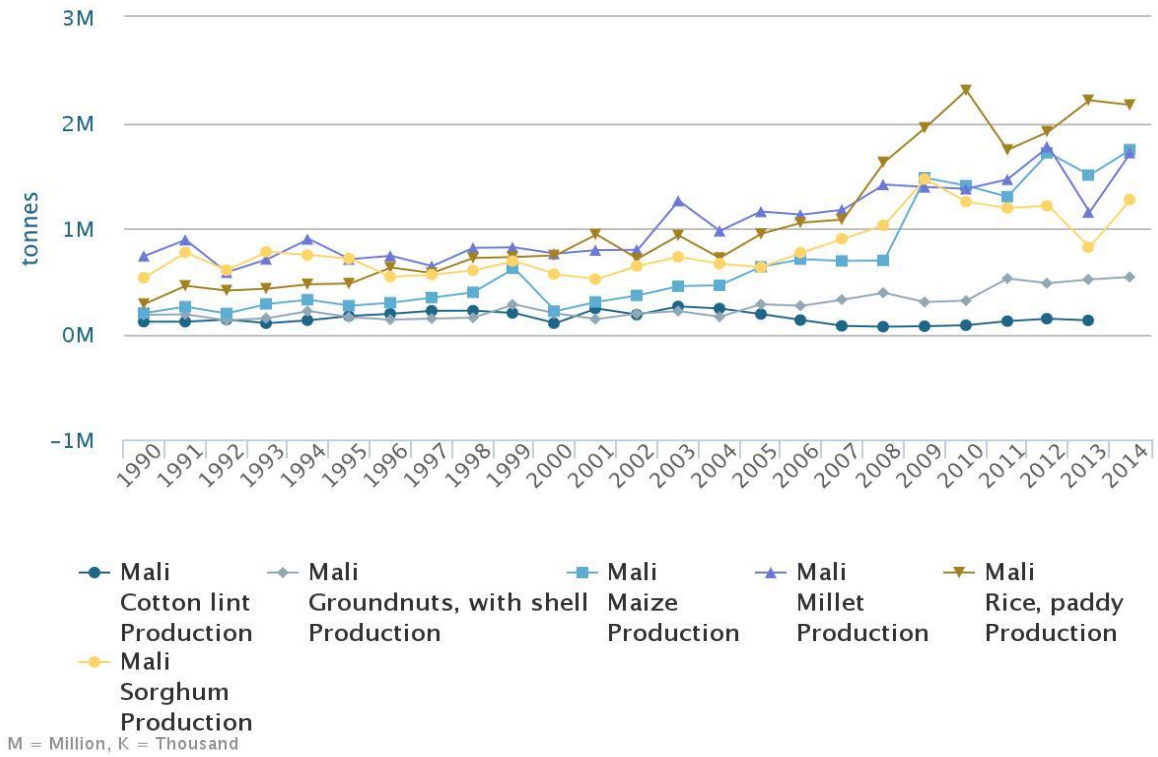
Only 325 400 ha of land is irrigated even though potentially 2.2 million ha could be irrigated in Mali. 95 % of the agriculture depend on rainfalls. Production of cereals has increased by 14 % between 2013-2014. Mali is the second greatest importer of mangos into Europe (17 000 t per year). Cotton represents 11 % revenues of exports of Mali, which is the second most exported commodity after gold (77 %). 7 % of population make their living by means of the cotton production. Figure 6 displays the trends in the production of main five crops over the period 1990-2014.

Agriculture was affected by a crisis in 2012 with islamist rebellions and a state coup which led to a decrease in agriculture. However, according to The World Bank Mali was able to overcome this crisis mainly thanks to agriculture.

Livestock in Mali contributes to GDP by 8.5 %. According to 2008 estimations 8.4 million of bovines, 10.2 million of ovines, 14.3 million of caprins and 34 million of poultry were produced in Mali. The potential of production of meat is higher than the actual trend. Mali exports meat, in particular to countries in the region. Fishing in Mali, particularly the non-maritime one represents 40 % of the non-maritime fishing of the region of West Africa with approximately 100 000 t of captured fish annually. For about 500 000 people is employed in fishing.[85]

By virtue of agricultural development the daily food energy availability increased significantly during 1980s. Slight declines were experienced during 1990s mainly due to political instabilities and conflicts in the country. However the overall food availability was on the rise starting from 1980. In 1980 the daily energy availability amounted only to 1 520 kcal/capita/day while in 2009 this value reached a number higher than 2 500 kcal/capita/day, however there is still an energetic deprivation of Malians when compared to the world.[75]

Figure 6: Production of main crops in Mali in the period 1990-2014



Source: Own based work on http://faostat3.fao.org/ data

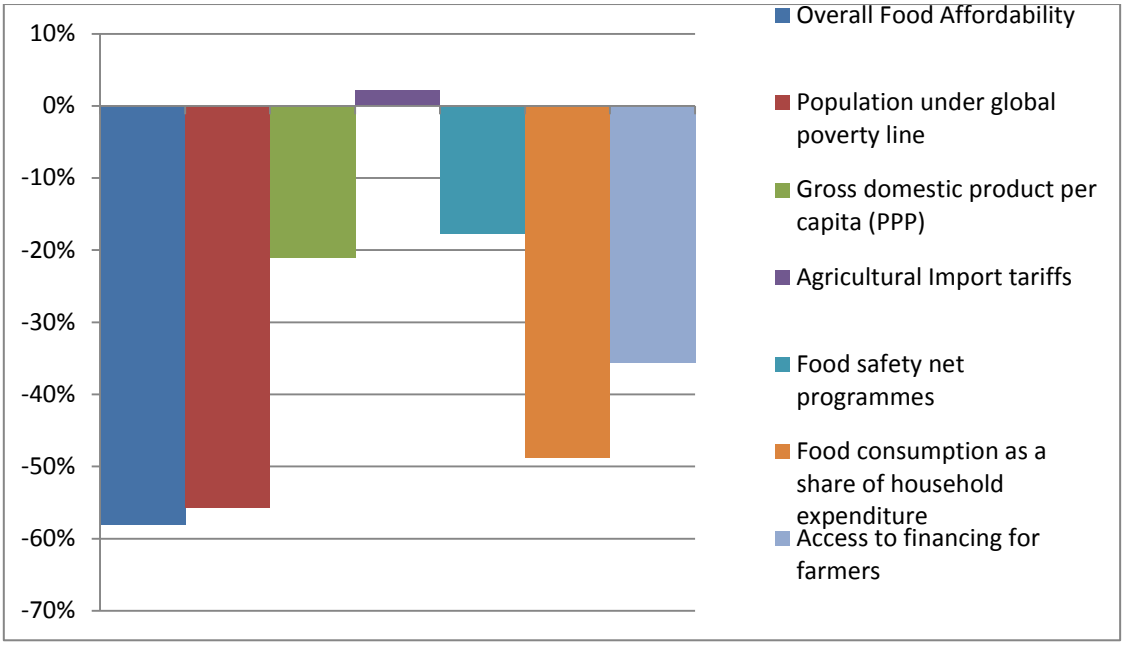
With 12.2 million ha of arable land, 30 million ha of grazing land, 3.3 million ha of wildlife reserves and 1.1 million ha of forest Mali represents a high agricultural potential, yet its agriculture is underdeveloped. Among other things we can name 2 600 km of rivers, high biological diversity and livestock which is well and easily adaptable. However the agricultural methods and tools remain outdated an ineffective and thus its potential is not fully used.[73]

2.7.3. Food security in Mali

Mali is 86th on the scale of the GFSI with the score of 38.5. Approximately 7.3 % of Mali's population suffer from undernourishment. The human development index is 0.41, which is a very low value. The intensity of food deprivation ammounts to 23 kcal/person/day. In the following subchapters the food security of Mali will be measured using the GFSI within three pillars: food affordability, food avalability and quality and safety of food.

Food affordability

Figure 7: Food affordability indicators of Mali compared to world averages (%)



Source: Own based work on http://foodsecurityindex.eiu.com/ data

Food affordability is generally low. In the Figure 7 situated above we can analyze that in majority of the indicators Mali reached much worse results than the world averages. The Figure 7 provides us with percentual differences between Mali's food affordability indicators and world averages. Mali scores 101st out of 109 countries in terms of food affordability. In terms of household expenditures, Malians spend 65.6 % of their budget on food, while world average is 33.9 %. Around 78.8 % of the population live below 2 USD per day. The world average is 25.9 %, so we can analyze that the prevalence of poverty in Mali is three times higher than the average amount. Another important indicator is the gross domestic product per capita (PPP). Concerning it includes mostly personal incomes it directly influences food affordability. The PPP in Mali is very low, which can be also estimated when looking at the proportion of people living below poverty line. The PPP of Mali amounts to 1 710 USD which is significantly low when compared to 18 558 USD of world average. Basically, it means that people reach low incomes and therefore cannot afford to buy enough food to secure their needs, thus to promote food security. However, in terms of agricultural imports, that are on average low, Mali exceptionally reached slightly better rate. Next measured dimension was the presence of food safety net programmes evaluated on a qualitative assessment from 0-4. This indicator deals with public initiatives to protect poor from food crises, existence of feeding programmes and food safety programmes in general. Mali scored

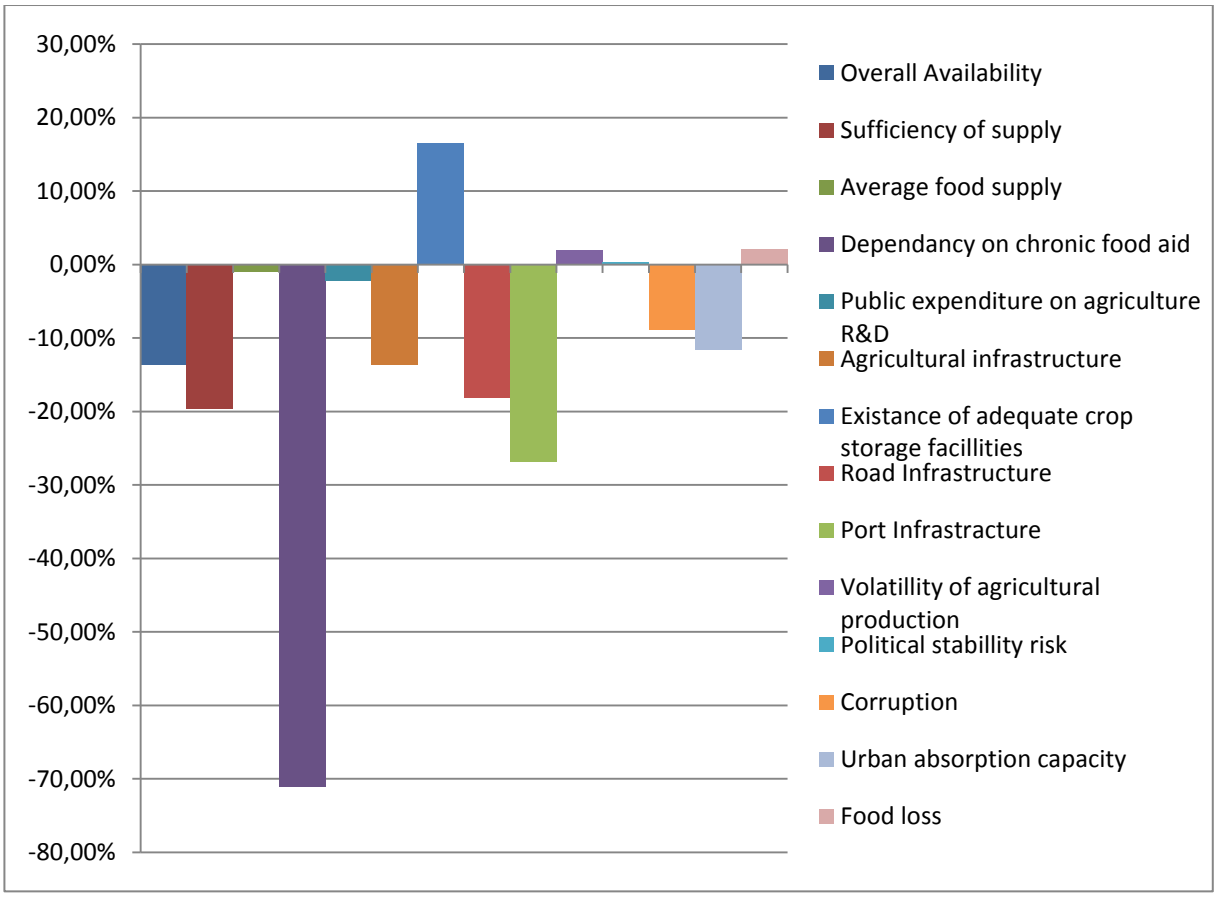
2 out of 4 which was 0.7 less than the world average of 2.7. The last measured dimension in terms of food affordability is access to financing for farmers. Again, Mali reached much lower score. This indicator considers depth and range of farmer financing.[69]

When looking at the statistics we can see that Mali embodied positive character only in regards to agricultural imports tariffs. The proportion of population under poverty line is very high and the PPP reaches significantly low numbers. Malians also spend majority of their resources on food. Making a conclusion we might indicate that food affordability in Mali is highly insufficient and should be improved.

Food availability

Food availability is without doubts more positive than food affordability since Mali holds 76th position. However, it means that Mali is still in the worst 33 countries in regards to food availability. The GFSI measures food availability within 13 different areas. Percentual comparison of the world average and Mali in terms of food availability is analyzed in the Figure 8. The first one is sufficiency of supply, which is a composite indicator measuring the availability of food through the food supply in kcal/capita/day and levels of food aid. Mali obtained 41.2 points out of 100, which is 19.7 % lower than the world average of 57.9. The average food supply which estimates the per capita ammount of food available for is 2 833 kcal/capita/day, which is sligtly lower than the world average of 2 855.4 kcal/capita/day. According to next indicator Mali is dependant on chronic food aid. The dependancy on chronic food aid measures whether a country is a recipient of chronic food aid over the last five years on an assessment from 0-2. Mali obtained 0 and is therefore strongly dependant on outter food aid, while the worlds average is 1.4, which is 71 % higher than in Mali.[69]

Figure 8: Food availability indicators of Mali compared to world averages (%)



Source: Own based work on http://foodsecurityindex.eiu.com/ data

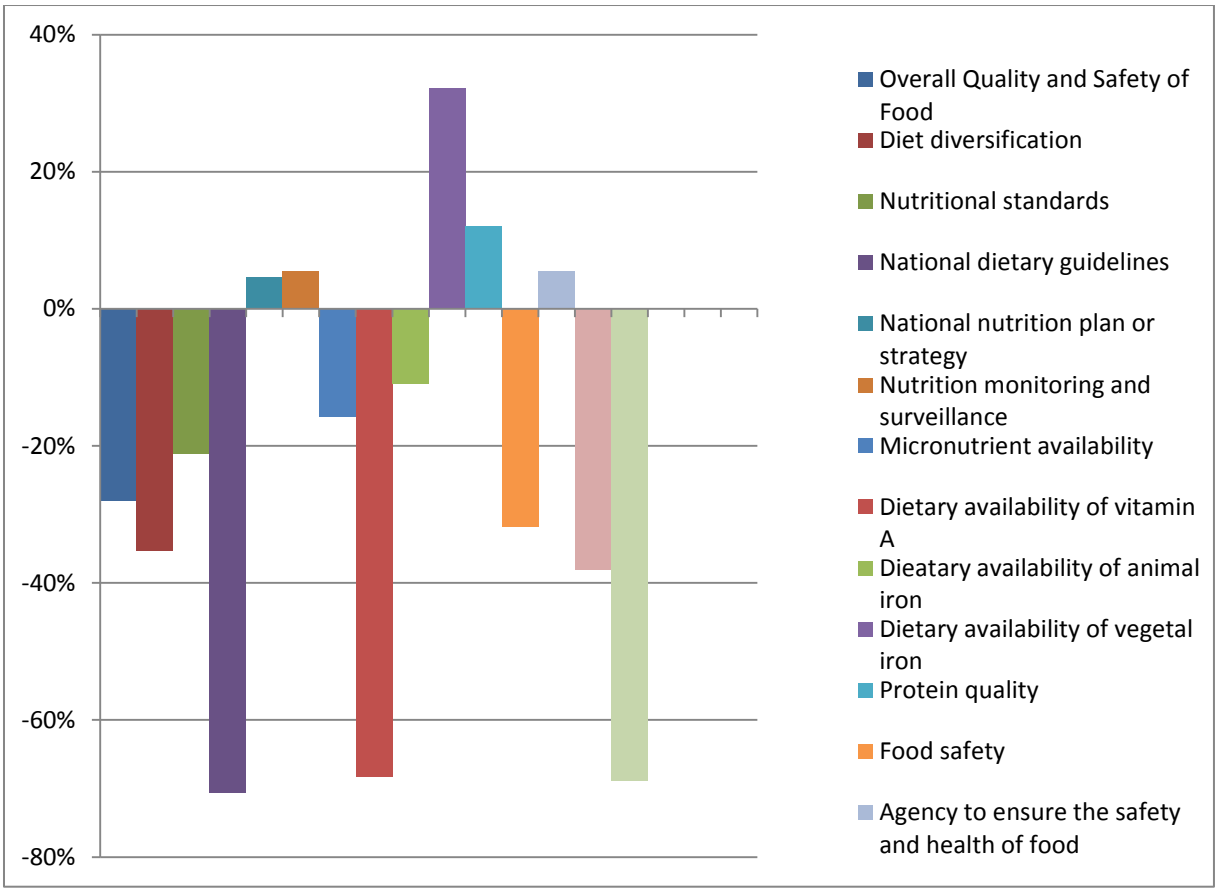
When it comes to public expenditure on research and development in regards to agriculture, the country reaches 2 points out of 9 which is not far from worlds 2.2 average. In terms of agricultural infrastracture the Republic of Mali embodies 41.7 points out of 100, which is 13.7 % less than world average. However, in terms of existence of adequate crop storage facillities Mali reached 16.5 % better score than the world average. In regards to road infrastructure the republic embodies score 1 out of 4 which is 18 % lower number than world average. Port infrastructure is even worse, since it is 26.8 % lower than world average reaching again 1 out of 4 while the world average is 2.1. On the contrary, volatility of agricultural production is 1.9 % higher than the world average. The volatility of agricultural production takes into consideration the development in agricultural production over the last 20 years and as we could see in the chapter concerning agricultural production in West Africa, it has been growing over the last 20 years with very positive annual production rates. That is also while Mali has reached quite a positive score. Among other aspects measured within food availability the political stability risk is taken into account and counted. The political stability

risk indicates general political instability and its potential to deteriorate access to food as trasportation block and decrease in food aid are often occurred when events linked with political instabilities take place. Its measurement is counted on a scale from 0 to 100 where higher value refers to higher political instability risk. Mali scored 45 which is comparable with the world average of 45.2. Corruption which is closely linked to political stability is another area measured for accurate food availability estimations. Mali scored 3 out of 4 which refers to a high corruption. World average corruption is 2.6 and therefore 8.9 % lower than in Mali. Consequently urban absorption capacity is taken into consideration. The absorption of urban population is counted as the difference between GDP and the urban growth rate and indicates whether a certain country is able to absorb the inflows of urban population while ensuring food security. Mali absorbs urban population inflows worse then the world on average by 11.7 %. Food loss is the last dimension calculated in terms of food availability. As indicated, Mali does not lose as much food as the rest of the world does on average as the total food loss in Mali was 2.1 % lower.[69]

Quality and safety

Mali is ranked as 84th country in regards to quality and safety of food. In terms of diet diversification Mali is strongly below average with its 32 % compared to 51.7 % average value. Percentual differences between Mali and the world can be seen in the Figure 9. Diet diversification considers the share of non-starchy foods in total dietary energy consumption. Nutritionals standards in Mali are lower than the world average. In regards to national dieatary guidelines Mali is worse by 70 % than the world average. This indicator measures whether the government publishes guidelines for a balanced diet. Mali proved to have almost no guidelines provided by the government. Next indicator named as national nutrition plan or strategy refers to the fact which describes whether the government designed a national strategy to improve nutrition. The value was comparable with the average world value. In terms of nutritional measuring and surveillance Mali scored 1 out of 1 on a qualitative assessment which is slightly better than 0.9 as world's average.

Figure 9: Food quality and safety indicators of Mali compared to world averages (%)



Source: Own based work on http://foodsecurityindex.eiu.com/ data

Micronutrient deficiences are significant in Mali. Micronutrient availability which measures the availability of iron and Vitamin A amounted to rating of 27.9 out of 100, while the average was 57.9. Availability of vitamin A presents a significant issue in Mali as its 68.3 % lower than on average in the rest of the world. Mali scored 0 out of 2 which refers to a situation where there is almost no access to vitamin A. Dietary availability of animal iron was counted as mg/person/day. The average amount of animal iron per day was 2 mg/person/day in Mali and 2.9 mg/person/day on average in the world. In regards to vegetal iron Mali embodied 16.7 mg/person/day which was a better value than 11.1 mg/person/day on average. The protein quality which is measured in grams is an indicator measuring the grams of quality proteins. With 65.5 gram/person/day the Republic of Mali scored better than the average of 58 grams/person/day. As far as food safety is concerned, Mali reaches 47.4 points on the composite indicator which is again lower than 57.9 in the world. In terms of another indicator refering to agencies which ensure safety and health of food Mali scores 1 out of 1 on a qualitative assessement and therefore we can conclude that agencies ensuring the health and

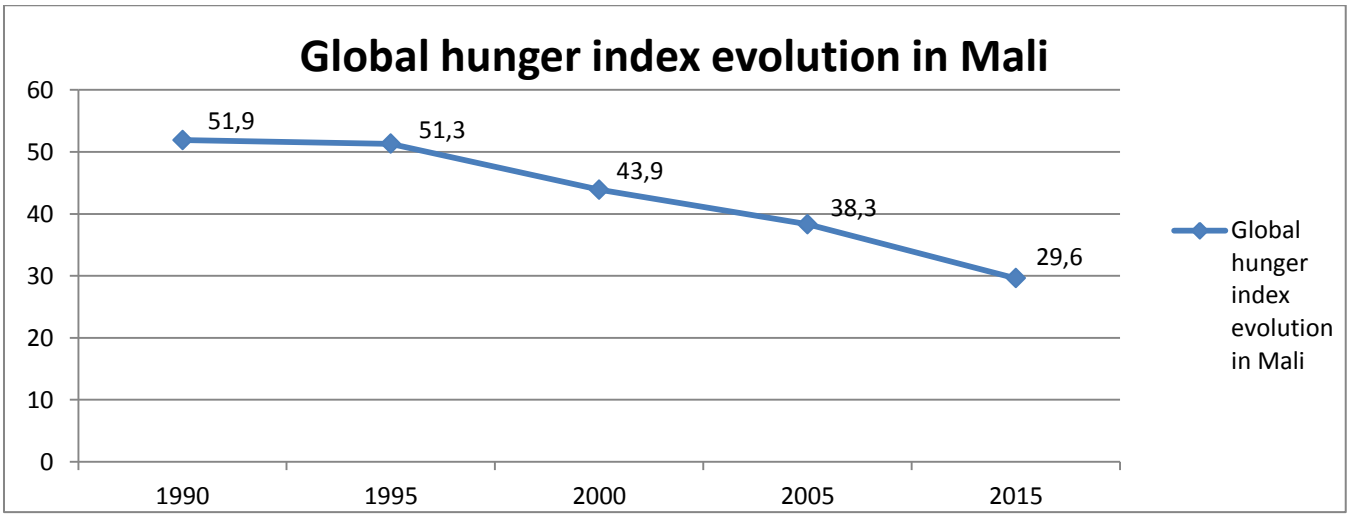
safety of food are existant within the country. However, only 54.2 % of Malians have access to potable water which is strongly below 81.2% refering to world average. As well there is almost no formal grocery sector.[69]

2.7.4. Hunger and health sitution in Mali

The overall hunger and health situation in Mali is still serious even though development has been achieved throughout the last years. The GHI score for Mali in 2015 was 29.6 which is significantly more favorable than 38.3 which Mali embodied in 2015. However, even though there has been an achievement in the hunger and undernoutrition eradication, Mali's situation is still labeled as serious. The proportion of undernourished population was 4.1 % in 2015. In 2005 10.1 % of Malians were undernourished, which indicates that in the last ten years Mali has achieved to significantly reduce this issue. Approximately 12.7 % of children under five years suffered from wasting in 2015, which was managed to be decreased from 15.3 % in 2005. Nonetheless, the prevalence of stunting in children under five is still extreme with 38.3 % of children that suffer from this problem. The achievement in terms of stunting of children has not been that crucial, since the value amounted to 38.5 % in 2005 which indicates an amelioration of only 0.2 % throughout the last ten years. The under five mortality rate was decreased from 17.2 % in 2005 to 12.3 % in 2013.

In the Figure 10 situted below we can analyze the evolution of Global Hunger Index in Mali from 1990-2015.

Figure 10: Global Hunger Index evolution in Mali



Source: Own based work on http://ghi.ifpri.org/ data

The Figure 10 situated above allows us to realize that the overall hunger and nutrition situation has developed in a positive manner throughout the last 25 years. The value of the GHI was somewhere at 52 which signifies a great success when compared to the value of 29.6 in 2015.[82]

Nonetheless, the situation in Mali remains serious. The median age of Malians is due to high fertility along with relatively high mortality rate only 16.1 years. With the population growth rate at 3 % together with birth rate of 44.99 births/1 000 population it is hard to control the overall food and health situation of the country. In addition to that, on average 13 persons out of 1 000 die every year, which places the death rate of Mali among the worst in the world. 40 % of the total population was urban in 2015 and this number rises. Maternal mortality rate amounts to 587 deaths/100 000 live births which places Mali among the worst 18 countries in regards to this indicator. Malians are third in the world in terms of giving birth with 6.06 children per woman on average. Health expenditures contributes only by 7.1 % to the GDP. Furthemore, only 0.08 physicians are available per 1 000 population. As well the hospital bed density is really low with only 0.1 beds per 1 000 population. One quarter of Malians do not have access to drinkable water. In total, only 24.7 % of the population have access to sanitation facilities. The diversities between rural and urban areas are crucial. Only 64.5 % of rural population have access to drinkable water, when compared to 96.5 % of the urban one. In regards to sanitation facility access, the diversities between rural and urban population are enormously high, access of urban residents amount to 37.5 % whilst the access of rural people accounts only for 16.1 %.

The prevalence of HIV is high with 133 400 people living with HIV, which accounts for 1.42 % of the entire population. 5.7 % of Malians suffer from obesity. There is also high risk of infectous diseases. In 2011 16 % of deaths of children under five was caused by Malaria. Pneumonia accounted for 23 % of deaths of children under five, diarrhoea caused 22 % of their deaths and prematurity caused death in 8 % of the cases. 1 323 cases of cholera were recognized in Mali in 2011. Among other diseases we notice a high risk of bacterial diarrhoea, dengue fever, hepatitis A and meningitidis. Many of those diseases are caused by food and water inequalities and insufficiencies. With low diet diversities, limited access to water and health facilities along with nutritional deprivation Mali is prone to health and food insecurity issues.[61]

2.7.5. Food security policy in Mali

Mali is a member of ECOWAS and its common agricultural policy. Next, Mali also cooperates with the programme PNIA (Programmes Nationaux d'Investissements Agricoles) concentrated on the improvement of agriculture, food security and sustainable developement along with strenghtening vulnerable population. In 2006 Mali effectuated laws oriented on enforcing agriculture and food security. Another organization AAFEX (Association Afrique agro export, groupement d'Entreprises africaines Exportatrices de produits alimentaires) has launched several missions in Mali on improving and reinforcing its agricultural exports.[85]

In the period of 2005 and 2010 every producer except for those producing cotton received prices lower than they might have if an effective policy had been applied. The cotton producers are strongly supported by the government, however, the domestic prices of cotton have become higher than the international market prices.

More than 25 % of government budget concentrated on agriculture is spent on rice, mainly then on irrigation and input subsidies. This led to increase in production. However, the price incentives of rice are not appropriate for the producers. This happened mainly due to lower import taxes and decrease in retail prices to prevent consumers from food crisis.

Moreover, producers in Mali are not aware of the value their products have, since they lack education and information. That is why the effect on rice production was not very strong and positive.

When it comes to producers of sorghum and millet, which are important crops in Mali, we observe that they receive very low prices of their products. Export of this products is restricted by government to assure food security. Additionally, government does not invest money in production and ensuring better opportunities on the market. Only a small share of govermental budget is used for food aid.

Cattle in Mali represents a very high potential and is the commodity the most exported in Mali, yet the cattle sector receives only 10 % of the agriculture specific budget. Thus, the potential of cattle remains rather untouched due to lack of policy.[71]

2.8. Case study - Senegal

Senegal is a West-African country located in the west of the Sahel region. Senegal borders the Atlantic Ocean and is situated between Guinea Bissau and Mauritania.[74]

Majority of this country lies in a tropical climate, however the north part is situated in the Sahel region. Even though Senegal has a variety of soils, many are prone to erosion and physical effects. As the rest of West Africa, also Senegal has been experiencing climate changes. Being a part of the Sahel region, Senegal noticed a decrease in rainfalls during 1970-1980 leading to droughts, scarcity of water and food insecurity.

Variability of climate in Senegal represents two main hazards which are drought and floods. Since this country is dependant mainly on agriculture as the majority of African countries, climate change representsa strong challenge.

2.8.1. Population of Senegal

The population of Senegal is approximately 14 550 000. The density of population amounts to 74 people/km^2. More than 20 % of Senegalese live in the capital Dakar where we therefore recognize the highest urbanization of the country.[68]

Senegal embodies a high fertility rate at 5 children/woman which causes its population to grow rapidly. Moreover, the population becomes young as the median age is only 18.5 years.

According to surveys only 54 % of children attend elementary school and 28 % secondary school. The total fertility rate differs when comparing urban and rural areas. While in urban areas women give birth to approximately 3.9 children, in the rural teritorries this number amounts to 6 children. Differences are also recognized in terms of children mortality in urban and rural areas. The average child mortality rate of Senegal is 47 deaths/1 000 births. The under five mortality is 72 deaths/1 000 children under five. While in urban areas the under-five mortality rate is 62 deaths/1 000 children under five, in rural areas 102/1 000 children under five.[70]

Approximately 54.8 % of population is rural while 45.2 % live in urban areas. The unemployment rate is 25.7 %, which means that one quarter of the active population does not have a stable post. Senegal being a low developed country hosts many residents living below poverty line. Around 47.6 % people live below poverty line. With the population growing rapidly the rate of urbanization has been skyrocketing. Urbanization rate of Senegal is one of the highest not only in the region but also in the world. As already said in the first paragraph, approximately 20 % of the entire population of Senegal live in the capital Dakar. While in 2002 the urban population accounted for 40.7 % today we count 45.2 % and this number is

growing faster and faster. It is predicted that by 2020 55 % of all Senegalese might live in the cities. The outbreak of urbanization leads to creations of slums which are becoming overcrowded, low access to job, serious problems in terms of health, infrastructure, transport; sanitation, energy supply, waste and water management. Furthermore, the environment is being exploited, forests are becoming deforestrated and green places are disappearing. This all stated together represents a significant challenge for food security.[79]

2.8.2. Agriculture

Agriculture and fishing represent 15 % of the GDP and employs 70 % of the active population in Senegal (4.51 million agricultural workers out of 6.55 million active residents). Nonetheless, 30 % of settlers and rural agricultural workers live below poverty line and suffer from hunger and food insecurity.[72] The agriculture is rather seasonal with only 5 % of land irrigated. Climate changes along with decrease in soil fertility and devastation have significant impacts on the production. Most favourable agricultural conditions are found along the river Senegal, where the most populated areas are situated.

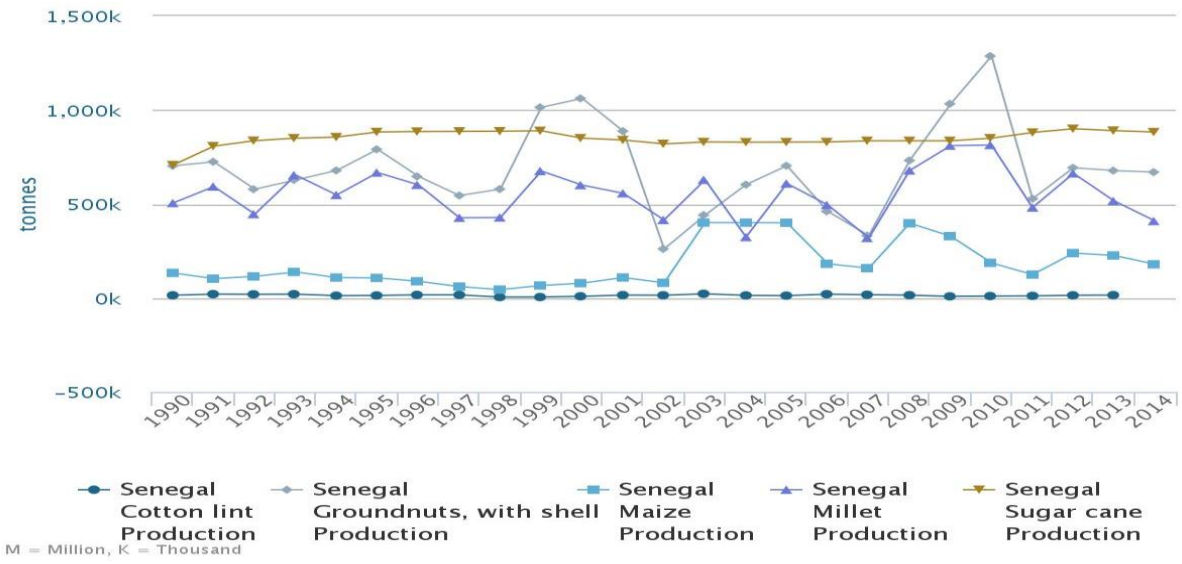
Senegal represents 14 % of exports of the UEMOA. 36 % of all exports of Senegal stream from agriculture. 57 % of the rural population is employed in agriculture. 95 % of agriculture is dependant on rainfalls (only 130 000 ha out of 350 000 ha that could be potentially irrigated are actually irrigated). Only 5 % of the underground water is used, usually for purposes of drinkable water for the population. 90 % of agriculture in Senegal is familial without access to information and technologies.

Peanuts cover 41 % of the cultivated areas. As such, peanuts represent a source of income for rural areas. It is estimated that one third of the entire population of Senegal live directly or indirectly of peanuts (consumption, income). However, the peanut production in Senegal is decreasing with issues including production of peanut oil. Cotton is of lower importance with 33 000 t produced in 2013 and represents only 1 % of total exports of Senegal. Next, sugar cane production mounted to 600 000 t in 2012, exploits about 100 000 ha of land and provides 100 000 t of sugar for local market. Production of sugar is supposed to augment in the upcoming years up to 140 000 t to cover the needs of the population. Fruits and vegetables represent 3.4 % of exports (mainly into the EU). The major fruits and vegetables are melons, cherries, tomatoes, maze, mangos and onions for instance.

50 % of the cultivated area is represented by cereals (64 % Millet, 10 % rice and 14 % maze). Production of cereals in Senegal has decreased by 20 % in the last 5 years mainly due

to lower productivity. Rice is the most imported product after petrol with 902 000 t imported in 2013. Rice wise, Senegal is dependent by 75 % on the imports. At the moment Senegal aims at increasing its rice production by 2017 in order to provide better food security. Figure 11 displays the production of main crops in the period of 1990-2014.

Figure 11: Production of main crops in Senegal in the period of 1990-2014



Source: Own based work on http://faostat3.fao.org/ data

Livestock has gained more of the attention from the government as it has a potential to improve the economy and food security of Senegal. In total 15.4 millions of ovines (19 000 t of meat), caprines (13 000 t of meat) and bovines (87 000 t of meat) were held in Senegal in 2011. Protected by interdiction of import of poultry, its production has increased significantly from 29 000 t in 2005 to 65 500 t in 2013. This step has helped in providing more poultry for the food security purposes in Senegal.

Since Senegal lies on the seacoast, fishing represents high significance. Approximately 450 000 t of seafish meat was produced in 2012. About 400 000-500 000 t of fish is caught in Senegal annualy. 11 % of exports of Senegal is coming from the fish industry, representing 1.8 % of GDP. Approximately 220 000 people are employed in fishing. 35.4 kg of fish meat per person is annually consumed on average in Senegal.[15]

Consumption in Senegal accounts for 370 kg of food per year which is on average twice less than in developed countries. 163 kg of the entire diet creates cereals. Most importantly rice, maze, wheat and sorghum. To ensure better food security, the agriculture of

Senegal is based preliminary on producing cereals (in particular rice), which are the most important substances of the diets of Senegalese.[62]

As already mentioned, rice is the most important element of the diet of Senegalese. The production of rice paddy was 436 000 t in 2013 which was less than 604 000 t in 2012. These changes in production are correlated with the unpredictable variations of rainfalls and climate. Nonetheless, comparing 232 000 t in 2003 and 436 000 t in 2013 we might analyse that the overall production of rice has been on the rise.[80]

Even though the production has increased over the last 20 years, it is still not sufficient and according to estimation it covers only 25 % of needs to ensure better food security. With 80 kg of rice eaten by a citizen of Senegal per year on average, the consumption of rice in Senegal is one of the highest in West Africa. That is also why Senegal has to import high amounts of rice. In 2013 1 million t of rice was imported mainly from Brasil and Thailand to better cover the needs of its population. Senegal is the second biggest importer of rice in Africa.[15]

In regards to livestock, the production of meat was evaluated to approximately 190 000 t in 2012. Mainly then Senegal produces cattle and poultry.[78]

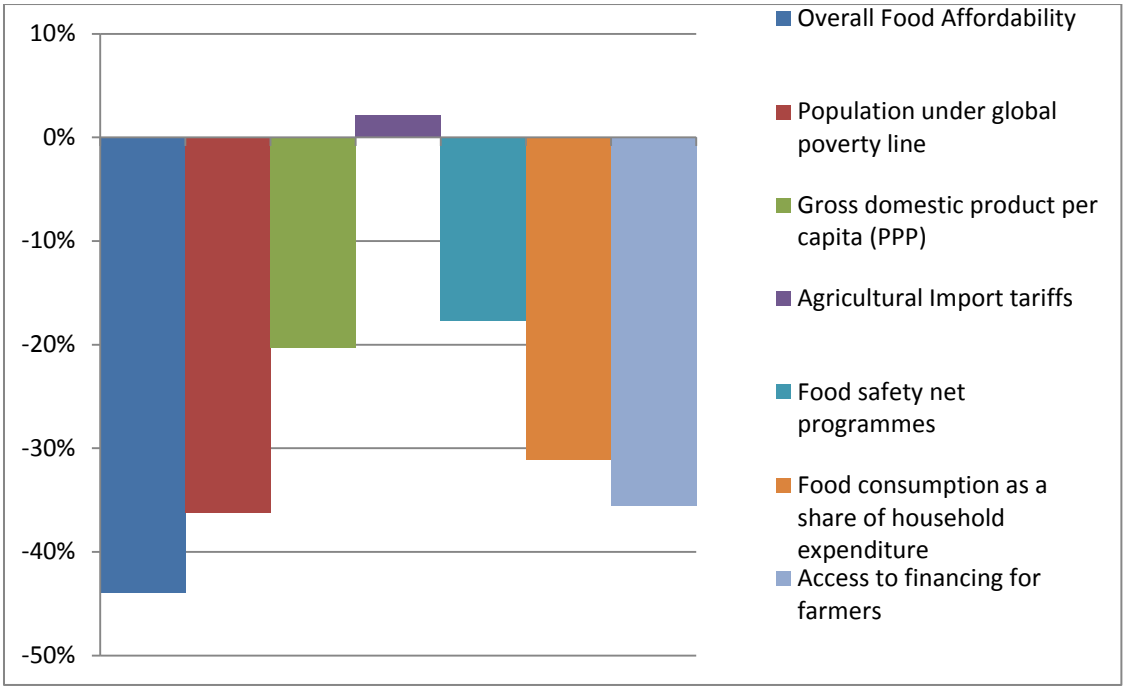
Since Senegal lies on the seacoast, fishing represents high significance. Approximately 450 000 t of seafish meet has been produced in 2012. Fish, along with peanuts and cotton are the most exported. On the other hand, cereals and oils are the most imported.[63] Rice and wheat are the most imported commodities. It is mainly due to its importance in terms of food security. With growing population also the consumption grows, thus it is necessary to cover basic needs of population. Furthemore, in 2014 the prices of rice and bread were fixed in order to promote better affordability.[81]

2.8.3. Food security in Senegal

Senegal is 80th out of 109 countries according to the Global Food Security Index. This number indicates that Senegal is rather insecure in terms of food security within its pillars of affordability, availability and quality and safety of food. The food deprivation of Senegalese amounts to 108 kcal/person/day. The HDI is very low at the value of 0.49.

Food affordability

Figure 12: Food affordability indicators of Senegal compared to world averages (%)



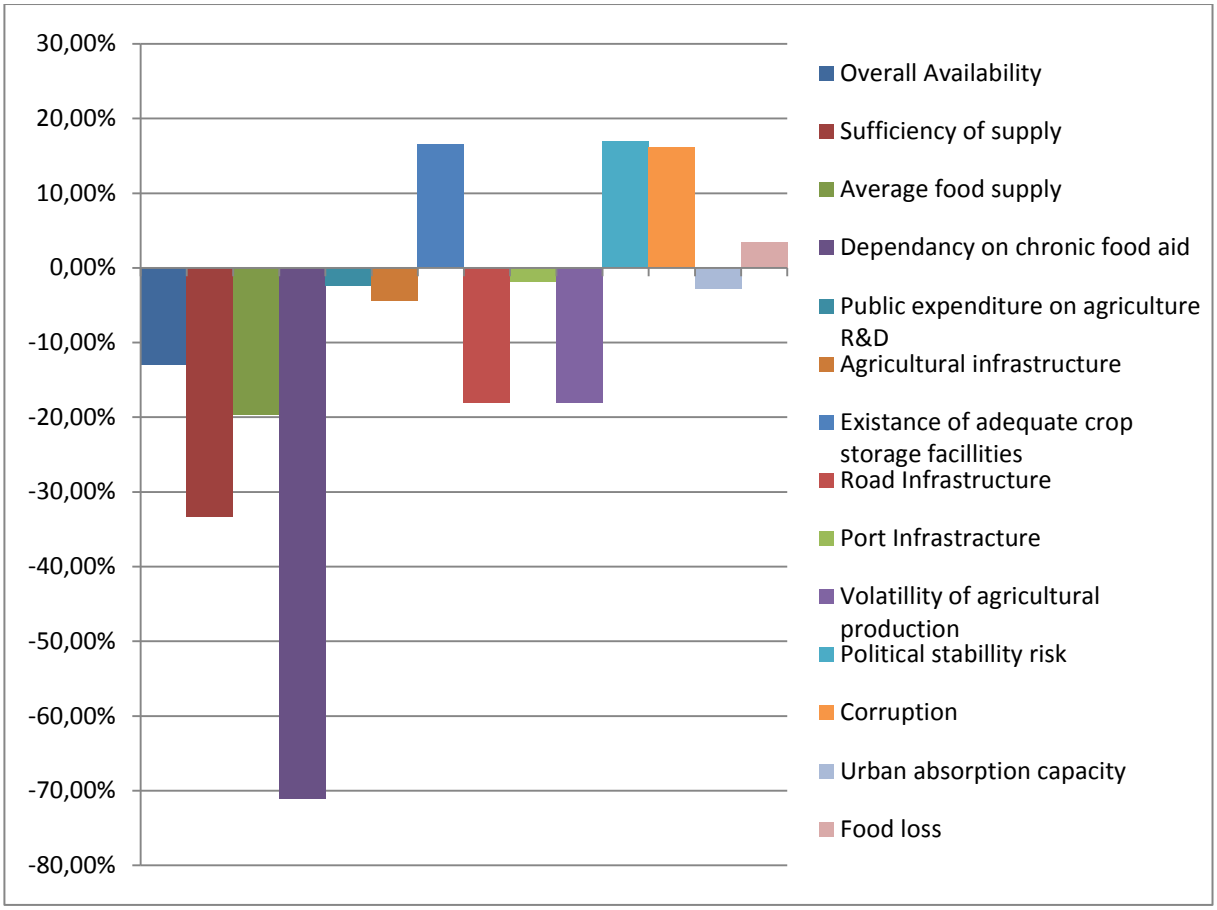
Source: Own based work on

http://foodsecurityindex.eiu.com/Country/Details#Senegal

Senegal is 88th in terms of food affordability which places it among the worst countries. To measure food security I used the GFSI as well as in case of Mali. Figure 12 demonstrates the percentual differences in food affordability between Senegal and world averages. Senegalese spend 54.2 % of their capital on food. World average is 33.9 % in this case, therefore Senegalese spend much more on food. 60 % of residents of Senegal have to live with less than 2 USD per day. The gross domestic product is very low at 2 310 USD per capita. As well as in Mali, the import tariffs are not high for those who aim at importing to Senegal. However, the occurrence of food safety net programmes is 17.7 % lower than the world average. Access to financing to farmers is 35.6 % lower than the world average. Based on these results we might conclude that food is not very affordable in Senegal. Majority of people spend almost all their budget on food, which intensifies poverty and food insecurity. Programmes of nutritional guidelines are inexistent and there is not enough financing on agriculture.

Food availability

Figure 13: Food availability indicators of Senegal compared to world averages (%)



Source: Own work based on http://foodsecurityindex.eiu.com/Country/Details#Senegal data

Figure 13 displays the comparison of Senegal‘s values with world averages in terms of food availability. Food availability reached the best score out of the three placing Senegal at 73rd position out of 109 countries. Refering to sufficiency of supply Senegal reached 27.5 %, which is much lower than world average of 57.9 %. The average food supply in Senegal amounts to 2 426 kcal/capita/day which means a food deprivation of 430 kcal when comparing to world average food supply. Senegal is also highly dependant on food aid as it reaches 0 on a qualitative assessment in terms of food aid dependency. Public expenditure on agricultural research and development amounts to 2 out of 4 which is comparable with 2.2 world average. The same can be said about agricultural infrastructure indicator which reached score 50.9 in Senegal and 57.9 on average in the world. Similarly as Mali, also Senegal is very well capable of storing crops which was found when calculating existence of adequate crop storage facilities since it reached 1 out of 1 on a qualitative assessment. On the other

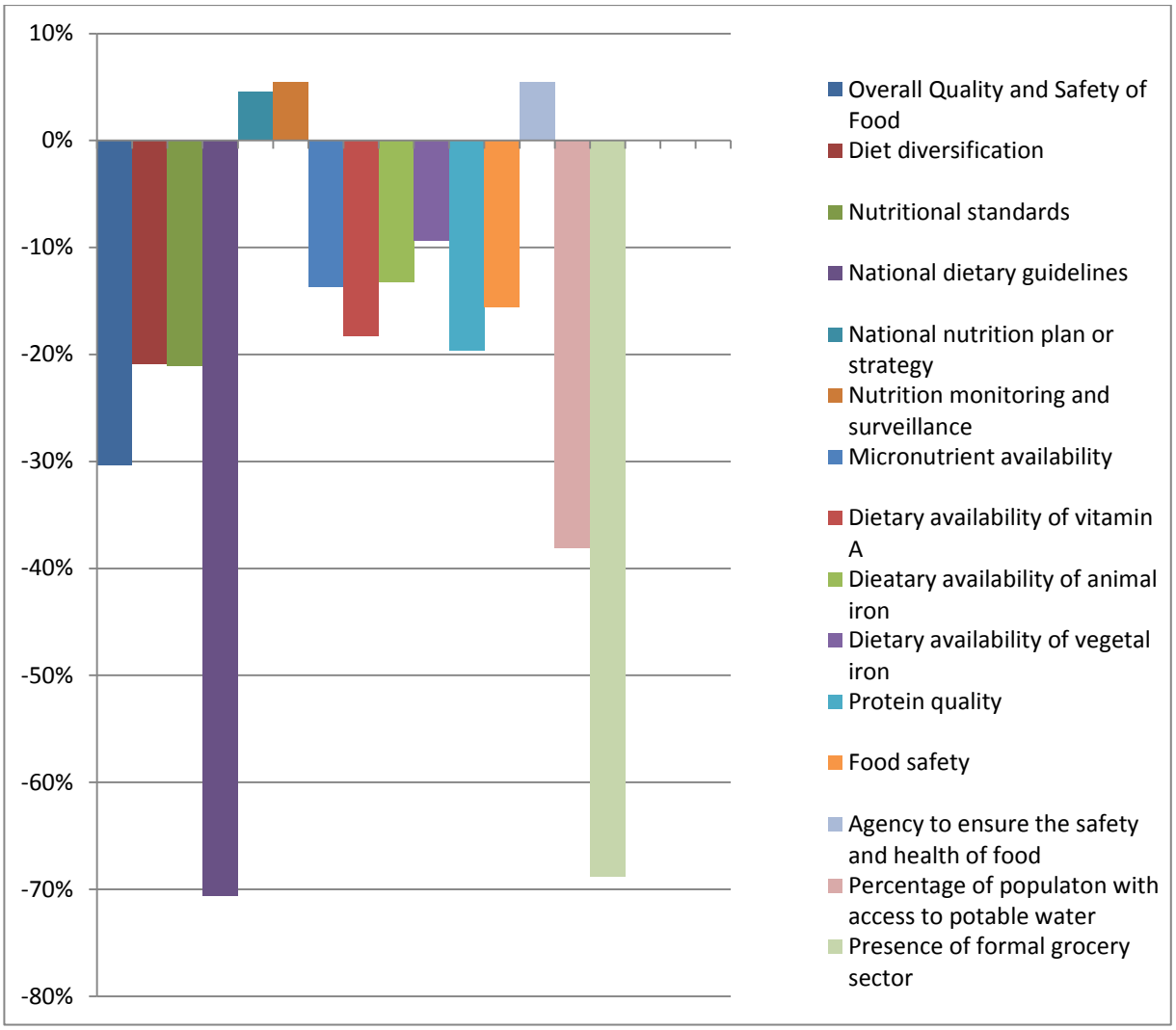
hand, road infrastructure is worse than world average by 18.1 %. Port infrastructure is comparable with world average when being less favourable only by 1.8 % in Senegal. Unlike Mali, volatility of agricultural production is worse in Senegal than the world average by 18 %. Political stability risk rate is 30 % in Senegal which represents a more favourable trend than 45 % average in the world. Corruption in Senegal embodies also rather positive characteristics. Urban absorption capacity is slightly worse than in the world. The GDP (percent of real change) minus urban growth rate generates 0.77 %, world average is 1.2 % in this case. The average food total lost in Senegal is 4.3 t which is better by 1.1 t when comparing to world average.

According to the data we might conclude that the food is not available enough in Senegal. High shortages were analyzed mainly in sufficiency of supply, agricultural volatility and similarly as in the case of Mali also in dependancy on chronic food aid.[83]

Food quality and safety

Senegal placed 87th in terms of this pillar of food security. Characteristics of the food quality and safety and its percentual comparison with world average value of different indicators can be seen in the Figure 14 situated on the next page. The commitment of government to increase nutritional standards is lower by 21.1 % than in the world. Furthermore, there are almost no national dietary guidelines in Senegal. National nutritional plan or strategy assessment was comparable between Senegal and the world average. Regarding nutrition monitoring and surveillance Senegal scored 1 out of 1 on the assessment, therefore, we can deduce that the government monitors the nutritional trends in Senegal. Nonetheless, the availability of iron and vitamin A in the food supply is low. The rating of Senegal in terms of iron and vitamin A in the food supply was significantly lower than the average in the world. On average, vitamin A is less available by 20 % in Senegal than in the rest of the world , animal iron availability is lower by 13.2. % and the availability of vegetal iron is lower by 9.4 %. Protein quality is worse by 19.6 % in Senegal than in the world on average. At the same time, food in Senegal is less safe by 15.6 %. Agencies to ensure the safety and health of food are existent in Senegal more than on average. Even though on average 81.2 % of people in the world have access to potable water, only 60 % of Senegalese can say that they have access to water that might be drunk. The presence of formal grocery sector is also worse in Senegal than in the world with a difference of 18.8 % between the two.

Figure 14: Food quality and safety indicators of Senegal compared to world averages (%)



Source: Own based work on http://foodsecurityindex.eiu.com/Country/Details#Senegal data

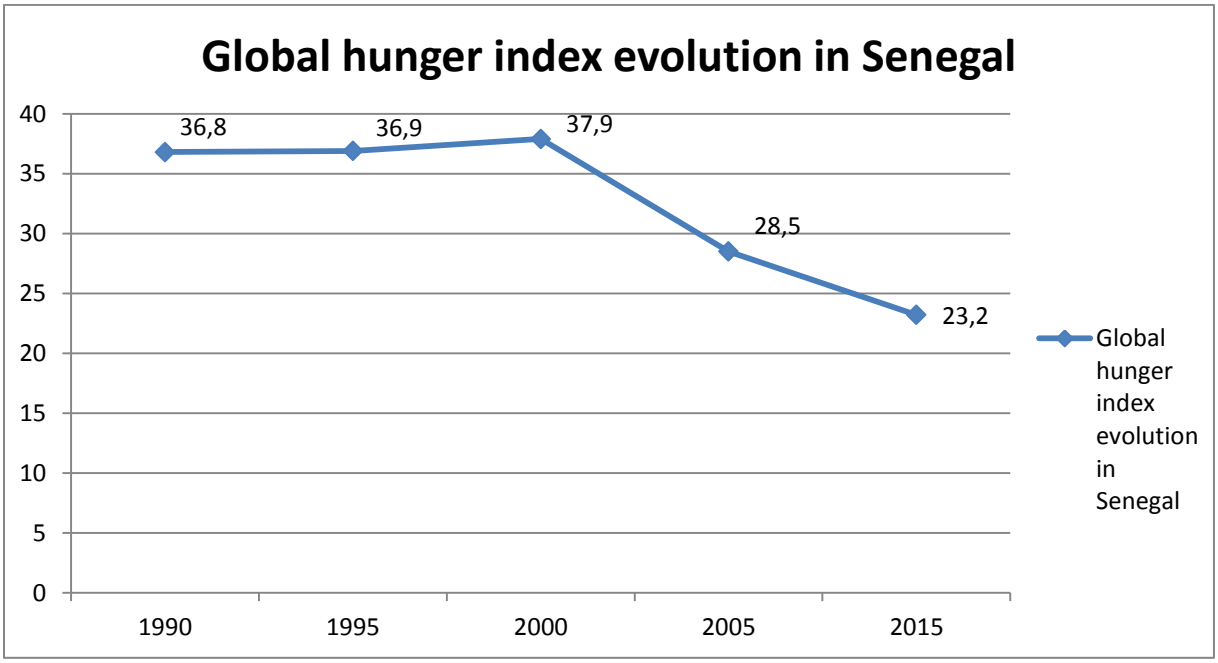
Based on these results we might analyze high shortages in terms of vitamin A, both vegetal and animal iron, proteins and nutritional guidelines.[83]

2.8.4. Hunger and health situation in Senegal

The hunger situation in Senegal is serious even after many improvements in the last several couples of years. The GHI score has advanced from 28.5 in 2005 to 23.2 in 2015. The level of GHI is serious according to the GHI severity scale. The proportion of undernourished people in Senegal remains high. In 2015 it was counted that 24.6 % of people in Senegal were undernourished which is not much different from 24.5 % in 1990. The proportion of wasting

in children under five decreased from 9 % in 1990 to 5.9 % in 2015. In terms of stunting of children the amelioration was even better as the 34.4 % prevalence of stunting in 1990 improved to 18.7 % in 2015. The under five mortality rate decreased from 14.1 % in 1990 to 5.5 % in 2013. We can therefore see that the hunger situation in Senegal has significantly improved in the last 25 years, however, there are still many challenges to face as the situations remain unfavourable.[84] The changes in the GHI of Senegal can be seen below in Figure 15.

Figure 15: Global Hunger Index evolution in Senegal



Source: Own based work on http://ghi.ifpri.org/ data

With the population growth rate of 2.45 % it is difficult to sustain food security as the number of inhabitants is ceaselessly rising. The birth rate of 34.5 births/1 000 population places Senegal at the 24th position in the world. The high rate of urbanizatiion (3.59 %) leads to increase of population living in the cities. Approximately 45 % of all Senegalese live in the cities. This fact leads to the uprise of many different issues. Maternal mortality rate is 315 deaths/100 000 births. The life expectancy at birth is rather low as newborns are expected to live until 61.32 years. Only 17.8 % of women use contraceptives. Government contributes to health only by 4.2 % of the GDP. Lack of investments and increasing number of people tend to create insufficiencies of health services. There are only 0.06 physicians and 0.3 hospital beds per person in Senegal. Urban population has better access not only to health services but also to water. 92.9 % of urban citizens have access to water against 67.5 % of the rural ones. The same trend can be analyzed in terms of access to sanitation facilities. Again, 65.4 % of

urban people have access to sanitation facilities while in rural areas, only 33.8 % of people can access sanitation facilities if needed.

HIV is also quite spread with 0.53 % of population suffering from this infamous disease. [74] Next, approximately 76 % of children and 54 % of women suffer from anemia. 63% of households have at least once been examinated for malaria.[70]

2.8.5. Food security policy in Senegal

Senegal has lately created a programme PRACAS focusing on a competitive, diverse and sustainable agriculture. The main goals are to feed its citizens, make profit in the international market, securing and improving the situations of rural people, creating more agricultural and non-agricultural jobs, effective and sustainable usage of resources and nutritional improvement.

This should be achieved through intelligent agriculture, agribusiness and rural development while keeping environment in good conditions and adapting to worriful climate changes. Improvements of techniques and agricultural machines along with effective and just implication of young population and women into agriculture. Additionally, products should be diversified and the demand for cereals should be met, empowering vulnerable people ought to be next aim of the policy. Furthermore, more effective water management, agricultural research and effective prices should be implemented and applied.

In terms of food security, Senegal tends to improve it within its main pillars, thus the food should become safer, more available and more affordable. Next, sustainable and more productive fishing should be promoted along with higher and intensified production of the most neccessary products such as rice, peanuts, onions , fruits and vegetables.

Financing of government is supposed to increase on seading, grain disponabilities and production and protection of plants as well. Moreover, hydro-agricole facilities shall be constructed.

Next, Senegal is a member of ECOWAS and its common agricultural policy ECOWAP (Economic Community of West Africa States Agricultural Policy). ECOWAS has created several different programs on the improvement of agriculture and food security in the region including the one of Senegal. Its cooperation is a strong weapon against food insecurity.

The rise of agriculture should result in improvement of the poverty situation, advancement of rural areas, ensuring better food security and increase of economy as itself.[15]

3. Recommendations for West Africa

Cooperation

In order for West Africa to become food secure there is a need for an effective collaboration on regional, national and international levels. Agricultural and Health sectors should cooperate in order to promote programs and projects focused on development of the region. Research and experience of old policies and programmes ought to be used as a tool for implementing new ones. Throught the collaboration, the awareness of main factors leading to food insecurity could be spread. The West African Health Organisation should collaborate with appropriate institutions such as UN and together they ought to integrate nutritional concerns into food security information systems, gather nutritional and food security data. This would facilitate the creation of food policies.

Cooperation between Health and Agricultural commissions of ECOWAS has to be intensified (through mutual development projects, plans and agreements) in order to promote more effective management of risks and food insecurity in the region. Next, biofuels (fuels derived from plants and waste rather than from coal and petroleum) should be promoted and taken into account as a possible alternative way for agricultural production and nutrition while protecting environment.

Countries of the region ought to mobilise resources in order to accelerate fight against food insecurity. A national and international cooperation framework shall be implemented or reinforced as to improve the communication and collaboration between stakeholders (organizations, non-governmental organizations, several research and education institutions etc.). Consequently, people from other areas should be involved (finance, education). Promotion of systematic use of rich biodiversity in the region in order to promote healthy and balanced diets should be next step.

Partner institutions should cooperate and support countries in the region. Linkages between the UN and other institutions and the region ought to be intensified in order to implement development plans on all levels and accelerate achieving the MDG. [16]

Project implementation

The cooperation has proved to be a key to development. Through the cooperation among UEMOA, ECOWAS, CILSS and the international world several projects have already

been succesfully implemented with oustanding development results. One of them is for example the Global Alliance for Resilience which is focused on improving the situation of vulnerable population and resilience and respond to shocks in a sustainable manner. Next programme created in the region is Food Crisis Prevention Network which helped to improve the overall food security in the last years also through implementation of agricultural policies.[1] These projects led to development of the areas in terms of food security, water access and overall management. Therefore there is a need to continue bringing new projects and cooperating in order to develop the region as a whole.

Early system warning and information systems

In order to be able to prevent food crisis, systems of the early warning should be implemented in West Africa. Several projects have already been launched (e.g. National Adaptation Programme of Action, Regional Plan of Action for Reducing Vulnerability in the Face of Climate Change in West Africa).[53] Next, current seasonal forecasting capacities need to be improved (regional and national meteorological centers). Cooperation between these centers in the region should be promoted. Adaptation of climate should make an equal part of development policies in the region.[46] I strongly recommend to implement the development of adequate information systems on both regional and national contexts into the strategies of these projects. It should be the main aim of these programmes to implement appropriate systems in order to be able to predict incoming changes. These systems chould be focused on predicting and preventing both climatic and demographic changes and outbreaks. Focus should be aimed particularly at the Sahel area which is prone to climate changes, therefore the information systems should be installed mainly there.

Agriculture

Agriculture is the backbone of food security and development in West Africa. Agriculture in West Africa is diverse and therefore needs different set of policies for and within each system from farming to retailing. Agrifood intervention should be focused mainly on understanding of changing consumer demand in order to analyze and indentify investment possibilities for different food stakeholders. The needs of both consumers and producers can be sustainably met only through impovements in productivity. The way to achieve this is through a combination of intensification, climate-inteligent agriculture and the evolution of value chains. Value of products has to be set appropriately and enhanced in order to capture better markets and increase incomes in the agrifood system. Among other things, regional

cooperation and integration is a must in order to be able for the region to compete on a international scale with a wide range of products. Through integration and mutual help of all countries of the region it is possible to provide effective agricultural research and technology development. However participation of the greatest countries of the region such as Nigeria or Senegal which often do not cooperate with the region is necessary.

Next, it is important to create an enhanced policy environment in order to promote more agricultural investments in productivity-improving technologies and innovations by private sector (including farmers). An enhanced policy environment would also advance the risk management in the agrifood system and provide adequate tools (price incentives, appropriate prices, adequate values of products...) in order to improve the access of food which is poor at the moment. Effective policy environment should be predictable, concentrated, inclusive, coherent and able to develop along with economy and society. Next, the amount of public investments ought to be raised (e.g. The Comprehensive Africa Agriculture Development Programme in Africa aims at increasing public investments at 10 %). The public sector ought to especially invest in areas which result in long-term and broad-based growth and which the private sector has limits to invest in due to a diverse set of reasons. Those areas are for example – agricultural research, evolution of human capital, reinforcing stakeholders, infrastructure (electricity, roads in rural areas, market infrastructure, irrigation).[11] With increasing urbanization both the number of people working in agriculture and demand change. ECOWAP which is a common agricultural policy in West Africa tries to adapt the modification in population and to promote better food security, food and water access along with better infrastructure and reinforcment of vulnerable people. As the demand develops and its evolution is rapid, there is a need for the ECOWAP to adapt it in order to be effective.[90]

Implementation of innovative agricultural methods in education

It should be of high governmental interest of the region to implement agricultural methods of 21st century in education. This would result in a genesis of an effective skill base in terms of agriculture. In order to achieve this current Agricultural education system in both primary and higher education must come through a reform. ECOWAS should focus therefore on teaching new agricultural methods and implement projects including both theoretical and practical skills to be taught to students of all different ages.[11] The costs of such projects would not be high as there is everything which is needed in West Africa and in the long-run

this would result in more agriculturally educated population. As such, these skills acquired at school could be subsequently used to produce agricultural commodities and achieve income. Therefore, it would ensure better incomes and higher productivity while exploting soils less than contemporary.

Health services

West Africa has only 0.12 doctors per 1,000 population. 70 % of all doctors of the region are found in Nigeria. On avearage only one doctor is available for approximately 8 300 inhabitants. Thus, health services are insufficient in West Affrica and not easily accessible. Even though ECOWAS and UEMOA have been focused on improving the health situation and services, it is a costly and long-run way to go. However, there are less expensive ways on how to improve health services.

In West Africa we can still find the so called tradipractioners (traditional healers). People often use the services they provide. For example in Ghana there is 1 tradipractioner per 200 people while there is only 1 doctor per 20 000 inhabitants. The traditional healer services are much cheaper and in the proximity of people both in rural and urban areas. Also some cultures do not recognize modern healing methods and thus can only use the traditional services. Nonetheless, traditional healers have often been restricted by the government. I would rather recommend to do more research in terms of traditional healing methods and to motivate and support traditional healers. With appropriate training, support and incentives from the governments these traditional healers would become effective and cheap health services employees. Among other things they could contribute to education and information as they are in proximity, explaining people basic methods on how to eat well and sustaining good health.[2] This could be therefore also a way to promote nutritional guidelines which are almost inexistant in West Africa.

Governmental support of traditional healers would therefore be an efficient tool in order to promote better health services and improve the overall health situation. Next, education and nutritional information would be spread and traditions of cultures would be protected. It is undoubtedly the right path to undergo.

Education in terms of sexual prevention

In order to slow down the population growth trend and spreading of different sexually transmitted diseases such as HIV it would be appropriate to implement education programs

focused on sexual prevention. This could be achieved through its implementation into scholar system. Media, spokesperson, celebrities and others could be used for spreading this knowledge among people.

Empowering rural areas

Rural areas are generally more vulnerable and prone to insecurities. The diversities between urban and rural areas in terms of health, water access, sanitation, work possibilities, education, malnutrition and food security are intensive. There is a need to invest more expenditures into these areas and develop them in a sustainable manner. With the remaining situation rural people tend to migrate and cities become overcrowded. Creating more job opportunities and improving the overall water and health access situation through programs and projects designed by the cooperation of ECOWAS, CILSS, UEMOA along with iternational aid focused on the rural areas would certainly lead to more balanced and sustainable population development. This could be achieved through implementation of the points mentioned above in this chapter (implementing of traditional healers, systems of early warning, cooperation on all levels).

Diversifying income and promoting more work possibilities

Majority of the citizens work in agriculture and apart from that they have almost no possibilities on how to make money. More post and possibilities for the citizens in order to assure diversification of income and accessability of food should be integrated.

3.1. Recommendations for Mali

First of all government of Mali should focus on education and agricultural development. Implementing of laws making education obligatory as in developed countries is missing according to my analysis and should be implemented. Next, it is important that Mali participates in the regional and international projects in order to be developed as they provide financing and aid.

The policies of Mali should aim mainly at the Northern part (Sahel) of the country which is much less developed than the Southern one.

In order to support education Mali has launched Higher Education Support Project in 2015.[88] Nutritional and agriculture education ought to be implemented in this project and in the education as a whole. People of Mali depend on cereals which are the main parts of their

diet which is not very diverse. Even though there is a diversity of products including vegetables and fruits people consider them as food for children. Diversification of diets through education of people could prevent vitamin and micronutrient deficiencies.

In order to motivate producers, adequate price incentives should be integrated. Government should invest more money in cattle and its export as its represents high potential and might bring high revenues. These incentives could lead to higher production and lower consumer prices if policies focused on diversyfying agricultural production were implemented well. High importance should be given not only to cotton and rice but also to horticulture and fruits as they have high export value and potential.

Next, there is a need to ensure infrastructure and lower transport costs. Furthemore, government ought to be focused on marketing and trade to promote its products.

3.2. Recommendations for Senegal

There are high differences between urban and rural population which make rural people migrate in the cities. As the PRACAS project indicates, these trends should be changed. The vulnerability of rural people could be diminished through better water management, improvement of water access, building new sanitation and education facilities and offering jobs. The government should focus on implementing the PRACAS project as effectively as possible because this program cocnerns development in every important area.

Next, Senegal has implemented National Health Development Plan which cooperates with a broad range of health actors and is focused on the general development of health situation in the region. By cooperation Senegal has obtained financial aid. Therefore collaboration on projects is a way to go to develop.[87]

Senegal lies on the sea-coast and thus has many fishing possibilities. Fish should be a daily part of diets of Senegalese as it is a good source of vitamin D and omega 3A6.

Inexistant nutritional guidelines shall be implemented into the primary and higher education. Not only it would not be expensive, but it would assure that people would get knowledge in order to eat in a healthy and balanced manner.

Next it is important to give value to products and motivate producers by price incentives. Appropriate import restriction could lead to rise in production. Senegal should

mainly focus on the production of rice as it is the most elementary particle of the diet of Senegalese.

Conclusion

The main aim of this thesis was to analyze the food security in West Africa and promote some of the reasons for which the region of West Africa became insecure together with providing deeper analysis of two countries Mali and Senegal. Furthermore, the thesis provided changes in agricultural production along with demographic and geographic challenges of food security in the region. To ensure rigorousness of the results and analysis of the food security two indexes were used, the GHI and the GFSI.

Every country should be capable of securing food for its citizens and thus promoting food security. Nevertheless, not always this is the case. West Africa is a region where food insecurity and hunger are still common problems. Facing several challenges, West Africa remains one of the least developed regions in the world even though it has the potential and resources to become more secure. One of the main issues that slows the development of the region and jeopardizes food security is the rapid population growth. As in majority of the world countries the population trend has already come through transition and is rather decreasing, West Africa has not noticed this transition yet. The more people are born, the more food, housing, health, infrastructure and other possibilities and facilities have to be ensured in order to sustain security. However, the population growth in West Africa has resulted in high urbanization, low infrastructure, food insecurity, low education and poor health situation. Furthermore, countries of West Africa belong among the least developed in terms of Human Development Index which among other things takes into consideration also education. Apart from demographic inflows and issues, West Africa, and the Sahel region in particular, have been facing serious climatic changes and unpredictable rainfall patterns resulting in droughts, floods and food crisis.

Agriculture, which is the spine of African economy and development has been able to keep up the pace with the population skyrocketing outbreak as its production has been constantly increasing. Even though many improvements in terms of food security, malnutrition and undernutrition have taken place, the situation of food security in West Africa remains serious. West African countries belong among the worst world countries in terms of food security as counted by the GFSI in the framework of three pillars, food accessability, food availability and food safety and quality. The overall hunger and malnutrition situation remains critical as indicated by the GHI.

On the other hand, there are possibilities and a potential to attain a change. Agriculture of West Africa represents a strong potential for eradicating the ongoing food problems. Its diversity and productivity are broad and sufficient enough to provide diversified and safe food on accessible prices for the whole population. Very important is to set a diverse set of policies and ensure a cooperation on both regional and international levels. Health sector might be improved through research and empowerment of traditional healing methods and tradipractitioners. Next recommendation is the implementation of the early warning systems in order for West Africa to be able to predict incoming changes and events, mainly in the Sahel and desert areas. Education is one of the main keys to development and to stop the population outbreak. Modern agricultural methods along with sexual education are recommended to be implemented into education system. Furthermore, there is a need to diversify incomes and reinforce rural areas.

With an effective cooperation and investments of the countries of the region on both regional and international levels, sustainable development and food security might be achieved. Climate and rainfall changes might be predicted when implementing sufficient meteorologic stations. Many organizations, institutions and programmes such as UEMOA, ECOWAS or CILSS have already been created in order to fight against the actual problems in the region. This fact indicates the increasing interest in regards to hunger eradication.

Many of us take food, water, housing possibilities, education and health facilities for granted. Nevertheless, approximately 795 millions of people do not have access to these fundamental elements for a healthy life. It is crucial to realise the importance of these problems, unify and take steps to prevent them. Not only in West Africa, but everywhere in the world people should have access to these principal life necessities. After all, it is possible that one day they it will be us who will face these issues and maybe after will we realise the seriousness and importance of this global problem.

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Annex 1: Correlation between population growth and low human development among West-African countries

HDI Rank	Country	1985	1990	2000	2005	2010
..	Very high human development	0,8	0,7	0,7	0,7	0,8
..	High human development	1,6	1,8	0,8	0,7	0,7
..	Medium human development	2,3	2,2	1,7	1,6	1,4
..	Low human development	2,8	2,8	2,6	2,5	2,4
123	Cape Verde	1,9	1,2	2	1,6	0,4
138	Ghana	3,3	2,8	2,3	2,5	2,5
152	Nigeria	2,6	2,6	2,5	2,6	2,7
161	Mauritania	2,8	2,7	3	3	2,7
163	Senegal	2,9	3,1	2,5	2,7	2,8
165	Benin	2,8	3,1	3	3,3	3
166	Togo	3,6	3	2,5	2,6	2,6
171	Côte d'Ivoire	4,1	3,5	2,5	1,5	1,7
172	Gambia	3,8	4,5	2,8	3,1	3,1
175	Liberia	3	-0,9	6,6	2,5	3,8
176	Mali	1,9	1,5	2,6	3	3,2
177	Guinea-Bissau	2,1	2,2	2,2	2,2	2,2
179	Guinea	2,4	3,4	2,2	1,8	2,5
181	Burkina Faso	2,5	2,6	2,8	2,9	2,9
183	Sierra Leone	2,4	2,4	1,1	4,3	2,3
187	Niger	2,8	2,9	3,6	3,6	3,7

Source: Own based work on http://hdr.undp.org/ data

Annex 2: Map of West Africa and Sahel

Source: http://www.soschildrensvillages.org.uk/