

**Mendel University in Brno**

**Faculty of Regional Development and International Studies**

**The value addition to fresh oranges as a means of reducing post-harvest loses  
and to improve the incomes of the orange farmers in Ghana**

Bachelor's Thesis

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I would like to thank to my mother for her support and to my thesis supervisor Ing. Samuel Antwi Darkwah Ph.D for his guidance during the process of writing this work and giving me the opportunity to implement my research in Ghana.

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## **Abstract**

**V. Prokopová, *The value addition to fresh oranges as a means of reducing post-harvest loses and to improve the incomes of the orange farmers in Ghana, Brno, 2015.***

The objective of the Bachelors thesis is to analyse value addition to fresh oranges as a means of reducing post-harvest loses and to improve the incomes of the orange farmers in Ghana by reducing waste of raw product and creating possible jobs for local people. The main work deals with health, agriculture, social and educational development in selected areas that are mainly engaged in farming and harvesting oranges. At the end of my thesis I will propose a simple value addition processing for orange farmers and other small scale processor which they can sell to the government for use in the school feed program.

## **Key Words**

Agriculture development, Fruits, Ghana republic, Health Development, Orange harvesting, Social development.

## **Abstrakt**

**V. Prokopová, *Přidaná hodnota k čerstvým pomerančům jako ukazatel k redukci po sklizňových ztrát and zlepšení příjmů farmářů s pomeranči v Ghaně , Brno, 2015.***

Tato Bakalářské práce analyzuje přidanou hodnotu čerstvých pomerančů ke snížení posklizňových ztrát a k zlepšení příjmů místních farmářů v Ghaně. Hlavním bodem v práci je vysvětlení důležitosti snížení plýtvání syrového produktu, vytváření pracovní pozice pro místní obyvatele, zaměření na zdraví, zemědělství, sociální a vzdělávací rozvoj regionů, které jsou orientovány na pěstování pomerančů. V poslední části je rozebrány hlavní kraje, které se specializují na pěstování pomerančů a jejich zdravotní výhody, které pro lidské tělo vytváří.

## **Klíčové slova**

Ghanská republika, Ovoce, Pěstování pomerančů Rozvoj zemědělství, Sociální rozvoj, Zdravotní rozvoj,

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## 0. Introduction

Ghana is a large domestic producer of fresh oranges. However, lack of knowledge and business skills are holding local farmers back with using and processing oranges, that don't correspond with their principles of trade. These oranges I am focusing on are usually with small noticeable peel damage, colour difference or have fallen down from the tree.

Location wise, the research was done in *Ashanti region*; in *Akrokerri* and *Obuasi areas* due to the area having the highest amount of oranges being harvested. Because of the simplicity of the process, we are aiming to co-operate with "Ghana School Feeding Programme".

The first part of the work analyses methodology, main objectives, approaches and target groups the thesis is focused on.

The second part is dedicated to the literature review about current agricultural position to added value of orange juice processing. This part focuses on the general topic such as development and agriculture, production of oranges and post-harvest losses in Ghana. This part also introduces the region, focusing on orange harvesting mainly and contribution to the socio-economic development.

In third part the author of the thesis is focused on theoretical descriptions of an arrange juice extraction and value addition by farmers and investment opportunity for small scale processing.

The last section is dedicated to analysing the economic implications of the thesis, such as costs, value chain and general information about orange harvesting in Ghana supported by numbers and figure. This part is also dedicated to budget and management of the research using such methodical tools like SWOT analysis and the Logical Framework Approach.

## 1. Aim of thesis

The main objective of this thesis is to reduce wasting of fresh oranges that are not being sold during the day at market or does not meet the quality demands of the buyers from companies who are exporting oranges abroad. Since the process of creating the final product, which is fresh orange juice, is not technically challenging and does not require special know-how, the opportunities to the farmers who can use this suggestion is endless. The research will focus on farmers in the area and give them basic information and lectures how to create the juice themselves, without any extra costs.

Table 1: Main objectives, advantages and disadvantages

<b>Main objectives</b>	<b>Advantages</b>	<b>Disadvantages</b>
Stimulation for buying more products	Immediate feedback	Short- term duration
Increasing sales	Contact with customers	Users are not faithful to the final product
Stimulation for selling products - try outs	Opportunity for constructive criticism and overtures	Dependence on the weather
Supporting sales by special offers for products - " Buy one and get one free "	Strategic partnership with government GSFP	Knowledge gap of local farmers

Source: Author



## 2. Methodology

### 2.1 Study Area

Ghana, a country on the West Coast of Africa, is one of the most thriving democracies on the continent. It has often been referred to as an "island of peace" in one of the most chaotic regions on earth. It shares boundaries with Togo to the East, la Cote d'Ivoire to the West, Burkina Faso to the North. The South border line of Ghana is the Gulf of Guinea. A recent discovery of oil in the Gulf of Guinea could make Ghana an important oil producer and exporter in the next few years.

The country's economy is dominated by agriculture, which employs about 40 % of the working population. Ghana is one of the leading exporters of cocoa in the world. It is also a significant exporter of commodities such as gold and lumber. The country covers an area of 238,500 square kilometres. Ghana has an estimated population of 25,199,609 (July 2013 est.), drawn from more than one hundred ethnic groups - each with its own unique language. English, however, is the official language, a legacy of British colonial rule.

In 1957, Ghana (formerly known as the Gold Coast) became the first country in sub-Saharan Africa to gain independence. After leading the country for nine years, the nation's founding president, Kwame Nkrumah was overthrown in a coup d'etat in 1966. After Kwame Nkrumah, Ghana was ruled by a series of military despots with intermittent experiments with democratic rule, most of which were curtailed by military takeovers. The latest and most enduring democratic experiment started in 1992 and it is what has gained recognition for Ghana as a leading democracy in Africa.

Ghana has several tourist attractions such as the Cape Coast, Crocodile Pond at Paga and Mole National Park. Most of the major international airlines fly into and from the international airport in Accra (ghanaweb.com, 2014).

The area of concentration of research in this thesis is in Ashanti region. Ashanti Region is currently the second most urbanized in the country, after Greater Accra (87.7%). the climate of Ashanti region is basically tropical and lies almost entirely in forest zone. Environmental problems identified in the region include deforestation, soil erosion, land degradation, agrochemical, air and water pollution. By current estimates, the population of the region is

approximately 3,130, 394 and the average density is 86 % per square km. The region is divided into 21 traditional councils headed by traditional chiefs (Konadu-Agyemang, Panford, 2008).

The Kumasi metropolis is the most populous district in the Ashanti Region. Agriculture is the dominant sector in the region's economic activities and it is endowed with abundant arable lands which support the production of cash crops such as cocoa, citrus, coffee, oil palm, citrus cashew, mango and food crops like cassava, plantain, rice, yam, cocoyam, maize, and vegetables (GhanaWeb, 1994).

The recent discussions on Ghana's successful agricultural growth have largely been based on the sector's performance at the national level over the past five years. However, agricultural growth during this period has been heavily influenced by favourable weather conditions and world market price for cocoa, which is the country most important agricultural export product (Bresing et al., 2008).

Agriculture employs the highest portion of country's economically active population (EAP) as farmers, fishermen in farm labour and other agricultural-related activities such as marketing, processing, etc. Although the proportion of EAP in agriculture has continued to decline over several decades, it still exceeded 40 % in 1995. However, the incomes of those workers in the agricultural sector as employees and self-employed are among the lowest in the country. Through growth in agricultural production and increases in agricultural productivity have been the main objectives of the agricultural policies of the past and present governments sustained success has eluded policy - makers on both counts. There have been wide fluctuations in agricultural growth which primary reflects fluctuations in the weather on which Ghana's agriculture largely depends and also on the poor performance of the food crop and livestock subsector, which constitutes about 60 % of agricultural output. (Aryeetey, Harrigan, Nissanke, 2000).

An important issue that arises is whether the agricultural sector has the capacity to adjust the changing incentives of the economic reforms. It is argued that for farmers who are unable to bargain successfully for exclusive rights, the land tenure system is viewed as an obstacle to realizing individual aspirations and to agricultural productivity (Tettey, Pupilampu, Berman, 2003).

### Average salary

Average net salary in Ghana is nearing to 873, 65 Ghana cedi per month. To US Dollar is around **238, 37 USD** (indexmundi.com, 2015). We have to understand, that this salary is average and not everyone are being paid that high at their job. With this information, it is important to point on how much struggle it is for Ghanaian families to sustain their kids and themselves. By my personal experience they do have to choose what they can afford and not, and mostly it is not much. This mean they can't go to supermarket and buy juices and try to have balanced nutriment. This is one of the many reasons, why Ghana struggles with so high children underweight and these products are mainly bought by tourists or rich people.

### 2.2 Approaches to study

For completing this thesis, many methodological approaches were used. To obtain primary data, it was necessary to execute an interview with respondents and their own experience with the issues. Many important information and data were collected during author's visits and meetings at University of Ghana in Accra-Legon and during interviews at local market places, collecting the information about the issue from orange sellers. Significant amount of data was collected during field trips in the Ashanti region. Since performing the process of creating the juice is very simple and during the stay in Ghana, the idea approved itself for being quick and there is no need to have any special technical education, nor professional equipment to create the final product.

In the theoretical part of the thesis, all the collected information from interviews and field research are included, together with various Internet sources, supported with selected facts extracted from literature. Secondary data was use to detail basic economic and territorial information about the country and target group of this research.

Practical part of the thesis includes various sources for successful evaluation and marketing. Capital budgeted in included in the first part of the practical part. Marketing strategies such as SWOT analysis and Logical Framework Approach are included in the annex part of the thesis. For evaluation of the thesis and profitability of the orange juice extraction for small scale businesses, summary of loans and interests is used. Cash Flow is included in the Annex part of the Thesis.

The discussion part includes all the obtained data and information and the author's suggestions are included as well.

### **2.2.1 SWOT Analysis**

This is a tool that identifies the strengths, weaknesses, opportunities and threats of an organization. Specifically, SWOT is a basic, straightforward model that assesses what an organization can and cannot do as well as its potential opportunities and threats. The method of SWOT analysis is to take the information from an environmental analysis and separate it into internal (strengths and weaknesses) and external issues (opportunities and threats). Once this is completed, SWOT analysis determines what may assist the firm in accomplishing its objectives, and what obstacles must be overcome or minimized to achieve desired results (Investopedia.com, 2015).

### **2.2.2 Logical Framework Approach**

As a methodology, the 'Logical Framework Approach' (LFA) is a systematic, visual approach to designing, executing and assessing projects which encourages users to consider the relationships between available resources, planned activities and desired changes or results.

At its core is a theory of change management, which presents the logical flow of causal outcomes between achievement of a project/program's activity targets, and the delivery of intended results. Log frames, to this end, enable planners to establish a hierarchy of objective or result statements – i.e. a development pathway – which articulate their best understanding of how change can be achieved (betterevaluation.org, 2012)

## **2.3 Target Groups**

### **2.3.1 Orange farmers and Small business**

The work will focus on the orange farmers and their families. How they can add value to the left over oranges that they could not sell at the market which will likely be thrown away as they are deemed not "good" by buyers. Also the work will consider the possible small scale business opportunity for orange juice making as small businesses are the lifeblood of any economy. In economic terms, a small firm is one with relatively small market share. It is managed by its owners and it is independent, in the sense that it does not form part of larger enterprise (Graham Beaver, 2002).

### **2.3.2 Schools**

The group of potential benefactors the research focuses on is students of primary schools. The reason behind that is that they are still developing their body and immunity system. For the kids from poor and not so wealthy families is important to support their health as much as possible.

### **3 Literature Review**

#### **3.1 Position of agriculture in Ghana's current economy**

Since independence agriculture has been a very important part of the Ghanaian economic structure. While policy and political failure had caused per capita GDP growth declining until 1980s, the agricultural sector had been less affected than the non-agricultural sector because it was less intervened by the government than the non-agricultural sector and its growth is primarily led by smallholders for subsistence purpose of production.

Agriculture is about 40 % of GDP in the late 1990s and was still above 35 % until 2007. Only in the recent two years of 2007 and 2008 share of agriculture falls to below 35 % at 34 % and 32 %, respectively, in these two years. Recent decline in the agricultural GDP share is the result of faster growth in the services, which has increased the share in GDP to 40 or more than 40 % in 2007 and 2008. Thus, it is first time in Ghana's history that agriculture is not more the largest sector in the economy and the service sector has taken this position. On the other hand, share of the industrial sector in GDP has not changed much after 1990s and share of the manufacturing sector has even declined to less than 10 % of GDP in the recent ten years.

Agricultural structure and the regional distribution of agricultural GDP significantly differ across Ghana's agro-ecological zones. The Forest Zone remains the major agricultural producer, accounting for 43 % of agricultural GDP, compared to about 10 % in the Coastal Zone, and 26.5 % and 20.5 % in the Southern and Northern Savannah Zones, respectively (Breisinger et al. 2008). The Northern Savannah zone is the main producer of cereals and livestock. More than 70 % of the country's sorghum, millet, cowpeas, groundnuts, beef and soybeans come from the Northern Zone, while the Forest Zone supplies a large share of higher-value products, such as cocoa and livestock (mainly commercial poultry).

According to OECD (2015), the heterogeneous agricultural production structure also indicates differences in the agricultural income structure across regions. The Forest Zone generates about half its agricultural income from two of Ghana's major export goods (cocoa and forestry). Including non- traditional exports and fishery, export agriculture also plays an important role in total agricultural income for the Coast and Southern Savannah Zones. In contrast, 90 % of agricultural income in the Northern Zone comes from staple crops and livestock.

### 3.2 Assessing agricultural growth performance and potential at national level

Agricultural transformation is characterized as a process of sustainably modernizing agriculture and such a process is often measured by significant improvement in land and labour productivity, greater market-orientation and diversified production diversification, as well increased domestic and international competitiveness. To accelerate agricultural transformation it is first necessary to understand the agricultural sector's initial condition. While agricultural productivity growth has started to pick up in the recent two decades, the main driving factor behind the rapid agricultural growth is the crop subsector (excluding cocoa), the largest subsector in agriculture, accounting for more than two-thirds of the agricultural economy. Staple crops such as maize, sorghum, rice, cassava, yam, plantain, pulses, and oilseeds dominate this subsector. Some high value crops such as vegetables and fruits are also included, but they play a relatively modest role in overall agricultural growth given their small size (oecd.org, 2015).

### 3.3 Orange Production in Ghana

Major crops (See Annex 5) produced in Ghana are: Citrus, Palm Oil, Cocoa, Plantain, Maize, Cassava, cocoyam, taro, etc. The Ministry of Food & Agriculture collaboration with Agricultural Development and Value Chain Enhancement (ADAVANCE) -ACDI-VOCA (NGO), NBSSI, and Obuasi Citrus Growers & Marketing Association claim about 63.75 % of citrus farms in the Municipality have been measured and mapped. In 2012 total production of fresh oranges in Ghana was 625.000.000 tons (See Figure 1 below). In total, Ghana is ranked on 18th place worldwide with orange production and Ghana's total world share with this commodity is 0.9 %.

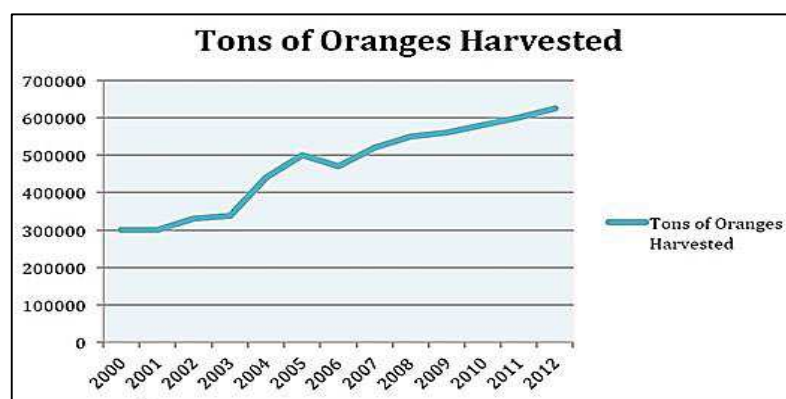


Figure 1: Tons of harvested oranges from 2000-2012. Source: factfish.com, 2012

Of this 70 % of the production was harvested from areas AKROKERRI and KWAPIA. These areas are situated in Obuasi municipality (see Figure 2 below), which lies south of the regional capital city, Kumasi. Obuasi has a settlement population of 175,043 people.

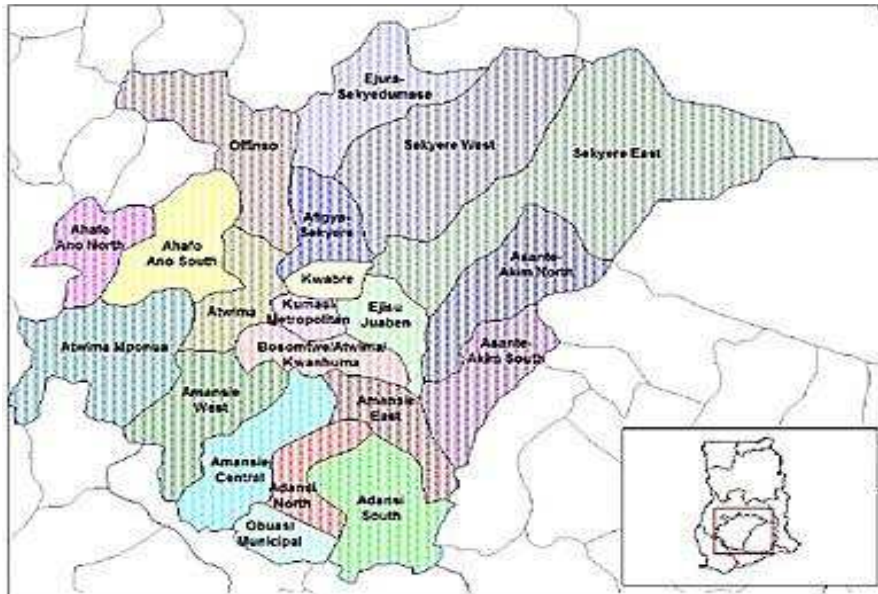


Figure 2: political map of the Ashanti region showing Obuasi municipality

Most farmers around Akrokerri, Bobriase, and Kwapia, are well known in citrus production. The name “Obuasi Ankaa woo”, is associated with oranges from these communities. About 70 % of oranges produced in the district come from this area. Efforts are being made by the District Directorate of Agriculture to bring the farmers together under one umbrella. The farmers could source for funds to establish an orange processing plant, to produce fresh juice for sale. It is envisaged that patronage will be very good, as the area is already known for its sweet and good quality oranges. This will also go a long way in creating employment and reducing poverty (ghanadistricts.com, 2006).

In a recent time section, Ghana farmers has been feeling pressure from the market side and the government for the product delivery and have issues with harvesting product of 100% quality. The low patronage and consumption of citrus fruits, particularly sweet orange, is compelling many orange farmers in the Ashanti region to abandon the farming of the citrus fruits for other cash rewarding crops.

Orange production is suitable for juice, jam and the extraction of essential oils from the peel. But some orange farmers in the Ashanti region have expressed concern over the poor sales and lack of market for oranges. They noted that market demand for oranges has been very low, and it does not encourage some of them to continue with its production.

They have therefore appealed to the government to assist them through the Ministry of Food and Agriculture to secure markets for orange farmers in the Region. The main reason why the farmers are willing to quit orange harvesting that it is cost and time consuming and in case of difficulties such as bad weather condition, peel diseases they are not able to deliver them on time to the buyers (modernghana.com, 2015).

There are some major challenges to orange production in Ghana. Disease and pest infestation constituted 30.8% of the challenges, 29.6% had difficulty marketing of harvested produce while 15.6% of challenges were on high cost of production. Poor road network to farming communities represented 14.2% and postharvest losses 9.8% (AKYEM-PEPRAH, 2012).

### 3.4 Nutritional value and uses of oranges

Orange is a very versatile product and by using the fruit, it doesn't mean the use of them ends.

Orange peel is known to have the following uses:

- **Lower Blood Pressure:** For thousands of years, Chinese medicine has used bitter orange peels as a natural medicine. Some herbalists suggest eating orange peels as a way to lower blood pressure naturally.
- **Depression and Anxiety:** The oil extracted from an orange peel can be used to help naturally relieve anxiety and depression.
- **Mosquito Repellent:** The citrus smell of fresh orange peel will repel mosquitos. By high level of mosquitos and malaria in Ghana this is very helpful and useful trick.
- **Fish and Muesli seasoning.**
- **Medical help:** Orange peel is not only rich for Vitamin C+ and can be used many different ways. Very important in the peel are Bioflavonoids. This particular substance human body cannot create and they are very important for function of blood pressure and blood-vessels (thesproutingseed.com, 2013).

**Oranges are also known to help prevent cancer:** Oranges are rich in citrus limonoids, proven to help fight a number of cancers including that of the skin, lung, breast, stomach and colon.

**They help reduce risk of liver cancer:** According to two studies in Japan eating mandarin oranges reduces liver cancer. This may be due in part to vitamin A compounds known as carotenoids.



**Oranges can prevent kidney diseases:** Drinking orange juice regularly prevents kidney diseases and reduces the risk of kidney stones. Drink juice in moderate amounts. The high sugar content of fruit juices can cause tooth decay and the high acid content can wear away enamel if consumed in excess.

**Lower risk of disease:** Oranges are full of vitamin C, which protects cells by neutralizing free radicals. Free radicals cause chronic diseases, like cancer and heart disease.

**They lower cholesterol:** Since they're full of soluble fiber, oranges are helpful in lowering cholesterol.

**Boosts Heart Health:** Oranges are full of potassium; an electrolyte mineral is responsible for helping the heart function well. When potassium levels get too low, you may develop an abnormal heart rhythm, known as an arrhythmia.

**Fights against Viral Infections:** Studies show that the abundance of polyphenols in oranges protects against viral infections.

**Oranges relieves constipation:** Oranges are full of dietary fiber, which stimulates digestive juices and relieves constipation.

**Helps create good vision:** Oranges are rich in carotenoid compounds which are converted to vitamin A and help prevent macular degeneration (care2.com, 2015).

### 3.5 Postharvest losses of Oranges

Citrus undergo some physiological disorders, which ultimately affects its quality during storage and the period of marketing. These disorders are affected by pre-harvest and postharvest factors. The major pre-harvest factors include nutrient deficiencies, sunburn and wind scars. Significant among the postharvest factors include temperature, humidity, atmospheric gas composition and mechanical stress.

Citrus fruits are susceptible to many diseases, which are caused by pathogens such as fungi, bacteria, viruses, viroid, phytoplasmas, spiroplasmas and nematodes. The major postharvest fungal diseases are green mold, blue mold, sour rot, grey mold, Alternaria rot and brown rot (Akyem-Pepurah, 2012).

### 3.6 Causes and mitigation of post-harvest losses

Post-harvest crop loss could be attributed to several causes including harvesting conditions; biological and chemical causes; environmental causes, and socioeconomic factors.

Harvesting methods employed (cutting knife, picking poles, etc.) may lead to heavy losses of produce through blemishes and injury. Also, early or late harvesting which might be caused by inadequate knowledge of period of maturity of produce may lead to post-harvest losses.

Produce is also sometimes harvested at a period where farmer believes he might get a high price for goods which might lead to harvesting of over ripped or under ripped produce. Biological causes are usually in the form of physiological deterioration and infection by diseases and pests. For the former, these losses are caused by conditions that increase the rate of natural deterioration occurring when fresh produce are exposed to extreme of temperatures, modified atmospheres or contaminations which may cause rotting or failure to ripen. Infestation of produce by pest who usually feed on produce may lead to a reduction in quantity or quality of produce. The presence of microorganisms such as fungi and bacteria, which are widely distributed in the air, soil and also on farm implements cause spoilage in produce which leads to microbiological food losses.

Mechanical damage (physical injury) arises from careless handling of produce during both harvesting and packing that causes injuries both internal and external to produce. Internal injuries may lead to spoilage of produce since its physiology is compromised. External injuries such as cuts and bruising may pave way for infections by pathogens and insects, which may lead to diseases.

The environmental condition under which produce is stored has a major effect on the storability as well as the quality of the produce. Temperature, relative humidity and moisture as well as solar radiation are but a few of the environmental characteristics that affect post-harvest losses. Reduction in high temperature for example, helps in increasing the shelf life of a produce since the rate at which water is lost from produce reduces at low temperatures. Modification of environmental conditions in which produce is stored helps to reduce post-harvest losses.

Transport losses are usually caused by unsuitable transport containers, poor or unsuitable roads as well as lack of feeder roads, methods of loading and arrangement of produce in vehicle and the virtual lack of appropriate storage facilities during transportation of produce to help keep produce in almost its original state. Time of transporting produce can also cause loss quality of produce. Provision of seasonal produce all year round can only be met when produce is well and

effectively stored. Storage does not prevent losses but reduces level of losses when the appropriate technique is undertaken. However, high cost of using adequate storage devices deters farmers from using them hence leading to high post-harvest losses. An increase in the length of storage before consumption also could reduce quality of produce, which can eventually lead to loss? Produce which have shorter shelf lives can be lost when storage time is increased.

Socioeconomic factors are considered secondary causes of loss as they encourage the primary causes of loss. These are usually the result of inadequate or non-existent capital expenditures, technology and quality control. Other miscellaneous causes of post-harvest losses include lack of storage for highly perishable produce, lack of efficient communication between producers and wholesalers, poor maintenance of transport, storage and handling facilities and over anticipation of price increase leading to longer periods of storage and loss.

Mitigating measures against post-harvest loss are both precautionary and curative. Proper packing, night movements of goods and use of cold storage are among major methods of post-harvest activities undertaken. Early harvesting as well as careful packaging was part of recent sensitization messages by extension officers. Both refrigeration and chemical methods are well known. In general any effective mechanism that can minimize losses in both the short run and long run should include the prompt harvesting of mature produce, selection of proper packaging materials, and speedy movement of goods in good condition vehicles during periods of minimum temperatures. Proper packaging, storage, good timing of produce movement, moderate to high extent of drying, good timing of harvesting, good timing of processing are important (Egyir and comp, 2011).

### **3.7 Value Addition to harvested Oranges**

#### **3.7.1 Added value**

Added value is defined as the value added to the cost of raw materials and bought-out parts by the process of production and distribution. To calculate it, the costs in bought-in items are deducted from the turnover figure that appears in the profit of loss account to give a figure of the value added by the efforts of the company's employees to make to best - most productive - use of the capital and other resources available to them. In non-accounting terms, added value represents the contribution made by employees to business success (Baron, Armstrong, 2007).

Examples of value added agricultural products include garlic braids, bagged salad mix, artisan bread, lavender soaps and sausages. Adding value to agricultural products is a worthwhile endeavour because of the higher returns that come with the investment, the opportunity to open new markets and extend the producer's marketing season as well as the ability to create new recognition for the farm. Increasingly, value-added products are hitting the local market as producers take advantage of high-demand product niches. This is the key to success in value added agriculture—niche markets are where smaller producers can be most successful in creating value and establishing a profitable business. Value added agriculture is not without its challenges to farmers. One of the largest hurdles to overcome is that of food business and safety regulations. For example, if you are interested in taking your organic blueberries and turning them into a high quality jam that you can sell at the local farmers' market, you must be a licensed commercial kitchen in order to produce that product and sell to local consumers. You will also need to carry liability insurance if you are selling at the farmers' market to cover any sort of illness or other food safety issues that may arise (Matthewson, 2007).

### **3.7.2 Early Attempts to establish citrus juice industry in Ghana**

British Sailors developed Vitamin C deficiencies on long voyages and there was the need to find cure for British soldiers who developed Vitamin C deficiencies on long voyages in the early part of the 20th century. It was discovered at that time that by drinking lime juice, the disorder could be cured. The Early Attempts to Establish Citrus Juice Industry in Ghana continued and the British government made attempts to grow lime in its colonies to supply lime juice to the sailors. This led to the introduction of the Mexican lime *Citrus aurantifolia* to Ghana specifically in the Asebu area in the Central Region around 1900.

By 1928, lime production had reached its peak in the Central Region and as a result, the Emil El Rose Citrus Factory was established at Asuansi to process lime juice for the sailors. Other citrus varieties including sweet oranges, lemons, tangerines and grape fruits were introduced from other parts of the world by the colonial government and established in a museum at Asuansi. From the Asuansi museum, citrus particularly sweet oranges spread to other parts in Ghana especially the cocoa growing areas where the soil and climatic conditions are conducive to the growth of citrus. A solid foundation was laid for reestablishment of citrus juice industry with the various citrus cultivars which made all year round production of citrus possible (Osei, 2013)

## 4 Theoretical framework for establishing orange juice extraction - farmers and small scale business

### 4.1 Process of orange juice extraction

The primary ingredient in orange juice is, of course, oranges. Oranges are members of the rue family (Rutaceae), and citrus trees belong to the genus *Citrus*. Oranges, along with all citrus fruits, are a special type of berry botanists refer to as a hesperidium. Popular types of oranges include navel, Mandarin, and Valencia. A blend of different types of oranges is generally used to provide a specific flavour and to ensure freedom from bitterness. Selection of oranges for juice is made on the basis of a number of factors such as variety and maturity of the fruit.

The fruit contains a number of natural materials that contribute to the overall flavour and consistency of the juice including water, sugars (primarily sucrose, fructose, and glucose), organic acids (primarily citric, malic, and tartaric), and flavour compounds (including various esters, alcohols, ketones, lactones, and hydrocarbons.)

Preservatives such as sulphur dioxide or sodium benzoate are allowed by federal regulation in orange juice although the amounts are strictly controlled. Similarly, ascorbic acid, alpha tocopherol, EDTA, BHA, or BHT are used as antioxidants. Sweeteners may be added in the form of corn syrup, dextrose, honey, or even artificial sweeteners. More often, though, citric acid is added to provide tartness.

Manufacturers may also fortify juices with extra vitamins or supplemental nutrients such as vitamin C, and less commonly, vitamins A and E, and beta carotene. (Beta carotene is naturally present in oranges, but only to a small degree.) There is some concern about the stability of these added vitamins because they do not survive the heating process very well. Calcium in the form of tricalcium phosphate is also frequently added to orange juice.

Oranges are harvested from large groves. Some citrus growers are members of cooperative packing and marketing associations, while others are independent growers. When the mature fruit is ready to pick, a crew of pickers is sent in to pull the fruit off the trees. The collected fruit is sent to packing centres where it is boxed for sale as whole fruit, or sent to plants for juice processing. The oranges are generally shipped via truck to juice extraction facilities, where they are unloaded by a gravity feed onto a conveyor belt that transports the fruit to a storage bin.

Proper juice extraction is important to optimize the efficiency of the juice production process as well as the quality of the finished drink. The latter is true because oranges have thick peels, which contain bitter resins that must be carefully separated to avoid tainting the sweeter juice. There are two automated extraction methods commonly used by the industry.

The first places the fruit between two metal cups with sharpened metal tubes at their base. The upper cup descends and the fingers on each cup mesh to express the juice as the tubes cut holes in the top and bottom of the fruit. The fruit solids are compressed into the bottom tube between the two plugs of peel while the juice is forced out through perforations in the tube wall. At the same time, a water spray washes away the oil from the peel. This oil is reclaimed for later use.

The second type of extraction has the oranges cut in half before the juice is removed. The fruits are sliced as they pass by a stationary knife and the halves are then picked up by rubber suction cups and moved against plastic serrated reamers.

The rotating reamers express the juice as the orange halves travel around the conveyor line. Some of the peel oil may be removed prior to extraction by needles which prick the skin, thereby releasing the oil which is washed away. Modern extraction equipment of this type can slice, ream, and eject a peel in about 3 seconds (ghanafarmes.com, 2013). The quantity of oranges and litre amount of juice that can be extracted is shown in Table 2 below.

Table 2: Quantity of oranges and amount of juice extracted.

Quantity of Oranges	Finished product
15 medium sized oranges	1l
5 oranges = 1 kg	0,3 l (one glass)
1 ton of oranges	300l

Source: Author's research.

## 4.2 Educating farmers for processing orange juice to mitigate post-harvest losses

### 4.2.1 Profile of Orange farmers in the study area

Majority of the farmers met are men, around 70 % with their families. Most of them don't have formal educations but a few with basic education. Average age is 60 and above. Major household income comes from the sale of citrus and other cash crops.

#### 4.2.2 Cost of engaging in juice extraction

All needed is the start-up expenses to cover the basic equipment to fulfil the aim of research. This includes containers in which the oranges juice will be transported from the farm or place of work to the market or schools and juice maker to extract the juice from fruit.

A commercial manual juicer a can be used to extract the juice. Depending on the number in the family, two to three of these juicers can be used. *The estimated price of one juicer is \$40.* The process of juice extraction is meant to be as simpler as possible, so the children in the school can participate and process the juice by them. *The estimated start cost for an orange farmer juice extraction is about \$150.*

#### 4.3 Small scale business investment opportunity

##### 4.3.1 Net Investment

The amount spent by a company or economy on a capital assets, or gross investment, less depreciation. Net investment helps give a sense of how much money a company is spending on capital items (such as property, plants and equipment), which are used for operations. Subtracting depreciation from this amount, or capital expenditure (since capital assets lose value over their life because of wear and tear, obsolescence, etc.), provides a more accurate picture of the investments' actual value. Capital assets include property, plants, technology, equipment and any other assets that can improve the productive capacity of an enterprise (investopedia.com, 2015). *The total amount of financial investment for start-up needed is 550 USD. Price for one juice extractor is 125 USD and expected amount of processor to be needed is around 4, so the process is more effective .Estimated price of buckets for carrying oranges is 5 USD, capacity of one bucket is 14 litres. Expected amount of needed buckets is 10.* For detailed overview of the items prices, see Table 3 below.

Table 3: Start-up costs for small-scale processor.

<b>Start-up costs</b>	<b>USD \$</b>
Containers for carrying the oranges (buckets)	50
Juice extractors	500
<b>Total:</b>	<b>550</b>

Source: Author

### 4.3 2 Loans and Interest

This part of business plans covers calculation how much financial need is required to cover all the initial costs which is in total 550 USD. Loan is needed and according to Bank of Ghana, actual interest rate for loans in 26%. Total payment makes 11052 USD and month payment is 172,7 USD. Expected loan maturity is 4 years.

Table 4: Initial cost

<b>Initial costs</b>	<b>550 USD</b>
<b>Interest</b>	<b>26%</b>
<b>Total payment</b>	<b>693 USD</b>
<b>Month payments</b>	<b>14,43 USD</b>

Source: Author

Table 5: Loans

<b>Year</b>	<b>Repayment</b>	<b>Interest</b>	<b>Amortization</b>	<b>Loan</b>
1	14,43	73,40	20,10	107,93
2	14,43	43,20	33,16	90,79
3	14,43	65,70	58,1	137,53
4	14,43	68,10	10,65	0

Source: Author

### 4.3.4 Cash Flow

The difference between the available cash at the beginning of an accounting period and that at the end of the period is the cash flow. Cash comes in from sales, loan proceeds, investments and the sale of assets and goes out to pay for operating and direct expenses, principal debt service, and the purchase of asset. Cash comes in from sales, loan proceeds, investments and the sale of assets and goes out to pay for operating and direct expenses, principal debt service, and the purchase of assets. A cash flow budget highlights the following figures:

- Revenues
- Financial capital requirements
- Operating expenses

The cash flow projections are based on the past performance of your business. To project cash flow, start by breaking down projected sales over the next year according to the percentage of business volume generated each month (entrepreneur.com, 2015).

Ghanaian taxes are 0 % in the first 5 years for new businesses in agro- processing and if is the company located outside the regional capitals, case of the model farmer, then there is no taxation at all (PricewaterhouseCoopers, 2012).



#### 4.3.4.1 Realistic variation of Cash Flow

Payback period shows, that juice processing will start paying it self-back after 2,03 years. It means that after second quarter of the year, juice processing will start to be profitable. Profitability index is 1,986. The rate of successful of the profit should be over 1, so this shows it is in positive rates.

Internal rate of return (IRR) is the interest rate at which the net present value of all the cash flows (both positive and negative) from a project or investment equal zero. In this case, IRR equals 83, 246%. Internal rate of return is used to evaluate the attractiveness of a project or investment. If the IRR of a new project exceeds a company's required rate of return, that project is desirable. If IRR falls below the required rate of return, the project should be rejected (investinganswers.com, 2015). Break-even point is 3470 litres, which means, if we want to have Entrepreneurial production, this is the amount of juices we need to sell. See table 6 for the numbers for realistic Cash Flow version. Full Realistic variation of Cash Flow is listed in Annex part of work.

Table 6: Numbers for realistic variation of Cash Flow

Payback period	2,03
Profitability index	1,986
Internal rate of return	83,246%
Net present value	16230 USD
Break-even point	470

Source: Author

#### 4.3.4.2 Pessimistic variation of Cash Flow

Payback period of the production starts at 3.45 years. Profitability index is 1120. Even though the number is low, it is still profitable since it didn't cross level under 1. Internal rate of return is 32, 67%. Net present value is 7300 USD and Break-even point is 5124. Pessimistic version of the juice production is therefor case, there is some unexpected problem with harvesting, for example bad weather condition, loses of the crops, etc. For details of the pessimistic variation please see Table 7. The full version is included in the Annex part of the work.

Table 7: Numbers for pessimistic variation of Cash Flow

Payback period	3,45
Profitability index	1120
Internal rate of return	32,67%
Net present value	350 USD
Break-even point	524

Source: Author

## **5 Discussions**

### **5.1 The Hazard Analysis and Critical Control Points (HACCP)**

The Hazard Analysis and Critical Control Points (HACCP) system is a logical, scientific approach to controlling hazards in meat production. HACCP is a preventive system assuring the safe production of food products. The application of HACCP is based on technical and scientific principles that assure food safety. An ideal application would include all processes from the farm to the table. The principle of HACCP can be applied to production, meat slaughter and processing, shipping and distribution, food service and in home preparation.

HACCP is a systematic preventative system that uses common sense application of scientific principles. The most important aspect of HACCP is that it is a preventative system rather than an inspection system of controlling food safety hazards. Prevention of hazards cannot be accomplished by end product inspection, so controlling the production process with HACCP offers the best approach. The application of HACCP is systematic because structured hazard analysis and implementation are provided. The process is common sense in that each processor understands their operation and is best able to assess controlling the process. HACCP is also science-based and so the controls that are placed in the process should be based on scientific information.

The HACCP system has two major components:

- The HA of HACCP represents the logic in the hazard analysis which identifies the where and how of hazards.
- The CCP of HACCP represents the critical control points that provide the control of the process and the proof of the control. The end objective of HACCP is to make the product as safe as possible and to be able to prove that the product was processed as safe as possible.

This does not mean that HACCP provides 100% assurance of food safety to consumers, but does mean that a meat processing companies doing the best job possible for safe food production.

The assurance of safety comes from the process of identifying the hazards, establishing controls for the identified hazards, monitoring the controls and periodically verifying that the system works (foodsafety.unl.edu, 2013).

To keep the juice bacteria free, keep the juice fresh for another few days, healthy alternative of preserving the juice is adding a fresh lemon juice. It will also increase the level of vitamin C.

## **5.2 Cooperation of farmers and Ghana's school feeding programme**

The government's Ghana School Feeding Programme (GSFP) was piloted in 10 schools in late 2005, and since then has progressively grown to serve over 1.6 million children in 4,000 public schools across all 170 districts in Ghana. As a strategy to increase domestic food production, household incomes and food security in deprived communities, the GSFP has become a very popular programme with the Ghanaian public, and enjoys solid commitment from the government.

The programme as a whole is highly valued by the Ghanaian public, its high profile has meant sensitisation of the benefits of school feeding have reached many isolated communities (hgsf-global.org, 2010).

School feeding programmes that are used as safety nets or for social protection purposes tend to be multi-sectorial in nature in both practice and impact. In Ghana, the Agriculture, Health and Education sectors are actively involved in the GSFP implementation in accordance with the programme design. Hence, national activities and statistics from these sectors are relevant and serve as baseline information for monitoring the GSFP implementation process and also the impact of the programme as a development strategy (hgsf-global.org, 2010).

The role of GSFP in this project is important. The main idea is that this research results will be submitted to them. With this abstract, they will select school in the examined area and implement the project and final product there. The main indicator which school will be selected is of course poverty ratio and number of students with health and social issues.

### 5.3 SWOT analysis of orange juice extraction

The table listed below specifies the details of SWOT analysis for added value of harvested oranges.

Table 8: SWOT analysis

Strengths	Weaknesses
Easy availability of material Quick and easy manufacturing procedure High quality of final product	Dependence on the weather and crop yield Knowledge gap of local farmers Lack of finances
Opportunities	Threats
Strategic partnership with government GSFP Health benefits Additional income for farmers Employment creation	Global warming Possibility of government not adding orange juice on the menu of GSFP

Source: Author

### 5.4 Value chain of orange juice production

A value chain is the whole series of activities that create and build value at every step. The total value delivered by the company is the sum total of the value built up all throughout the company. Michael Porter developed this concept in his 1980 book 'Competitive Advantage'.

The significance of the value chain: The value chain concept separates useful activities (which allow the company as a whole to gain competitive advantage) from the wasteful activities (which hinder the company from getting a lead in the market). Focusing on the value-creating activities could give the company many advantages. For example, the ability to charge higher prices; lower cost of manufacture; better brand image, faster response to threats or opportunities.

Porter defines the value chain as made of primary activities and support activities. Primary involves inbound logistics (getting the material in for adding value by processing it), operations (which are all the processes within the manufacturing), outbound (which involves distribution to the points of sale), marketing and sales (which go sell it, brand it and promote it) and service (which maintains the functionality of the product, post sales).

The support functions which feed into all the primary functions are the firm infrastructure, like MIS which allows managers to monitor the environment well; Human Resource, which develops the skills needed to steer the company well; procurement to buy/ source goods at the right price, which increasingly takes importance because of difficult economic conditions and technology, which could give the firm speed, accuracy and quality.

Both these allow the firm to charge a margin, which partly comes from the value addition of the primary and support functions and partly from the advantage that the company gains due to communication of the value addition to the consumer (brand image, faith, trust and so on) (economictimes.indiantimes.com, 2015).

The initial state is, that leaders and TOP management decides what school they do want to support with their programs. They do accept project that is being created, but have their own right to choose who will be supported. This cooperation leads to supporting school, that need help the most and project will be the most effective.

The development is also counting from support with of women and mothers from villages and school staff to prepare the fresh juice, since there is no income from this project. The Figures 3 and 4 below are showing detailed value chain for small-scale orange juice extraction business and for farmers.

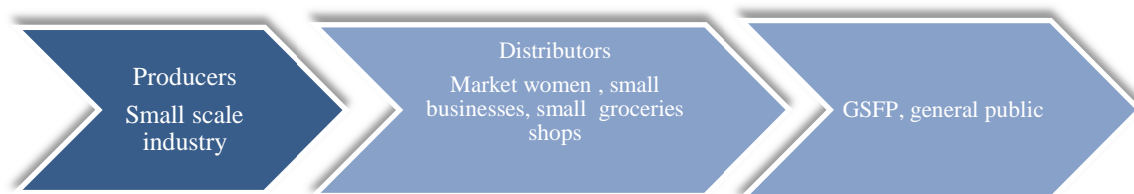


Figure 3: Value chain for small-scale orange juice extraction businesses. Source: Author



Figure 4.: Value chain for farmers of orange juice for extraction businesses. Source: Author

### 5.5 Support for the small scale business

Also with this thesis can be shown and taught how easy it is to make fresh orange juice and that they actually can make other fresh juices or other fresh supplements.

#### What steps should improve the research:

- Make a lecture for parents and students about nutrition
- Make a lecture for parents and students about oranges and their health benefits
- Flyers about raw oranges and orange peel

Implementation of project can't be done without personal support. By this mean, it is very important to get a volunteer support. I would like to solve this problem by creating a position for volunteers on web idealist.org. This could provide us cheap personal support from people, who want to help and are interesting into the project.

Other option is to co-operate with university with focus on territorial studies and international relations like Mendel University, Faculty of regional development and International Studies. Because I had a chance to experience Ghana by absolving SID program, co-operate in similar case and provide students who will volunteer on this project and make a case study based on it.

## **6. Recommendations**

It is important, to keep recommendations on a level that is realistic and performable even for Ghana government, supporting organizations and local people who are connected to the project or do live in the area where the project is being held. Stable agricultural policy with regularly changed weather is the key to success of the project and continuous functioning of supplying to the schools.

Supporting domestic trade and create better opportunities for local farmers to have their products sold at supermarket and not to import harvest from abroad countries if Ghana is able to grow the same product for a cheaper price.

Raise awareness for local farmers about creating product with added value so there is no more waste of a raw and vitamin rich product. One of the main issues is to deal with the lack of know-how and ideas how to effectively use up the whole crop without waste. If the orange is not suitable for selling by peel damage or wrong shape, it is important to spread the information that letting the crop rot isn't the right way to go and the item is still profitable.

Creating workshops and lectures sheet about health benefits of oranges, different uses and medical benefits is very important things. Local people in more socially poor districts might not be used to see orange juice being sold at school. It is very important to show them and teach them what this final product can give to their kids and how important it is to support their immune system. If the project is successful it is not impossible for the parents and all the village people to take over the idea.

In Ghana in this area it is normal for local people to have orange tree in their back yard. They can provide healthy, vitamin rich juice for their kids and whole family. Even the peel of the oranges can be used as a natural defense against mosquitos and since Ghana is country with Malaria disease, it can only help and have a positive impact on health and socio-economic status of the county.

## 7. Conclusions

The main aim of this thesis to analyze the possibility of adding value to fresh oranges in Ghana and to examine what the possible repercussions for socio-economic development in the selected is. In this thesis, the research is focused on the Ashanti region, to be more exact areas of Akrokerri and Obuasi. For the examination primary and secondary data were used.

Theoretical part of Bachelor's thesis is focusing on position and development of agriculture in Ghana and its current position. Also, overview with basic information about the country, together with the main objectives about Ghana School system can't be missed.

To analyze the economical part many methodological tools were used such as: *break-even point, cash flow, net investment, profitability index, and internal rate of return and payback period*. The internal rate of return is 1,986, which shows, that the production of fresh orange juice is returnable and the investments won't be lost. *All of these results that business plan includes should be implemented in realization of the production.*

With production of fresh juice, this is going to bring constant income and can be implemented into many different situations and areas. Since Ghanaian agriculture is stable, arises and climatic conditions are more than positive for creating a product from very common commodity in Ashanti region is not a hazard. Information about added value, process of creating fresh juice and overall use of oranges and alternative use is included.

Due to the development of small-scale business, Ghanaian government is open for supporting these kinds of projects' and many can be found on the territory of Ghana republic.

The marketing part of Bachelor's thesis is focusing on SWOT analyses, Logical Framework approach and Risk chart. The annex part of the work includes Logical Framework and Risk chart for detailed overview. One of the main threats for the juice production can be unpredictable change of weather condition, so that the crops will not be suitable for ingestion. Strong part of the production is its simple procedure, that is not time challenging and no special or previous skill are needed.



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## LIST OF ABBREVIATIONS

BHA	Butylated hydroxyanisole
BHT	Butylated hydroxytoluene
EAP	Economicaly Active Population
EDTA	Ethylenediaminetetraacetic acid
GSFP	Ghana School Feeding Programme
GHC	Ghana Cedi
HACCP	The Hazard Analysis and Critical Control Points
IRR	Internal Rate of Return
LFA	Logical Framework Approach
MIS	Management Informational System
PSC	Programme Steering Commitee
PTA	Point of Total Assumption
SLE	School Life Expectancy

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## ANNEXES

### Annex 1. Logical Framework Analysis

	Invention logic	Objectively verifiable indicators of achievement	Sources of means and verifications	Assumptions
<b>Overall objective</b>	Make contribution of school in the Obuasi area that are supplied by fresh orange juice.	Increase level of not underweight kids, spread the information about benefits of oranges.	Periodic auditing.	
<b>Specific objectives</b>	Provide healthy dietary supplement	Increase level of non- underweight kids, improve health, creating job offers for local people	Periodic reports	Job opportunity, increasing know-how and health for local school students and teachers
	Transfer know-how about nutrition.	Increase level of non- underweight kids, improve health	Periodic lectures about health and teaching about nutrition	Theoretical knowledge about subject of lectures, know-how
	Improve sales of oranges and lower their wasting	Bring informations about oranges and their benefits to families of students	Periodical lectures, educational flyers and board, spreading informations	Willingnes of people to learn and co-operate with the project
	Transfer know - how for auditing system	Establishing auditing system	Transferring know-how into practical life	Transferring know-how, external expert for the concept, supervising and leading the project
<b>Expected results</b>	Involving women in economic activities	Establishing cooperative	Legal establishment	Interest in cooperation. Knowledge of cooperatives of using the auditing and accounting system.
	Lowering waste of oranges	Establishing cooperative between local farmers and us, legal contract	Legal establishment	Money for establishment, spreading know- how and educate local families and their kids at school
	Creating auditing system	Increase awerness of production	Periodic reports	Existence of externist expert for transferring and making know-how

Source: Author

## Annex 2. Risks

Type of risk	Probability of risk	Severity of risk	Impact of risk	Elimination of risk
<b>Technique</b>				
Wrong preparation of the project documentation	average	great	Project disapproval	Time management, consultations with project mentor
Wrongly selected territory of the project	great	great	Wrong land, field research and communication with sellers on market	Field research, move to another location
Failure of time management	medium	medium	Problems with orange supplies	Co-operate with big farm
Natural disaster	great	great	crop failure	Find a replacement crop
<b>Finance</b>				
Unexpected increase of cost	medium	great	Impossibility in completing project	Financial reserves
<b>Operational</b>				
Unreability of workers	great	great	Impossibility in completing project, make the product	Have backup workers and volunteers
Lack of product because of school congestion	great	great	Every student won't be able to get fresh orange juice	Have backup oranges
Volunetter shortage	medium	medium	insufficient amount of staff, time management failiure	Hire local university students

Source: Author

### Annex 3. Realistic variation of Cash Flow

In USD	Year 1.	Year 2.	Year 3.	Year 4.	Year 5.	Year 6.	Year 7.	Year 8.	Year 9.	Year 10.
Utilized capacity	20%	30%	45%	70%	45%	30%	20%	45%	30%	70%
Revenues	685	800	534	780	5134	800	686	5134	800	780
Total costs	535	750	878	570	678	750	535	878	650	570
Depreciation	850	850	850	600	600	0	0	0	0	0
Profit before interest and taxes	870	1000	370	980	400	1000	370	400	1000	600
Interest	131	127	1100	765	0	0	0	0	0	0
Profit before taxes	-240	469	780	760	400	130	870	400	300	600
Tax	0	0	0	0	0	0	0	0	0	0
Profit after taxes	-240	469	800	790	400	300	870	400	130	360
Net cash flow (NCF)	-150	613	670	599	400	130	870	300	100	360
Cumulative cash flow	-150	968	850	660	204	168	890	150	189	350

Payback period	2,03
Profitability index	1,986
Internal rate of return	83,246%
Net present value	16230 USD
Break-even point	470

Source: Author

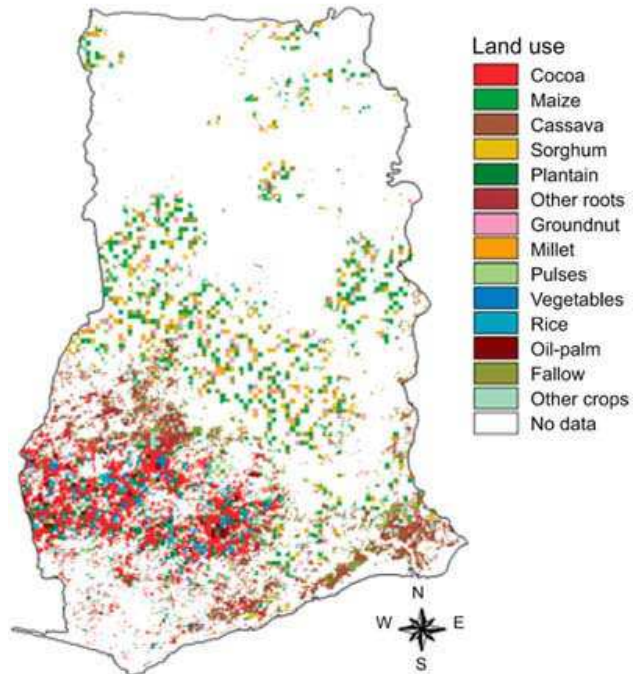
#### Annex 4.: Pessimistic variation of Cash Flow

In USD	Year 1.	Year 2.	Year 3.	Year 4.	Year 5.	Year 6.	Year 7.	Year 8.	Year 9.	Year 10.
Utilized capacity	20%	30%	45%	70%	45%	30%	20%	45%	30%	70%
Revenues	185	200	334	670	334	200	186	334	200	670
Total costs	535	650	678	370	278	650	535	678	650	370
Depreciation	350	350	380	600	600	0	0	0	0	0
Profit before interest and taxes	80	300	400	980	400	300	870	400	300	600
Interest	1015	1070	1000	765	0	0	0	0	0	0
Profit before taxes	-340	569	800	690	400	100	800	400	300	600
Tax	0	0	0	0	0	0	0	0	0	0
Profit after taxes	-340	469	800	690	400	300	870	400	1000	600
Net cash flow (NCF)	-150	613	570	599	300	100	870	300	100	360
Cumulative cash flow	-150	268	550	460	134	158	890	150	169	380

Payback period	3,45
Profitability index	1120
Internal rate of return	32,67%
Net present value	350 USD
Break-even point	524

Source: Author

## Annex 5. Overview of land use



Source: FAO Corporate Document Repository, 2004