Quality standards of Tea.

"A case study to investigate the causes and effects of low tea quality on the Cameroon Tea Estate (Tole tea)"

A Research Project Submitted to Larenstein University of Applied Sciences in Partial Fulfillment of the Requirements for the Degree of Master of Development, Specialization International Agriculture

By

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Dedication

This thesis is a gift that I would like to offer my uncle Professor DR. P.K Fogam who sponsored my education in the Netherlands. I would also like to send my warmest regards to my mother Tachang Judith Kahdoh and my girl friend Sirri Vawlet who offer me great love, endless patience. May the Almighty God Bless you.

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List of Abbreviations

BP	Broken Pekoe
CAC	Codex Alimetarius Commission
CCP	Critical Control Points
CDC	Cameroon Development Corporation
CTC	Crush Tear & Curl
CTE	Cameroon Tea Estate
EU	European Union
F	Fanning
FAO	Food and Agriculture Organization of the United Nations
GAP	Good Agricultural Practice
GDP	Gross Domestic Product
GHP	Good Hygienic Practice
GM/AP	Good Manufacturing/Agriculture Practice
HACCP	Hazard Analysis Critical Control Point
IMF	International Monetary Fund
OAS	Organization of American States
PEST	Political, Economic, Social and Technology
P	Pekoe
PO	Peroxidase
PPO	Polyphenol Oxidase
QA	Quality Assurance
QMS	Quality Management System
SLDBs	Small and Less Develop Businesses
SPS	Sanitary and Phytosanatary
SWOT	Strength, Weakness Opportunity and Thread
TBT	Technical Barrier for Trade
TRIC	Tea Research Institute of Cameroon
USA	United States of America
USD	United States of America's Dollars
VFC	Volatile Flavor Compound
WHO	World Health Organization
WTO	World Trade Organization
WTO	World Trade Organization

Abstract

Tole Tea Estate has attempted to export tea to the EU market but was rejected because of low quality. However the main causes of low tea quality remains a dilemma to Tole. This study aims to investigate the causes and effects low tea quality on Tole Tea Estate in order to provide management information towards improving quality. Results from related literature and interview shows that the causes of low tea quality can be classified into two broad categories:

- **Exogenous**. These are climate, soil type, government policy on environment and elevation.
- **Endogenous**. This includes agricultural practices which are pest and disease management, soil erosion, harvesting that is harvesting technique and harvesting rounds. Processing techniques and equipments used in processing and quality management systems and its implementation.

For this purpose, a fieldwork was conducted in Tole Tea Estate with the objective to investigate the major causes and the effects of low tea quality. The quality management system was used as a concept on the basis of which the quality of tea was assessed. Data collection methods used were desk review of information, group discussions, personal observation, key informant interviews as well as other secondary sources provided by the Cameroon Development Corporation (CDC).

The results showed that the major cause of low tea quality on Tole Tea Estate was pest and disease infestation which could not be solved by simply spraying the tea field with chemical. However other minor causes which if not taken care of could be detrimental to tea quality were hygiene of workers and equipments, lack of staff training, method of harvesting, poor implementation of quality management system, low wages to workers and absent of specialised functions like quality control department in the organisational structure.

However the causes mentioned above led to the following effects on Tole Tea Estate.

- Low income to Tole Tea Estate and workers
- Low price on the market
- Unable to replace old and dilapidated machine and hire professional staff
- Bad reputation both on the domestic and international market
- Lost of customers
- Unable to access the EU market.

Based on the above mentioned causes and effects, the following recommendations were made:

- It was also recommended that workers be trained on integrated pest management which seems to be a way out since pesticides has proven not to be effective and also had negative effects on the environment. This was a new idea for Tole and required that management of Tole invested in training of field staff.
- In order to efficiently apply pesticides, It was recommended that Tole Tea workers be trained on pesticides application or the operation manager organizes briefing sessions on pesticides application where workers are briefed before they apply pesticides.
- For workers to put in maximum effort in their job, it was also recommended that Tole Tea Estate improves working conditions of workers by providing health insurance to the temporal workers and re-instate their fringe benefits. Also it is advocated that the earnings of workers especially the temporal workers be increases above the minimum wage as stipulated by proponents of fair trade.
- For quality of tea to be improved, It was suggested that the percentage of coarse and fine plucking be reverse from 60% and 40% respectively to 40% and 60%. Also it is also suggested that if operation manager organizes the labourers in to two groups; one group

responsible for course and the other for fine plucking in the ratio given above, the quality of tea might improve.

- It was also advocated that if Tole change its plucking system from 30 days to 15 days this will partly solve the problem of pests and improve tea quality.
- For Tole tea to produce quality tea, It is proposed that Management of Tole Tea invest in quality management by implementing the Codex alimentarius in the field and improving on general hygiene in the factory. Posters and pictures deemed necessary to be pasted on the walls instructing workers on what need to be done like washing of hands, wearing outer garment and how equipments should be handled. This could also help inform visitors on what could be done when they visit the factory.

1. Introduction

This study is a thesis for the Master in Management of Development at Van Hall Larenstein University of Applied Sciences. The study has been designed to investigate the causes and the effects of low tea quality in Tole Tea Estate in order to provide management information towards improving quality of tea. This study is also an assignment from my uncle who anticipates setting up a medium size tea estate of 350 hectares in the North West Region of Cameroon. The outcome of this research will provide recommendations to both my uncle and Tole Tea Estate on how tea quality can be improved.

This chapter focuses on the general introduction to the thesis. Section 1.1 presents the background to the study. Section 1.2 describes the problem in Tole Tea Estate, research objective and research questions. Section 1.3 presents the methodology used in the research. 1.4 discusses analytical methods and 1.5 elaborate on how the procedure was modified. Section 1.6 discusses the key words used in the thesis and finally section 1.7 shows how the thesis is organized.

1.1 Background to the study

Tea production and marketing can be traced as far back as 1928 at Tole, on the South Eastern slopes of Mount Cameroon, in the South West Region. It has an altitude of 2200 meters above sea level and an average temperature of 22^0C. In 1952, the Cameroon government launched the Tole Tea Estate and put it under the Cameroon development corporation (CDC) and four years later a small tea production unit of 54 hectares was planted. This developed by 1968 to about 450 hectares with production figures in excess of 1080 metric tons with an annual sale of about USD 1,728,000 (Konning 2000). Quality remains the key factor to access different markets and it is a must to apply good manufacturing practices (GMP) and hazard analysis critical control points (HACCP) in order to be competitive on some markets like the European, USA and the Japanese. This estate is specialized on processing of black tea because of it high demand on the Nigerian and domestic market. Also because of the high demand for cheap tea on these markets, low quality tea was produced because the market could not afford high quality. 80% of the tea was sold in Nigeria while the remaining 15% and 5% went to the domestic market and the USA respectively due to the high demand on the Nigerian market. The great success of Tole Tea Estate in producing and marketing tea profitably made the government to create two more tea estates in Ndu, the North West Region and Djuttitsa, the Western Region. We also have the Ndawara and the Liko tea which are privately owned and located in the North West Region and South West Region respectively which also specialized in the processing of black tea. The tremendous increase in tea production without corresponding increase in demand in both the Nigerian and domestic market let to a decrease in price. These markets were flooded with tea and CDC fetched very low price on these markets. These tea estates could only survive because of government subsidies on inputs like pesticides, fertilizer, extension service and labor. It then decided to look for new markets where its excess product could be sold. Due to the increasing demand for tea on the European markets, CDC decided to access these markets (Gana 2000).

Tea traded internationally needs to comply with mandatory standards (e.g. EU's food safety and labeling regulations). Quality standards imposed by the EU, USA markets and other major private companies in key markets have increasingly important implications for export of tea from developing countries (Luning 2006). To access these markets, food (tea) commercial enterprise must meet them through the application of GM/AP and HACCP (FAO 2006). The implementation of sound quality assurance programs is also a must to increase

their competitiveness. Several attempts were made by CDC to export tea to the EU markets but were rejected because of low quality. Due to the above ramification, CDC continue to receive low price for its tea on the Nigerian and domestic market and a niche market was found in USA which could only absorb 5% of its low quality product as mentioned above. The inability of CDC to make profit led to its privatization in 2002 to the Cameroon Tea Estate (CTE) who is also the proprietor of the Ndawara Tea Estate. Another reason that led to the privatization of the Tea Estates was due to structural adjustment program and demands from the World Bank and the IMF on privatization of some key state estates (Bouddih 2003). The CTE is made up of four tea estate; Ndawara, Tole, Ndu and Djuttitsa. After privatization of the tea estates, subsidies were removed and about 50% of its workers mostly harvesters were laid off and a harvesting machine was introduced because the new company could not cope with the high cost of labor. The harvesting machine was abandoned a year later because it was not selective in picking tea leaves that resulted in very low quality which could not be accepted even on the domestic market. Some of the workers were re-employed (Kaluh 2000).

Findings from a study by (Kalu 200) indicates that Tole Tea Estate is unable to identify the major causes of low tea quality which has deprived her from accessing high valued markets like the EU. These study further points out that the underlying causes and effects of low tea quality require clear understanding of possible interventions that could help Tole Tea Estate to access the EU market.

1.2 Problem Statement

Tea production and marketing was once the most profitable export crops in Cameroon. The rising demand for high quality tea on both the domestic and export market has made the Cameroon tea estate to re-think on the strategies needed to meet market quality demands. Several attempts were made by the Tole Tea Estate to export tea to the EU markets but were rejected because of low quality. However the causes and effects of low tea quality remain unknown to Tole Tea Estate.

Research Objective

The main aim of this study is to investigate the causes and effects of low tea quality on Tole Tea Estate so as to provide management information to improve tea quality.

Main research question

What are the causes and effects of low tea quality on Tole Tea Estate?

Sub questions

1. What are the critical control points (CCPs) in tea production and processing?
2. What are the determining factors for quality of tea?
3. What are the equipments used by Tole Tea Estate in tea production, processing, packaging and grading of tea and how do they influence quality?
4. Which quality management system does Tole Tea Estate use?
5. In what way is the quality management system of tea implemented?
6. In what way does the organizational structure of Tole Tea Estate influence quality management system?
7. What are the consequences of low tea quality on Tole Tea Estate?

1.3 Research Methodology

This part discusses the data collection process used in the study. Specifically, it outlines key issues pertaining to the research strategy, study design and approach, data collection methods, analysis strategies used and procedure modification.

1.3.1 Research Strategy

This study focused on Tole Tea Estate because it is accessible and located in the capital of the south west province with good road and it is easier to get information since it is just 55 km to Douala, the headquarter of CTE. More attention was paid on tea bush management, Post harvest handling and processing of tea in the factory because those were the most critical control points in tea production and processing.

This research study used two types of data collection strategies; desk review of information pertaining to the research topic and a case study on Tole Tea Estate.

- Desk review was conducted to have an overview of the different causes of low tea quality on the tea value chain. Specific topics like climate, inputs like fertilizer, pesticides and diseases control, tea bush management, soil erosion, harvesting and processing techniques were looked at. These topics gave an insight on some of the causes of low tea quality.
- A case study was conducted in Tole Tea Estate to have in-dept causes of low tea quality and important topics like organisational structure and its influence on quality management systems, harvesting technique, critical control points, management information system, monitoring and evaluation and good manufacturing practices. These topics gave in-dept causes of low tea quality on Tole Tea Estate and results were compared with relevant literature in order to cross check and provide sufficient information on the main causes of low tea quality.

Case study

- A survey of purposive sampling of 15 laborers who weed, spray and prune tea bushes was interviewed in order to acquire information on tea bush management. The sampling was done purposively because there were limited numbers of people who had knowledge on the research topics. Only 15 farmers were chosen because of the limited time frame for the research and semi-structured questions were used as shown in appendix 2
- 25 tea pickers were interviewed on harvesting technique and on how the harvesting equipments are used (harvesting stick and basket) so as to acquire information on logistics and the type of leave that is plucked in order to triangulate with literature and semi-structured questions were also used .
- The general manager was interviewed on the organizational structure in order to acquire information on how the various departments interact in terms of information flow. He was also interviewed on quality management system and how it was implemented. Opened ended questions were used to have an overview of the whole system but limiting him to the above topic.
- 5 processing technicians were interviewed on GMP/GHP and HACCP in order to verify with literature and semi-structured questions were used.
- 3 tea tasters were interviewed on characteristics of good quality tea in order to compare with markets point of view of good quality tea and open ended questions were used.
- The field officer was interviewed on the application of chemical fertilizer and pesticides.
- The estate master was interviewed on monitoring and evaluation and how transport net work in the factory can be improved.

- Key informant interviews with NGOs like WINHEECAM, Home-Based organization like ASCODA, U & I Business consultancy INT LTD, South West Regional delegation of agriculture (Technical director for quality control) and community leaders actively involved in food safety and quality assurance in the study area. Interviews were based on quality standards and on the services they render to Tole Tea Estate in order to identify gaps. Open ended questions were used.
- A temporal picker and a permanent labourer that manage tea bush were interviewed on social issues like health and earnings.

Direct Observations

This technique is important for learning about the causes of low tea quality, identifying constraints, local solutions and other available resources (Verschuren 1999). An attempt was made to learn a lot about the causes of low tea quality during the six weeks of fieldwork through very close observations of the way different groups of workers in Tole Tea Estate perform their activities and the effects on tea quality. An attempt was also made to understand more about the causes of low tea quality and the viewpoint of the workers through participating in some field activities. The researcher participated in harvesting and observing how tea is processed in order to identify the critical control points and how it influence quality.

Focus Group Discussions

Focus group discussion is a technique whereby a group of people (as few as 6 and as many as 30) is brought together for a joint interview session (Benturd, 1988) cited in (Eyob 1999). Focus group discussion is not a way to measure precisely the amount of some behavior in a population, but it is an excellent method for getting an indication of how pervasive an idea; value or behavior is likely to be in a population, or for understanding how deeply feelings run about products, issues or public figures.
Focus groups differ from regular discussion groups because a moderator is present to provide all participants with an opportunity to have input and enable participants to lead the direction of the discussion until no more new ideas are raised. It is important to rely on individuals who have local knowledge and experience with respect to the topic that is the focus of the discussion. In order to get preliminary results, focus group discussion was organized with representatives from all the departments in Tole Tea Estate on good hygiene practices, challenges in tea production process and causes of low tea quality in order to compare with relevant literature and triangulate with individual interviews and semi structured questions were used.

1.4 Analysis of results

The analysis of findings in this study was based on the Strategic planning model that is Strengths Weaknesses Opportunities and Threats (SWOT) to ensure that the objective was attainable and to identify the internal and external factors that were favorable and unfavorable to the tea estate in achieving the research objective. Multi-stakeholder analysis approach as noted by Chambers (2007) that when looking at organisation and societal problems the focus should not only be on one dimension but address other dimensions by looking at different stakeholders. The macroeconomic environment in which Tole Tea Estate operate is constantly changing. The growing importance of environmental factors in the first decade of the 21st century has given rise to green business. The PEST was used to analyze the institutional context in which Tole Tea Estate operates. The quality management system was also used to analyze Tole Tea Estate's ability to meet market standards. In the area of quality management, this study captured information related to monitoring and evaluation,

management information system, organisational structure of Tole Tea Estate, GMP/HP, HACCP, value chain analysis, attribute of good quality tea, policy issues by interviewing different stakeholders to get different views of the stakeholders on causes of low tea quality.

1.5 Modification of procedure

In this research the literature reviewed was in English, thus the checklist was first developed in English. However, it was actually used for collecting information in Tole Tea Estate which about 75% of the respondents does not understand English. Therefore, the English version had to be translated into a language which is understood by the entire respondents which is Pigin. This translation might have biased the original design of the questions. A number of quality management terms, such as standard, quality assurance, HACCP could not be precisely translated into Pigin terms. Various measures were taken in order to minimize these potential problems. The English version was translated into Pigin by the author himself, who had previously did an internship in field of quality management in Tole Tea Estate and was therefore assumed to have enough knowledge of quality management in both English and Pigin . Some English terms were translated into Pigin by providing additional explanations so that respondents could better understand them. After translation, the Pigin version of the checklist was mailed to three estate managers of CTE. They were asked whether:
(i) The items were stated in a shared vocabulary,
(ii) The items were precise and unambiguous,
(iii) There were biased wordings,
(iv) They could answer the questions.
They returned the questionnaires with their comments, and some alterations were made according to their suggestions. During the author's research visit to Tole Tea Estate the Pigin version of the checklist was formally pre-tested on various people (U & I consultants, 3 tea pickers, a processing technician, and a field officer). The author interviewed these people and asked them to provide feedback on ease of comprehension, clarity of the specific items, suggestions for possible change, and suggestions for additional items. Their suggestions were then carefully evaluated by the author. After this step, the author was confident that the questionnaire could be used for the research.

During the time of the research, the study had some certain difficulties. First there were some constraints when working in the field such as insufficient data and interviewed people. Some of the respondents could not understand the Pigin version of the questions especially the elderly laborers who had more experience. Due to limited budget, the study only conducted interviews with limited number of stakeholders. It would have been better if researchers from tea research institute of Cameroon were interviewed to get their views on causes and effects of low tea quality. Also it would have been better if worker of other tea estates in Cameroon like the Ndawara Tea Estate were interviewed in order to cross-check and have a broader view of the issue. The study was conducted during the rainy season which also limits the amount of information due to more rainy days. Besides, the limitation of resources also prevented the study to investigate more information on the value chain of tea. If such issue had been addressed in the study, the analysis of the causes of low tea quality along the tea value chain would have been more critical. Some of the interviewee objected the idea that their names and photos be included in the project. A few accepted and their names and photo will be included in this research.

1.6 Definition of Key Concepts

In writing the thesis, the flowing words were used according to the context as described below.

1. **Quality management system**

Quality Management System (QMS) can be defined as a set of policies, processes and procedures required for planning and execution (production / development / service) in the core business area of an organization. QMS integrates the various internal processes within the organization and intends to provide a process approach for project execution. (Anderso et. al., 1999)

2. **Post harvest handling**

Post harvest handling is the stage of crop production immediately following harvest, including transport, cooling, cleaning, sorting and packing. The instant a crop is separated from its parent plant, it begins to deteriorate. Post-harvest treatment largely determines final quality, whether a crop is sold for fresh consumption, or used as an ingredient in a processed food product. (Thompson 1998.)

3. **Quality**

Tea is said to have low quality when it has poor flavor, fetch low price, smell, and dull color, no uniformity of size, high fibre content and trueness of grade for the dry leaves.

4. **Quality assurance**

Quality assurance refers to planned and systematic production processes that provide confidence in a product's suitability for its intended purpose. (Merriama1996)

5. **Good hygienic practices**

All practices regarding the conditions and measures necessary to ensure the safety and suitability of tea at all stages of the tea value chain.

6. **Codex HACCP system**

A system which identifies, evaluates and controls hazards which are significant for tea safety, described in Annex 1, the Codex General Principles of Food Hygiene (FAO and WHO, 2003).

7. **HACCP-based system**

A system that is consistent with the seven principles of HACCP but does not conform to the layout or steps of the Guidelines for the food business managers and food enforcement officers.

8. **operating core**

Staff undertaking the basic work of an organization

9. **strategic apex**

Top management in organization

10. **pooled interdependence**

The divisions of an organization are linked through its centre/central management

11. **Metaphor**

A figure of speech in which a term is transferred from an object it ordinarily designates to another object, it can designate by implicit analogy

1.7 organization of report

This thesis is organized into 6 chapters. Chapter one introduces the problem statement, research question and objective. Chapter two reviews the basic concepts. Chapter 3 presents results from interview and chapter 4 compares the results and relevant literature presented in chapter 2. Chapter 5 analysis Tole Tea's external and internal environment using PEST and SWOT respectively. Chapter 6 is the final chapter and contains a conclusion and recommendation.

2. Value chain of Tole Tea Estate and quality management system

This chapter will put emphasis on the organizational structure of Tole Tea Estate, value chain and quality management systems. Section 2.1 presents the background of tea. Section 2.2 describes sustainability in tea production. Section 2.3 discusses the structure of the tea sub sector in Cameroon. Section 2.4 introduces Tole Tea Estate. Section 2.5 presents the organizational structure of Tole Tea Estate. Section 2.6 discusses the value chain of tea and critical control points and finally section 2.7 presents' quality management systems.

2.1 Background of Tea

'Tea Tipping in'
Source: the Author

Tea is a perennial evergreen shrub belonging to the Camellia genus of the Theaceae family. It is manufactured by a variety of processes, producing a range of beverages from green, non-fermented tea through to black, fermented tea. The consumer acceptability of this beverage is largely dependent on the flavour of the finished product (Bergman 2001). Tea aroma, which is of the volatile flavour, Compounds (VFC) generated during tea processing is an important quality parameter, determining the price of made tea. These VFC Can be divided into two groups;
1. The group I compounds are mainly the products of lipid breakdown, which imparts an undesirable grassy odour.
2. The Group II compounds, which impart a sweet flavoury aroma to black tea, are mainly derived from amino acids. The flavour of made tea depends on the ratio of that VFC Group I, which is the flavour index.

2.2 Sustainability in tea production

Globally, agriculture is under environmental pressure with growing competition for available land loss through soil erosion and increasing agricultural impact on water supplies. Since the mid-1990s, the department of sustainable agriculture in the ministry of Agriculture in Cameroon has been working with agricultural experts, NGOs and the Cameroon Tea Estate (CTE) to promote agricultural sustainability programs intended to safeguard its environment from being degraded while promoting good agricultural practices (GAP), ecological benefits and social responsibility. After water, tea is the most popular non-alcoholic beverage in the world and contributes to about 2% to GDP of Cameroon (MINEFI 2006). Ensuring sustainable tea production is a major focus of these programs. They focus on reducing pesticide use and supporting natural biodiversity by maintaining forest strips in the plantations. The CTE is also using plantation wood as fuel and hydro-electricity to generate electricity with the aim of reducing carbon dioxide emission.

2.3 Structure of the tea sub sector in Cameroon

The tea sub sector forms part of a wider agro-industry or agri-business sector. The tea sub sector can be represented in a flow chart which shows the whole 'Tea Chain' from primary agricultural production to the consumer as shown in figure 1.When we consider the situation prevailing in many developing countries, we find that the tea sub sector is so far only moderately developed and often shows imbalances. Moreover, there is generally a striking dualistic development, with on the one hand a rather well developed modern sub-sector that produces for export and/or for local higher income markets and on the other hand a much less developed sub-sector producing for the local market only. This dualism is particularly strong in many African countries but also noticeable in Asia and Latin America. The doted line in figure 1 shows the functions that Tole Tea Estate performs.

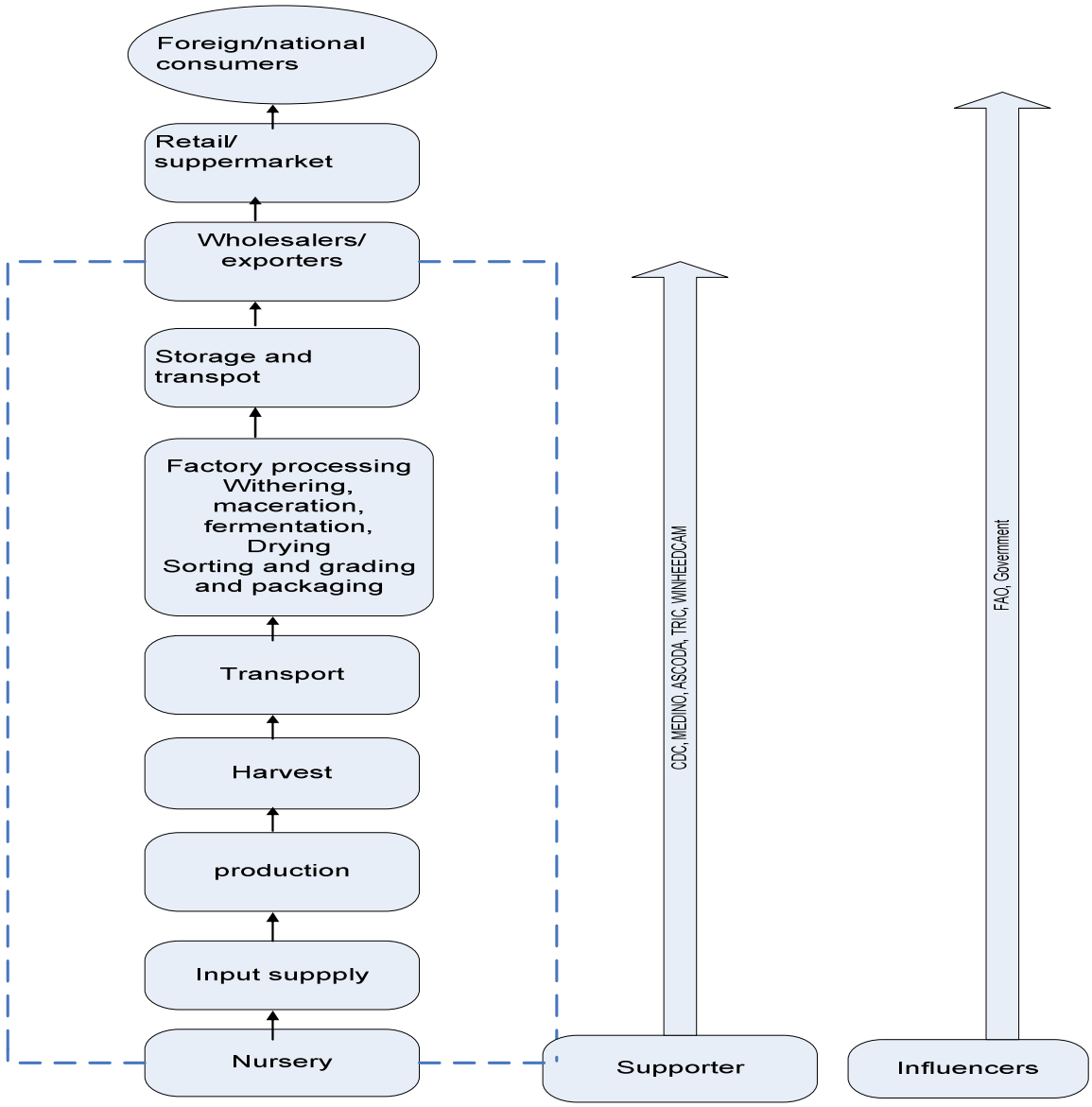

Figure 1 structure of the tea sub sector in Cameroon
Source: the Author

2.4 Introductions to Tole Tea Estate

An experimental tea estate was originally created in Cameroon by Cameroon Development Corporation (CDC) in 1928 at Tole, on the South Eastern slopes of Mount Cameroon, near Buea with an altitude and average temperature of 2200 meters above sea level and 22^0C respectively. In 1952, the CDC re-launched the Tole Tea Estate and four years later a small tea production unit of 54 hectares of tea was planted. This developed by 1968 to about 450 hectares with production figures in excess of 1080 metric tons with an annual sale of about USD 1,728,000 (Konning 2000). The goal to Tole Tea Estate is to produce and market quality tea profitably. This estate has specialized on the cultivation and processing of black tea. Tole is one of the four tea estates of the Cameroon Tea Estate (CTE) as mentioned in section 1.1 with a work force of 325 employees of which 95 and 15 are temporal and professional workers respectively. Table 1 below shows the average yields of the four tea estates of the CTE.

Table1 Average yield of made tea

Average Yields of made tea (1990-2005)	
Yield range (kg/ha)	**Estates**
550- 749	Tole
600- 800	Djuttitsa
700- 950	Ndu
1000- 1,200	Ndawara

Source: CDC 2006

It can be seen on table 1 that Tole has the lowest yield while Ndawara has the highest. This is because Tole is the oldest tea estate and the tea bush specie mostly belongs to the "China Jat" and "China hybrid" which depreciates with age while the Ndawara tea estate was established recently and specie coming from hybrid propagated in Kenya. The Tole specie is hardly cultivated nowadays because it degrades easily with age as mentioned above showing various signs like low yields, small leaves and is susceptible to pest and disease as will also be seen in section 4.2.

2.5 Organizational structure of Tole Tea Estate

The Tole Tea Estate's organisational structure is comprised of two main branches; the technical branch and the administrative branch. Since the main goal of the organisation is to produce quality tea, the presentation of the organisational chart (figure 2 below) has put more emphasis on the technical branch which hosts the operating core of the organisation.

The organisational structure design of Tole Tea Estate is what Morgan (1989) as quoted by Rollinson (2008) on the basis of the Mintzberg theory defines it as machine bureaucracy. The organization has a hierarchical structure with three levels of management comprising the strategic apex (Director, General Manager and the Operation Manager), the technical management team (Assistant Operation Manager, Estate Master, Field officer and Supervisor) and the Administrative management team (section officer, assistant section officer and clerk). The technical branch of the organization is mandated to implement standardised/specialised quality management on the entire tea production and processing chain of Tole Tea Estate. This branch is responsible for production, pest and disease management, and quality improvement. This branch is technically managed by the assistant

operation manager. The administrative branch is responsible for the administrative operation of the estate like human resource, finance and procurement. The two branches' activities contribute towards the achievement of Tole Tea Estate's overall goal which is *to produce and market quality tea* as stated in section 2.4. Each branch receives support from strategic apex. In this context, it is observed that despite the branches operating as specialized functional groupings, they all contribute to the organizational goal in a design which Thompson (1967) as quoted in Rollinson (2008) describes as pooled interdependence. Within each branch, there is a scalar chain of command with specified lines of supervision and reporting systems from the different job levels to the overall management. Due to existence of different branches, goal setting in Tole Tea Estate is typical of "Interactive Goal Setting" in which case goals are initially set by a branch and then negotiated to a consensus with the strategic apex (as shown by information flow in figure 2 below)

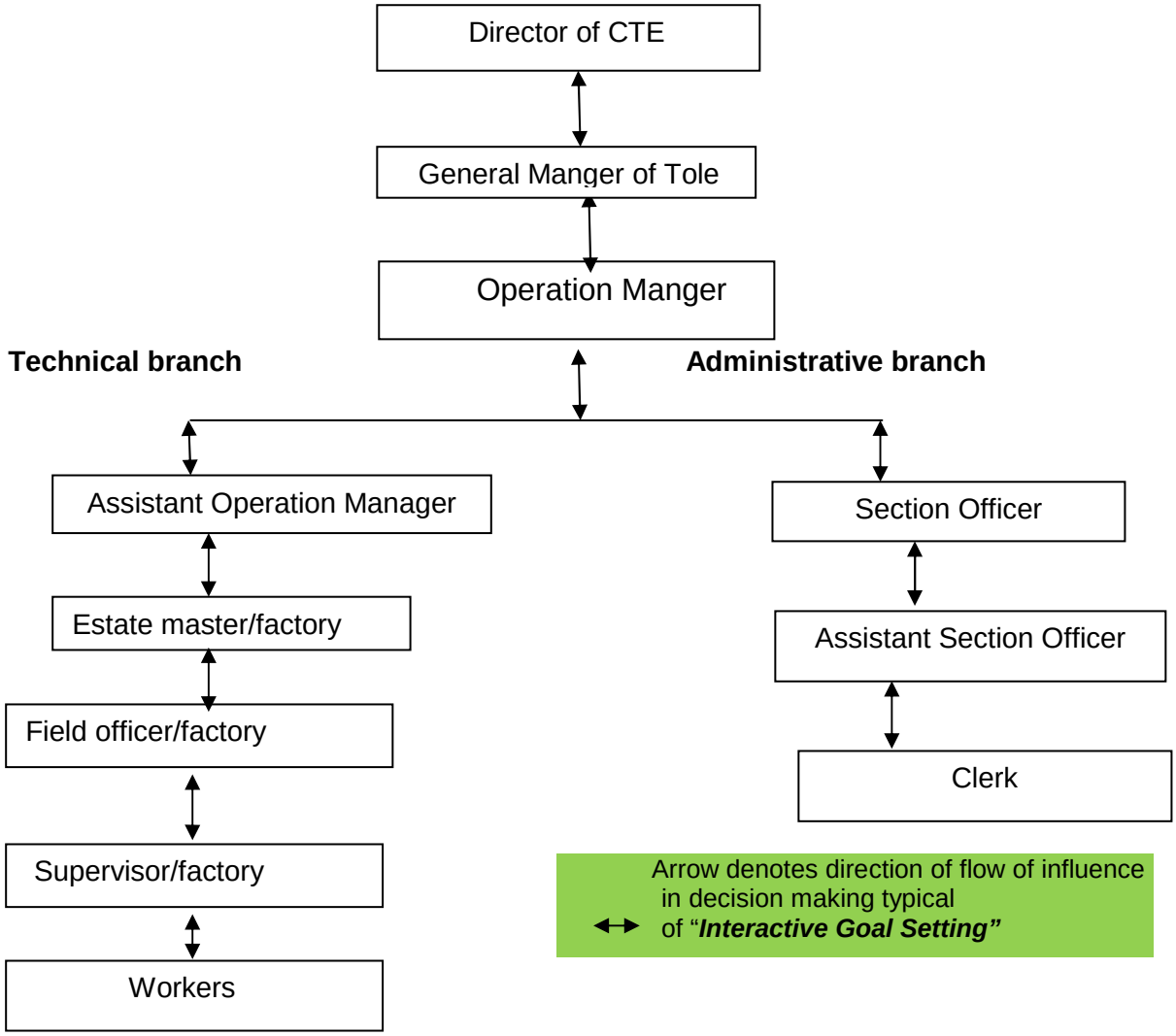

Figure 2. Organisational Chart of Tole Tea Estate
Source: CDC 2006

The organizational structure is based on what Morgan (1989) describes as a machine metaphor. Tole Tea Estate has a central focus with overall tasks split into structured branches. It is also an old agricultural organisation that has been in existence for about 45 years. In terms of size, the organisation is large with a total workforce of 325 of which 95 and 15 are temporal and professional staff respectively. Choice of this metaphor was meant to help ensure ease of coordination and control of the organization which is relatively large through a central coordination unit.

2.6 The Tole tea value chain and critical control points

The implementation of sound quality assurance program is obligatory for Tole tea to increase its competitiveness on the world market. There are standard procedure and manufacturing practices that if Tole tea follows, it will be competitive on the world market. This procedure and practices begins from the farm practices and the harvesting of the fresh leaves to the processing plant. Below are the method and procedure to meet the national and the international norms of HACCP. To obtain quality tea controls and monitoring have to be made at the initial stage such as the climate, soil, husbandry management, harvesting, processing and grading (Mortimore, 2000).

2.6.1 Tea bush management

Tea bushes cultivated in Cameroon, formerly by the CDC mostly belongs to the “China Jat” and “China hybrid” species. It is a hardy multi-stemmed slow growing evergreen shrub which if allowed to, can grow up to 2.5 meters in height. It takes four to six years to mature. The leaves are small and dark green (Lonla 2005).

Suitable climatic condition

A suitable altitude for tea cultivation ranges between 1500m and 2250m above sea level. Tea does well in an environment with well-distributed rainfall ranging from 1200mm to 2500mm annually with long sunny intervals. Suitable temperature for tea growth ranges from a minimum of 12^0C to a maximum 29^0C. Soil type and climatic condition are very important factor for tea growth; therefore the soils must be well drained. A PH range between 4.5 and 6.5 is suitable beyond which the tea is retarded. Research from Lonla (2005) showed that Tole Tea which is located at the foot of mount Cameroon is suitable for tea cultivation.

Tea Husbandry

The development and production of good quality seedlings is a critical and sensible area within a nursery since the quality of any final product depend on the input, tea is not an exception. The nursery site should have enough land area, water and availability of good mother plants from where cuttings will be prepared or obtained. The nursery is prevented from pests, diseases and invaders by constructing a canopy using hooks and covered with transparent polythene sheets that will provide the cutting with normal temperature within a period of 4 months. The nursery and the tea fields should not be sprayed with chemical pesticides too often because some natural enemies of pest may be destroyed and residues of chemical will be found in the processed leaf. (Wahs 2003).

Planting of the cuttings in the beds

After soil preparation, cuttings are transplanted in the field in sachets. This is done to avoid the plant from losing water. In order to maintain a manageable plucking table and lateral spread of the tea plant, the tea bush is pruned. Pruning cycle begins after 3 to 4 years that the tea was planted but it depends on the rate of growth of the tea plant. The picture below shows how tea is pruned. The tea plant is kept at 1 meter but if allowed can grow to 5 meter. Pruning is CCP because it removes diseased, dead knotted branches so as to rejuvenate the plant. Knives, file, graded/marked stick are used in pruning and pruning time should coincide with the end of the peak-growing period (June to November) when there is adequate moisture in the soil. The pruned leaves are not removed from the field because it helps to:

- Prevent soil erosion
- Improve soil structure
- On decomposition release large amounts of plants nutrients into the top soil
- Form mulch that prevents weeds from sprouting in the garden.

Tea pruning. Mr Babila
Source: Author

2.6.2 Tea harvesting

Plucking season begins in March and closes by November, the cold dry season months of December to February are periods of dormancy. Harvesting cycle is done after every two weeks or one month but depends on the season and management. Each hectare yields an average of 850Kgs of made tea and about 4kg of green leaves equal 1kg of made tea less than the yield in Kenya. Plucking standard as mentioned above is two leaves and a bud, a very soft banjhi is also acceptable. This type of plucking is called fine plucking. The finer the plucking the better the quality of tea, but plucking one leaf and a bud and premature shoots would result in high quality tea, but the price obtained cannot compensate for the low weight of leaf plucked. Plucking three leaves and a bud results in poor quality which sells at low price and may not be acceptable in the market. The harvesting equipments are; basket fitted with straps, stick about 3 meter long and a plucking cap. The plucking stick is used through out to differentiate areas that have been plucked. The plucking cap prevents direct sunlight

from entering the basket and also from burning the picker. Good plucking entails using both hands and carrying a plucking basket on the back. Leaving the basket at one end and moving to and fro carrying leaves in the hands waste picker's time and causes heating up of the leaf. Every picker should aim at plucking an average of 30kgs of green leaves a day. Banjhi shoots above the table must be plucked in order to stimulate new actively growing plucking points (Owuor. 2001).

Chemical changes after plucking

Once the leaf is plucked the anabolic reaction ceases and catabolic reaction leading to the breakdown of large organic compounds to simple molecules starts. There is rise in temperature in the mass of the plucked leaf during storage and transportation due to respiration. This is one of the most critical points because if the leaf temperature exceeds 29^0C, the entire leaf is damage and any attempt to continue processing the damaged leaf will only produce tea that cannot be consumed. It is important to harvest in the morning since the temperature is lower and the leaves should be transported immediately to the factory so as to give more time for the leaves to be processed the same day. Harvesting on rainy days should be avoided since it takes more time to process wet leaves and also results to low quality tea. In the process of respiration organic substances in the cells (usually sugar) are oxidized into carbon dioxide and water with the release of energy as shown in the following equation:
$C_6H_{12}O_6$ (Glucose) + $6O_2$ (Oxygen) $\rightarrow 6CO_2$ (Carbon dioxide) + $6H_2O$ (Water) + 674 calories (Heat)

The above reaction shows that carbohydrate degrade to produce sugar, which burns in the presence of oxygen and produce energy to run biochemical reactions, which are enzymatic and temperature dependent.

2.6.3 Tea manufacture

Tea manufacturing is normally carried out in two ways:

- **Crush, Tear & Curl (CTC).** CTC refers to the process where the withered green leaves are passed in-between two rollers rotating in opposite directions. There is complete maceration of the leaves and the resulting powdery material is referred to as "cut dhool". Enzymatic action is maximum in CTC type of manufacture. This process gives better thicker liquor and yields more cups of tea per kg of leaf as compared to the orthodox type of tea.
- **Orthodox**. In orthodox type of manufactured, the withered leaves are rolled or macerated on specially designed orthodox rollers which twists and crushes the leaves thereby rupturing the cells. The maceration is less as compared to CTC processing. But this process results in teas which are famous for its aroma, bright liquor and subtle, slight fruity flavour, which are mostly sought attributes by the consumers of overseas countries (Owuor. 2001).

The process of black tea manufacture involves enzymatic action on green leaf and is completed in four stages:

Withering

Withering is the first processing step in the factory and is a process in which freshly plucked leaf is conditioned physically, as well as chemically for subsequent processing stages. It takes an average of 15 hours for the process to complete and is one of the most critical control points in tea processing. Withering is one of the most important tea processing steps and is the foundation for achieving quality in tea manufacture because it increases the

caffeine content which contributes towards briskness. Also it leads to partial break down of proteins to amino acids which act as precursor for aroma. In order to facilitate the next step in tea manufacture and to obtain good quality tea, various equipments such as Tat Withering, Tunnel Withering, Drum Withering and Trough Withering are used.

Leaf Maceration (Rolling)

The principal objective of leaf maceration is to undertake cell rupture carried out in a rolling machine where progressive disintegration of cellular organelles takes place. The process results in exposure of cell sap leading to intermixing of chemical constituents and enzymes in the presence of atmospheric oxygen to form the important chemical constituents responsible for characteristics aroma of tea. The mechanical breaking of shoots at this stage also results in the formation of particles of various shapes and sizes. Therefore, leaf maceration is also a key step in tea manufacture. The Orthodox and CTC method of tea manufacture are separated at this stage of tea manufacture (Hampton 1992).

Oxidation (fermentation)

The principal difference between black teas and other types of teas like green tea and oolong tea is the presence of condensed catechins. For example polyphenols of higher molecular weight is formed through enzymatic oxidation with the help of enzyme polyphenol oxidase (PPO) and peroxidase (PO). The objective of oxidation is to allow catechins to come in contact with the enzymes mentioned above, which oxidize these catechins in presence of oxygen. The temperature and relative humidity also have a role in these oxidation reactions and is kept at a level at which the enzyme activity is at the peak that is 25^0C and 760mmHg respectively. For complete oxidation, adequate amount of oxygen is needed and this is achieved by exposing the leaf in free air. Further, various liquoring qualities of tea are formed depending on the extent to which catechins have been oxidized. Briskness, flavor, strength and color change with time and temperature and each character is at its peak at different times. Flavour is developed much more rapidly than the other quality attributes and may slowly disappear if oxidation is unduly prolonged. Similarly, strength is a measure of the soluble matter in the liquor (Hampton 1992). There are basically two methods of oxidation used in the Cameroon Tea Estate:

- Floor and Rack
- Deep Bed/Forced Air

The floor and rack is used more frequently than the deep bed/forced air because of its simplicity. The latter is complicated and requires more experience and professional staff.

Drying

After the tea has been oxidized, its moisture content is still high. However the tea has to be dried. The main objectives of drying are:

- To arrest enzyme action
- To remove moisture from the leaf particles and
- To produce a stable product with good keeping quality.

Tea tasting

Tea tasting has its own distinct routines. The taster takes the tea into his mouth with a loud sucking noise. He swirls the liquor round his tongue and gums, drawing the aroma back into his mouth and up into the olfactory nerves. The tea is assessed by a tea taster for its taste, color and liquoring qualities while it is mainly the tongue that experiences taste, other surfaces of the mouth also play a role here. There are four main kinds of tastes: salty, sour, sweet and bitter. Tea tasting is a precise skill and can only be performed with a good natural

palate and active olfactory nerve. Apart from tasting and describing tea, the ability to value a tea calls for long experience and knowledge. (Hampton 1992)

Sorting, grading and packing

Sorting is the operation in which tea particles of the bulk are separated into various grades of different sizes and forms confirming to trade requirements. The process of sorting has two objectives:

i.) To enhance the value and
ii.) To impart quality.

The grades generally produced are named as follows: Broken Orange Pekoe (BOP), Broken Pekoe (BP), Fanning and Dust. The grade specifications are entirely artificial though not completely arbitrary. After sorting and grading, the tea has to undergo a further cleaning process which is necessary for removing any stalks, fibrous residues and other foreign particles. Winnowing in some form or other is a routine practice and according to the size and density of the particles this separates the fanning and dust. It also carries away the fibrous residue and tea fluff, which is of no commercial value as a grade. Packing is the process of preserving the product using the cheapest but most appropriate material taking into accounts the product properties and the specific needs of the end users (Hampton 1992).

2.6.4 Marketing

Tole tea estate has marketed its products nation wide and internationally with Nigeria being its main export market. 90% of its product goes to the export market while the remaining 10% is consumed locally. 70% of its domestic consumers are institutions like the arm force, schools, restaurant, hotels and hospitals. It has use the marketing mix that is product, price, place and promotion to create awareness of its products and to have maximum customer satisfaction. It has branded its product into red and blue label tea and is parceled in small cartons that are convenient to carry by the customer. One important distinction with this tea is that it gives prescription on the quantity to be consumed per day and shelf life. It has also use price war to combat competition with coffee which is a close substitute to tea. It gives out discount to customers that buys in bulk and also sells on credit to loyal customers and at times transports the goods to the costumer's destination (CDC 2006). It has segmented its market as shown in table 2 below.

Table 2 market segmentation

Brand	High quality	low quality
Red label	hotel, restaurant high income earners consumers in big cities 50%	low income earners in villages 20%
Blue label	Arm force, hospitals 20%	boarding school 10%

Source: CDC 2006

From table 2 above, the target market is institutions like hotels and restaurants and high income earners where 50% of its high quality tea is sold. It has position it products on this market and has use advertisement and price war as weapons to combat competition with coffee. Since Tole is the oldest tea producer in Cameroon, it has always used the slogan "age is wisdom" to win its customers. It has failed to position its product on the European market due to its low quality tea which this research attempts to establish the causes.

2.7 Quality management system and critical control points

Quality management is a method for ensuring that all the activities necessary to design, develop and implement a product is effective and efficient with respect to the system and its performance. It can be considered to have three main components: quality control, quality assurance and quality improvement. It also focused not only on product quality, but also the means to achieve it. Quality management therefore uses quality assurance and control of processes as well as products to achieve more consistent quality. It involves all activities of the overall management function that determine the quality policy, objectives and responsibilities and implement them by means such as quality control and quality improvements within a quality management system. (Luning 2006)

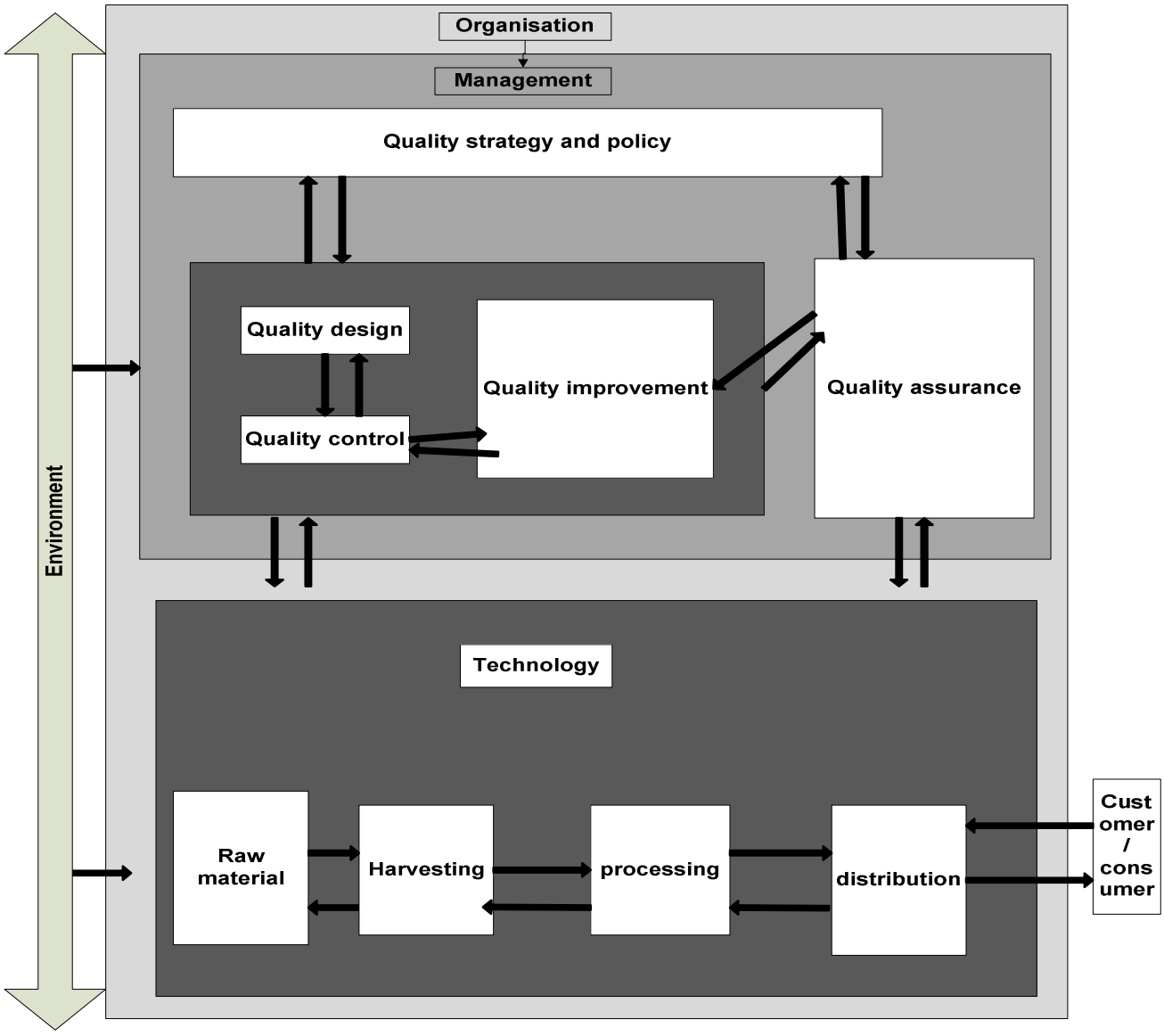

Figure3 Quality management model
Source: Luning 2006

Figure 3 above shows how techno-managerial approach resulted to tea quality management model. This model includes:

- The organization in its environment, where management and technology interact striving for product quality that meets customer expectation.
- Technology is perceived as a technological system, with complex interactions fulfilling different functions in order to meet product quality requirement.
- Management is perceived as management system with complex interactions fulfilling different functions in order to activate technological system to give it a right direction and to ensure that it meets customer expectations.

The above model is applied in ToleTea Estate through Codex Alimentarius and HACCP-system, where critical technological hazard are controlled by human and monitoring systems and quality function development through intensive and organized collaboration of different department in Tole Tea Estate.

2.7.1 Codex Alimentarius

The Codex Alimentarius Commission (CAC) was established in 1963 by the Food and Agricultural Organization of the United Nations (FAO) and the World Health Organization (WHO) to protect the health of consumers and ensure fair practices in food (tea) trade. The commission sets a collection of internationally adopted food (tea) standards, guidelines and codes of practice. The relevance of the codex Alimentarius standards increased since the foundation of the World Trade Organization (WTO) in 1995. (FAO 1999)

The Codex Alimentarius system presents a unique opportunity for all countries to join the international community in formulating and harmonizing food (tea) standards and ensuring their global implementation. With respect to the ever-increasing quality requirement on the global market, in particular, the advantages of having universally uniform food (tea) standards for the protection of consumers are self-evident. It is not surprising, therefore, that the agreement on the application of Sanitary and Phytosanitary measures (SPS Agreement) and the Agreement on Technical Barriers to Trade (TBT Agreement) both encourage the international harmonization of food (tea) standards. (Longenecker,1993). This quality management system has been used in Tole Tea Estate but to a lesser extent (ISO 1998).

2.7.2 The Hazard Analysis and Critical Control Point (HACCP)

HACCP system was introduced approximately 20 years ago as a means to control food and beverage related hazards. It has become increasingly important at national and international levels. It is widely recognized that good hygienic practices (GHPs) form the basis or an integral part of HACCP. HACCP or HACCP-based systems (including good hygienic practices) are important for all food businesses along the food chain. However, in some countries HACCP has been most successfully introduced in large food businesses supplying export markets, perhaps because the adoption of HACCP systems is sometimes a basic requirement in major international food markets. Nevertheless, governments increasingly acknowledge that Small and Less Developed Businesses (SLDBs) provide an important source of food and contribute to the national economy. The importance of consumer protection applies equally to all food businesses (Mizuno, 2002). The principles of HACCP system have been adopted by Tole Tea Estate through the Codex Alimentarius Commission and guidelines to its application are provided in Annex 1.

2.7.3 Good manufacturing/agricultural practices (GM/AP)

Quality assurance has become a transnational issue in tea production and processing, because the suppliers are now required to guarantee that they are in compliance with the standards set forth by the buyers, especially those in the European Union and the USA. In order to meet these standards, good agricultural/ hygiene practices are done in the field and good manufacturing/hygiene practices in the factory. The public regulatory bodies and other institutions involved with this industry such as the Tea Research Institute of Cameroon (TRIC), in the wake of this understanding, proposes a set of stringent and mandatory Good Agricultural Practices (GAP) for producers covering the areas of use of pesticides and fertilizers, practices related to harvesting, leaf handling and transporting, processing, personal hygiene of laborers, and record keeping. All these practices are aimed to enhance the technological and managerial aspects of the organization (Hoogland, 1998).

The basic hygiene practices that personnel should adhere to and how equipments should be handled in order to get maximum product safety as presented by Hoogland (1998) are provided below.

Personnel

- Any person who is shown to have an illness or any abnormal source of microbial contamination that may cause tea contamination should report such conditions and be excluded from operations.
- All persons working with tea processing should conform to hygienic practices such as wearing outer garments, washing/sanitizing hands, maintaining gloves and wearing hair nets.

Plant

- Plant building and structures should be suitable in size, construction, and design to facilitate maintenance and sanitary operations. Buildings should be in good condition and provide adequate lighting.

Sanitary Operations

- Building, fixtures and other physical facilities of the plant should be maintained in a sanitary condition and should prevent tea from becoming adulterated.
- Cleaning and sanitizing substances should be free from undesirable micro organisms and should be safe under the conditions of use. Toxic chemicals should be identified and stored properly.
- No pests should be allowed in any area of a tea plant. Effective measures should be taken to exclude pests from the processing areas and to protect against pest contamination.
- All tea-contact surfaces should be cleaned as frequently as necessary to protect against contamination.
- Cleaned and sanitized portable equipment and utensils should be stored in a location and manner that protects against contamination.

Sanitary Facilities and Controls

- Hand washing facilities should be adequate and convenient and be furnished with running water at a suitable temperature.
- Rubbish should be conveyed, stored, and disposed of as to minimize the development of odour and protect against pests and tea contamination.

Equipment and Utensils

- All plant equipment and utensils should be adequately cleanable and properly maintained.
- Instruments and controls used for regulating or recording temperatures, pH, or other conditions should be adequately maintained, and adequate in number for their designated uses.

Processes and Controls

- Appropriate quality control operations should be employed to ensure that tea is suitable for human consumption.
- Overall sanitation of the plant should be under the supervision of one or more competent individuals.
- Use of a quality control operation in which the CCPs are identified and controlled during manufacturing.

3. Results

In the previous chapter, discussion focused on the organizational structure of Tole Tea Estate, value chain analysis and quality management systems. In this chapter presentation of results and preliminary interpretations of the interviews made with Tole Tea workers and other stakeholders is discussed.

- A total of 15 laborers that manage tea bush (weed, prune, control pest and disease, apply fertilizer) were interviewed on their daily activities in order to identify gaps on tea bush management.
- 25 tea pickers were interviewed on harvesting techniques, types of pest they identify during picking, harvesting equipments, hygiene practices and transportation of leaves to the factory.
- 5 processing technicians were interviewed on quality management systems which are GMP, HACCP, Codex Alimentarius, type of tea produced and the method of production, equipments used in processing and effects on quality, hygiene practices and their idea on how quality can be improved.
- 3 tea taster and testers were interviewed on the attributes of tea and how tea is assessed.
- The operation manager and the general manger were interviewed on the organizational structure and the implementation of quality management systems and the challenges encounter in its implementation, economic aspects of the chain like value share, cost of production and price of tea at different levels of the tea value chain.
- A temporal picker and a permanent worker that manage tea bush were interviewed on their activities, earnings and health insurance.
- Finally some stakeholders like ASCODA, U & I Consultant, WINHEEDCAM, Technical director of the South West Region in the Ministry of agriculture in charge of quality control. Focus group discussion was carried out with representatives of all the departments as mentioned in chapter 1.

3.1 Tea bush management

Among the 15 respondents that manage tea bush ages ranged from 21 to 61 years old, and the average age was 39. The employment length of these respondents ranged from 2 to 35 years, and average employment length was 20 years. Among them, 10 were male and 5 female. Out of the 10 males 6 were illiterate while two were literate. All the females were illiterate. Only 3 of the 15 laborers had formal training on tea bush management 10 years ago.

3.1.1 Weeds clearing

They were interviewed on weed clearing and it was found that weed clearing is one of the most time-consuming tasks and CCP in tea bush management. It is important not only for liberating the crop from weeds, pest and diseases and giving it the conditions to flourish but also because it shows the devotion the labourers puts into his/her work on tea bush management. The weed clearing is done manually with machete and by spraying with chemicals. Depending on how big the weeds are, there are various ways to do it; Cutting the weeds at the roots and when the unwanted vegetation is cut five centimeters above the ground or spraying with chemical to kill the weeds. This is faster and carried out when the crop is big enough to compete with the weeds. The weeds are either left in piles in the field or spread all over the field.

3.1.2 The use of chemicals and pruning

A study made in 2002 in Tole by Konning showed that there is indiscriminate use of chemical fertilizers and pesticides and interviews in this research showed the same results. Only 1 woman said that herbicides and pesticides are used in order to save weeding time and kill pest that destroy tea bush and it has a negative effect on tea quality and some natural enemies of pest are destroyed in the process. She said "*we do not want to use chemicals, but to advance the work of weeding. But they say that spraying spoils the land, it impoverishes it I think and make us to sick because we are not given all the safety materials to use".* The field officer said *"no, it is better to spray because we do not spray on the soil, rather on the weeds and pests that are destroying the crop. However we do not have enough money to pay for manual weeding".* A laborer who was also against the use of pesticides and herbicides added that, "*it is not necessary to use it because when using it, the weeds come back".* The other 13 workers agreed with the field officer and Kumche one of the laborers said "*it is good to use chemicals because it serve time of weeding and kill the pest which is a big problem in Tole".* It was also found that only about 15 % of these laborers were trained to used herbicides and pesticides. 85% of the laborers approves the use of chemical fertilizers and said it improves soil fertility while 10% said it is not good to use chemical fertilizer and says the soil gives the plants the nutrients that it need and there are lots of organic matters to use in order to increase soil fertility. 5% of the laborers were indifferent. Many of the answers also showed lack of awareness that chemicals may have negative effects on tea quality. However some laborers were very knowledgeable about the negative effects of chemicals and Kumbela said "*all of these weeds die and inside of these piles there are small crickets and worms and this gives more strength to the soil. When spraying all these animals die".* They identify mosquito bug, caterpillar and green leafhopper as the most dangerous tea pest and said it also bite and burn them when they are working giving them fever.

The respondents were not knowledgeable on the pruning cycle and time. 70% of the respondents did not know how pruning influence quality and had no idea how quality could be improved. Clippers and machetes are used in pruning.

3.1.3 Soil erosion

One of the problems that the researcher identified that could have serious effect on tea quality was soil erosion. However, the labourers were not familiar with the word erosion, so in order to find out if they observed that the tea fields were eroded and the impact on quality, the researcher clarifies the term erosion and talk about the color that runoff water from the fields has, what was in this water and if this is something good, bad or unimportant.

- 3 of the interviewed laborers said "*soil is leaving the tea field with the rainwater: When there is rain everything remains washed. All the ashes all that black, all the trunks, fertilizers everything is cleaned. The soil is totally wetted with the running water".*
- The remaining 12 laborers said that there are no problems with erosion on the fields.

They also added that the rain is not damaging the tea plant it is the opposite, rain gives life and make the harvest grow well.

However, some of the labourers said that there is no erosion on the fields but they recognized erosion problems in other places like, for example, the path. These quite contradictory statements raise a question. How can it be that one recognizes erosion on the path but not on the tea field? One woman argued that it does not rain so much that the water would wash away soil on the fields. However, she continued speaking about last year that the river grew so much that the village was flooded and some of houses went down with the river. During the study in Tole the river Ndogo was very swollen and several labourers talked

about the problem of finding a good place to wash clothes. The issue is similar to the one above. How could it be that it rains so much that the village is flooded and that the labourers do not observe that this affects the tea plant? The above ramification show that the laboures could not identify the effects of soil erosion on the tea plant which the researcher saw it as one main problem that require urgent intervention.

What could be done about erosion?

One of methods that NGOs working in the region like WINHEEDCAM have tried to implement has been to plant living barriers of Eucalyptus. The idea is that the living barriers would lower the water speed on the tea plantation and in that way prevent soil erosion. However, so far the management of Tole has not approved this technique because it takes time before the barrier grows up. They are looking for alternative way to prevent soil erosion.

In Tole inhabitants have made communal agreements not to touch forests in special zones especially near the tea plantation. Under these agreements it is decided that no one is allowed to cut down forest around streams that act as drinking water supplies to the village, nor on steep parts where deforestation could cause landslides. The village meeting, where the villagers decide about the communal agreements, is a modern variant of the traditional form of decision-taking in the village. The villagers at a meeting, presided by the local mayor or the municipal agent, take the decision as a communal agreement. However, the decision needs to be approved by the "charismatic leaders" in the villages, who are not elected but act more as "natural leaders". The communal agreements can be an official agreement like all the children in the village should go to get immunization, or it can also be an unofficial agreement, like organizing yearly fiesta of the patron saint, keeping the paths in good condition. The communal agreements can organize things like a bridge over a stream, looking for a new school teacher, or the public speaker systems used for spreading information, but also environmental protection. One example of this is the Ndongo stream along 15 kilometers for which no one is allowed to touch the surrounding forest nearer than 200 meters from the stream.

Other stakeholders like ASCODA used to offer training on hygiene practices, good agricultural practices and tea manufacture while the South West technical directorate for quality control of the Ministry of Agriculture supervises the implementation but has stopped after the tea estate was privatized. The ultimate reason was that government did not allocate budget anymore to offer the services.

3.2 Harvesting

Among the 25 respondents that pick tea, 5 were temporal pickers and the permanent pickers ages ranged from 18 to 55 years old, and the average age was 38. The employment length of these respondents ranged from 1 to 30 years, and average employment length was 15 years. Among them, 4 were male and 21 female. Out of the 4 males 3 were illiterate. 5 females were literate. Only 7 of the 25 pickers had formal training on tea picking and identification of pest and disease of tea 11 years ago. About 75% of the pickers were very knowledgeable about their job. The critical control points during harvesting according to the harvester were:

- Type of leave picked (coarse/fine picking)
- Plucking rounds and
- Transport methods and equipments
- Temperature of green leaf.

They picking start at 7am and end at 4pm and transport the leave to the factory for processing to start the next day. The plucking round is monthly and according to the harvesters was to allow the tea to grow enough shoots. The types of plucking was both coarse (3 leaves and a bud) and fine plucking (2 leaves and a bud). The pickers were allowed to do both coarse and fine plucking with 60% and 40% respectively so as to strike a balance between quantity and quality. How they measure the percentages of coarse and fine plucking was not clear to the researcher but the respondents made the researcher to understand that their experience made them to estimate. The permanent pickers were paid monthly while the temporal pickers were paid daily and are expected to pluck an average of 25kg per day. The equipments that were used in harvesting were plucking basket, sacs and plucking stick. The pickers identify mosquito bug and green leafhopper as the major cause of low tea quality and the only way management have used to fight these pests was the use of pesticides. They were aware of the repercussion of using pesticides but according to them, that was the only way to combat the pest. They also identified heavy rain during summer and poor transportation as some of the causes of tea quality. The researcher observes that basic hygiene was lacking in green leaf handling. The picker identified that coarse plucking is also the cause of low tea quality but fine plucking can not cover the cost of production. The pickers were not supervised when picking and the leaves were not checked before processing as observed by the researcher but according to the estate master and other documents on quality control, the leaves were checked.

3.2.1 What is important in order to get a good harvest and quality tea?

When discussing what is important in order to get a good harvest, the pickers mostly gave two answers. One response was hard work on the field, with timely weeding so that the plants can flourish without too much competition with the weeds; secondly, that the weather is good, with enough rain and workers should be paid on time and their living condition improved. Only in one interview did the labourer explain that the soil quality would be important for the resulting yield. He said "*it is important that the soil has its manure so that it is soft and humid*". The fact that very few of those interviewed considered the soil as important for the harvest is consistent with the responses of the laborers who spoke about the effect of soil erosion.

In order to have an insight on the living condition of workers in Tole, 2 workers were interviewed; 1 temporal worker and the other a permanent worker. They were interviewed on their daily activities and selected topics like wage rate, health and prejudice were used as guide. The results of the interview is provided in box 1 below.

Box 1 Life of a temporary picker in Tole

Limunga, a 24-year-old woman, starts her day at 7 am. She puts on her boots and hat and picks up the tea collecting basket, all of which she had to buy herself. Limunga is a temporary picker at Tole Tea Estate. She has been working at the plantation for five year. As a temporary picker, her monthly earnings depend on the amount of tea she picks, leaving her without a fixed wage. She normally picks 20 to 25 kg of tea leaves a day, earning her 7 to 8 US dollar cents for each kilogram she collects. This would give her an average daily income of USD 1.72, which is about USD 46 a month. Many times, however, she does not receive the full amount, for instance if she buys rice on credit from the estate shops. Mother of a six year old, she works for additional income to supplement the monthly salary of USD 75 of her husband, who works as a permanent weed picker on the same estate. The total monthly income of the family many times does not cover expenses. Daily food expenses for her child may be as high as USD 1, while Limunga herself needs nutritious meals as well to keep herself picking continuously during the day. "*Tea pickers eat a lot, five times a day is normal"*, she said. The first picking session is from 07.00 to 09.30 am, with the first weighing session starting at 09.30. The second session is from 10.00 to 12.00, with the second weighing at 13.30. Pickers normally take the weighing sessions to eat. Pickers who have become permanent workers receive fixed monthly wages, and facilities such as housing, healthcare, pension and children's education tuition fee. The monthly wage of permanent pickers is about USD 75. By contrast, Limunga is only entitled to bonus and annual holiday benefits. She is free to take any day off, notifying the estate master is sufficient. Taking a day off always reduces her monthly wage, however. Permanent pickers often also need to look for additional income, for instance by providing motorbike transport services, called Okada, earning about USD 3 per day. *"It is difficult here to become a permanent worker. For this you need to have a lot of money",* Limunga said when asked when she could get a permanent contract. "*After 10 years one of my friends has finally become a permanent picker, but sometimes it takes others only 2 years",* she added. How was that possible? "*I don't know such things. If you have money, it is easy. As for me, the most important thing is that I have a job to support my family"*. Limunga is referring to a case in which a picker bribed the supervisor for a permanent status. Each permanent worker is obliged to meet the daily minimum target of 30-35 kg. Non-permanent workers are divided into groups, each with a maximum target, which varies from day to day. For instance, Limunga is in a group of twenty with a target of 450 kg, which the group should meet but should not exceed. Permanent and non-permanent workers always work on different locations, each being supervised by a different supervisor.

Results from box 1 shows that temporal workers in Tole tea are paid below the minimum wage which is USD 67.9 a month in Cameroon. Also health care is not given to temporal worker. There is very limited hope to become a permanent worker coupled with the fact that bribery was involved. This makes the life of temporal workers very gloomy. Also given the fact that temporal workers constitute a significant part of the labour force in Tole, their status could significantly influence tea quality.

3.3 Tea processing

Of the 5 tea manufacturing staff interviewed, 2 were women. They manufacture black tea but occasionally mostly on commands they manufacture green tea. 95% of tea is manufactured using CTC method and also orthodox tea is manufactured on command. According to them

most of their customer preferred CTC teas. According to the processing technicians, the CCPs in tea processing were:

- Checking the leaves when it arrives the factory for impurities like weeds and pest infected leaves
- Percentage of coarse and fine
- Temperature of leaves and
- The processing steps that are leaf withering, maceration, oxidation and drying.

The researcher observations showed that when leaves arrives the factory in the evening, it is spread down and processing starts the next day. The leaf is not checked for temperature and percentage of coarse and fine plucking. The other points mentioned above were thoroughly checked like impurities and the processing steps. Rather one technician said "*Our pickers know the right leaf to pluck they are very experience. We used to check but now they are doing a good job".* One reason may be that the organization lack equipments to measure leaf temperature and manpower to measure the percentage of coarse and fine plucking which could greatly influence tea quality. The researcher also observed that the processing equipments were very old and very difficult to clean. Hygiene was very much lacking like dressing, washing of hands before carrying on an activity. The working space was also small with congestion. Some of the problems that could lead to the production of low tea quality were power failure and low voltage which makes Tole to always process tea one day later. *"Some times we have electricity just twice a week. But the generator that we have does not produce enough power so we have to keep leaves at time for 3 days before processing"* said Nahnyonga. When asking the tea technician what according to them was the cause of low tea quality, Bilola said *"Pests in the fields are also big problem. They sucks up the buds that is the backbone for tea quality since it contains more tannins leaving the other leaves that add just about 10% to tea quality. Our machines are also old".* All the workers in Tole are aware of pest problems but management did not see it as something that requires urgent intervention reason being that pesticide was not very effective anymore and they were not conversance with integrated pest management which seems to be a way out. The researcher observed that the staffs were very knowledgeable about their job of tea processing.

Tea tasting

Two tea tasters were interviewed on the quality attributes of tea. One taster called Sama said *"We taste flavour, colour and strength of tea".* When they were asked if the tastes of the tea did not meet their expectation, their answer was that it will be called reject and sold to the domestic traders. There was no situation where the tea was dispose. They also confirmed that the main cause of low tea quality was pest.

3.4 Economic analysis of the tea value chain

In order to have an in dept idea of the tea value chain, the general manger was interviewed on the average cost of producing a kg of made tea. The results from the interview are shown on the table below. However the result in table 3 is based on the general manager's estimation.

Table 3 Cost of producing 1kg of made tea

Cost items	**US dollars/kg of made tea**
Field costs: input, tools manpower	0.15
Plucking and leaf transport	0.32
Processing: manpower, tools	0.12
Management and overheads, packaging	0.20
Marketing	0.08
Depreciation on factory building and machinery	0.10
Total	**0.97**

The above table shows average cost per kilo of made tea produced rearranged under more conventional headings. The rearrangement has some uses but the general procedure of not distinguishing between those cost items which vary with the level of output and those which are fixed may lead to the misleading conclusion. Provided revenue per kilo is in excess of 97dollar cents, then profits are being made. Figure 4 below shows the chain map of Tole Tea Estate and the price per kg of tea.

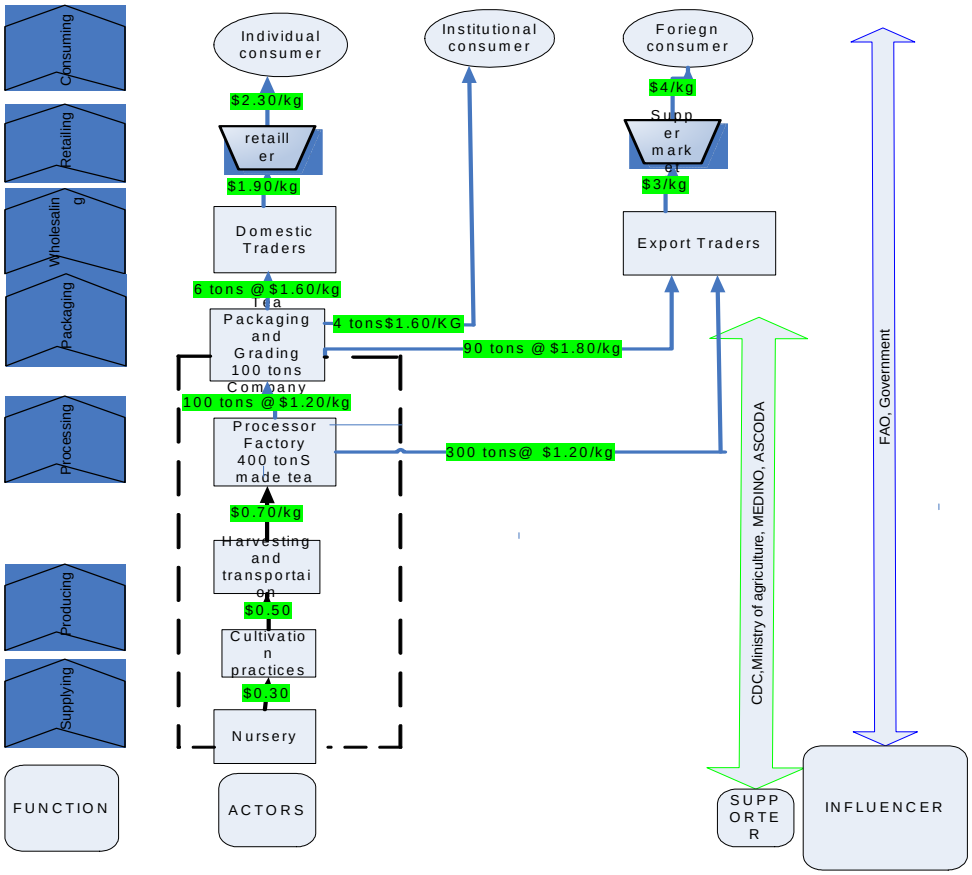

Figure 4 chain map of Tole Tea Estate

The general manager also provides information on the price of made tea along the tea value chain as shown in the figure 4 above. The data provided were also based on his estimation. The price of tea sold to domestic trader and the export market is USD 1.6 and 1 respectively. The low price on the export market was mainly because the tea was sold in bulk without packaging. However, a considerable profit is still made according to the estimation. The overall annual tea production in Tole is 1080 metric tons with sale of USD 1,728,000. The average cost of producing 1080 metric tons is USD 1,047,600 with an annual profit of USD 680,400. The above calculation is based on the assumption that all the output was sold on the domestic market.

3.5 Organizational Structure of the Tole Tea Estate

Interview with the operation manager confirmed with information provided by CDC that Tole Tea Estate has two main branches; the technical branch and administrative branches. The technical branch hosts the operating core as shown in figure 2. The operation manager made it clear that two main channel of communication are used in the organization; verbal and written. Both formal and informal types of communication are used in Tole Tea Eatate. Under formal communication, official letters, meeting minutes, office memo are used. There are both downward and upward communication. This type of communication system is very effective but the researcher's observation did not match with the explanation of the operation manager. There is one way top down authoritarian form of communication which is not effective.

3.6 Implementation of Quality Control process in Tole Tea Estate

In determining how the quality control process in Tole Tea Estate is implemented, the research used selected topics based on the Codex Alimentarius guidelines. These were used to determine the current state of quality control in the Tole Tea Estate. The information was got through focus group discussion with representatives from all the departments in Tole. The topics used were; laborer's knowledge on fertilizer and pesticide, weeding and harvesting, temperature control, hygiene and plucking rounds. The results of the study are presented in table 4 below.

Table 4 implementation of Quality Control process in ToleTea Estate

Control point	Positive aspects	Negative aspects	Comments
1. Fertilizer and Pesticide	60% of the labourers are well informed that Chemical fertilizers and pesticides are detrimental to tea quality	10 percent said it makes the tea plant healthier	30% said that fertilizer and chemicals are the only means to control pest and make the soil healthy. Manure was used from animals but is limited in supply now
2. Weeding	All labourers use traditional method and chemical spray to control weeds (sometimes hoe, sometimes hand weeding)		
3. Harvesting	There is standardization on harvesting from laborer's knowledge		
4. Temperature	20% of the labourers understood temperature control method	70% has no idea of controlling temperature but acknowledged that it can have a detrimental effect on tea quality	10% has no idea of controlling temperature but failed to acknowledged that it can have a detrimental effect on tea quality
5.Plucking rounds	Labourers implement what the experts asked them to do. That is plucking monthly which has some advantages	Not clear about the effect of plucking rounds on tea quality.	Labourers do not participate in decision making.
6.Personal hygiene	70% of workers has a clear idea about hygiene and what need to be done like washing of hands, changing cloths, and wearing boots	25% labourers interviewees gave wrong answers on "proper hygiene";	5% labourers are unaware of it. However good hygiene was not implemented.
7.Awareness about working procedure	Every workers interviewee has a high awareness on things needed to be done	Not clear about quality improvement	

Results from the above table show some lacking issues in the area of leaf temperature control and the effects of plucking rounds on tea quality. However the other issues from the table above shows general awareness on personal hygiene, working procedure, and fertilizer application.

3.7 Core issues within quality improvement

In order to have an in-dept understanding on how the Codex HACCP was implemented in Tole, the general manager was interviewed on the topics presented in table 5 below. His answers were cross checked with Codex general guidelines as outlined in appendix 1.

Table 5 List of core issues for quality improvement

No	Codex HACCP	Level	Findings
1	Has a hygiene risk analysis been performed for the harvest and pre-farm gate transport process?	Major Std.	No.
2	Are documented hygiene procedures for the harvesting process implemented?	Major Std	There is documentation on hygiene procedure but has not yet been implemented
3	Have workers received basic instructions on hygiene before handling produce?	Major Std	Not yet but plans to do so.
4	Are the containers and tools used for harvesting cleaned, maintained and protected from contamination?	Major Std	Yes. No further improvement needed.
5	Do pickers and processing staffs that come into direct contact with the leaves have access to clean hand washing equipment?	Major Std	No
6	Are production equipments used exclusively for the production of tea?	Major Std	Yes. No further improvement needed.
7	Is packing material in the factory protected against contamination?	Major Std	Yes. Further improvement needed.
8	Are signs clearly displayed instructing workers to wash their hands before returning to work?	Major Std	No
9	Are all the CCP identified and corrective action put in place?	Major Std	No

The above findings of the research allowed the study to examine areas that did not perform well like 1, 5, 8 and 9 in table 5 above. Basing on the Codex Alimentarius standard, further improvement is needed in order to satisfy the market. This is because the research considers quality improvement a means to increase customer satisfaction, by achieving higher quality levels.

3.8 Summary

Finally the causes of low tea quality can be classified into the following headings

1. **Cultivar**. This includes the fermentation ability, chemical components and agronomic characters vary with cultivar. For black tea, quality is more important than yield.
2. **Environment.** Soils and climate are two major factors affecting the quality of tea. High elevation is considered to be the most favorable for production of high quality tea.
3. **Agricultural practices.** These include tillage, weeding, fertility management, irrigation, drainage, plant protection and harvesting and transportation management. These factors have a considerable effect on tea quality though their effects on yield may also be very significant. Amongst the management practices affecting tea quality, leaf age, harvesting seasons and harvesting rounds are the most considerable.
4. **Processing technique.** The processing technique of black tea involves a series of complicated operations (withering, maceration, oxidation and drying) which indeed can be regarded as an art. Slight changes or manipulation of one step can affect the final quality including appearance, liquor aroma and taste. It is not surprising that the quality of made tea from the same batch of fresh leaves may vary greatly.
5. **Quality management systems.** This includes the way Codex Alimentarius was implemented, GH practices, quality control and quality improvement.

However the major causes on Tole Tea Estate was associated with agricultural practices, processing techniques and quality management system.

4. Discussion

In the previous chapter discussion focused on the presentation of results and preliminary interpretations of the interviews made with Tole Tea workers and other stakeholders. This chapter will dwell on comparing and analyzing the results from interview, value chain of Tole and quality management system presented in chapter 2 on what need to be done if Tole want to produce quality tea that will be accepted on the sophisticated EU market. This chapter is arranged into the following sections: section 4.1 discusses tea bush management, 4.2 put emphasis on tea harvesting and 4.3 discusses tea processing. 4.4 show how grading, packaging and labeling is done. 4.5 discuss the organizational structure, 4.6 elaborate social issues and section 4.7 discusses the challenges that Tole is facing in applying the Codex HACCP.

4.1 Tea bush management

Tea bush management is one of the most CCP in tea production especially in the area of pest using chemicals as shown in section 2.6.1. However, results from interview in chapter 3 shows that there is indiscriminate use of chemical pesticides and fertilizer. The above ramification shows the environment is also at risk of pollution. Therefore to manage a tea plantation well, it is important to understand the tea ecosystem. The word ecosystem means the combination of all things that are found within a tea plantation, both living (tea plant and micro organism) and non living (rain, sunlight). All things in the ecosystem affect each other. Spaying the fields with chemical pesticides will destroy some natural enemies of green leafhopper which is a pest that destroy tea. Agricultural practices have a great effect on the tea ecosystem. It constantly changes the ecosystem through punning, weeding, plucking, pesticides use, mulching, and fertilizer use. Therefore before making decision about agricultural practices, it is very important for management to understand tea field ecosystem.

To help improve quality of tea, the tea plantation should be managed according to the following principle propounded by Hampton.

- **Protecting and helping natural enemies**
  Many natural enemies live naturally within the tea field and others live in wild plant in nearby fields. Just like crops, natural enemies must be managed so that they become abundant in the field and become effective. This is a new idea to management of Tole so they have to be trained on integrated pest management.
- **Regular field observation and analysis**
  Management can only make good decision if they have information on agro ecological environment. This information can be obtained and analyzed by the field workers. This calls for training and monitoring at the field level.
- Practices like mulching and the use of shade trees can reduce drastic change in temperature in the tea field and humidity from season to season and the use of non chemical to manage pest as described above.

  Degraded tea
  Observation made by the researcher in chapter 3 shows that 1/3 of the tea field in Tole is showing the following problems:
  - Low yield
  - Poor leaf quality
  - Increasing number of empty spots due to death of weak bushes
  - Buds are small and scarce

The combination of the above problems is called degraded tea. Sometimes the name “ageing tea” is used. However the problem is caused more by bad management rather than the actual age which is just 5 decades old as compared to Lesla Tea Estate in Kenya which

is more that 9 decades old and is not showing the above mentioned problems. When the tea plantation is degraded, it is often best to rejuvenate the bush by heavy pruning close to the ground so that the tea plant can grow completely new frame of young branches.

4.2. Tea harvesting

This is one of the most important activities in Tole and requires a lot of manpower. It is also a CCP as discussed in chapter three which are:

- Type of leave picked (coarse/fine picking)
- Plucking rounds and
- Transport methods and equipments

Section 2.6.2 show that harvesting should be done in the morning because of the following reasons:

- So that processing should be done the same day.
- If the plucked leaves are left to stay over night, the quality will be much lower.

Plucking should not be done on rainy days because the wet leaves takes too long to dry during processing which reduces tea quality. Result from interview in chapter 3 confirms the statement above but observation by the researcher showed that processing is done the next. The whole day is used for harvesting and transporting the leaves to the factory. Processing is not done in the evening when the leave arrive the factory because of power shortage. In the evenings many people in Tole municipality are using electricity so the voltage is generally low in the evenings and cannot supply the factory with enough energy to process tea. Keeping the leave overnight is one of the main causes of low tea quality because the leaf might lose its briskness and other liquoring qualities.

Type of leaf harvested

Only the bud and the two (at most three) youngest leaves are tender and green enough for high quality tea. Older leaves are not be plucked because it will produce low quality tea. The third leaf has low tannins and less soluble content which are attributes of high tea quality. It is good to pluck both fine and coarse so as to strike a balance between quality and quantity in order to cover the cost of production. However results from interview shows confirms with section 2.6 that compressing the leaves in a basket will cause bruises which will reduce quality. Therefore care should be taken not to compress the leaves in the harvesting basket.

How many times to harvest?

There are two popular systems for harvesting:

- Plucking after every 30 to 45 days, harvesting most of the buds
- Plucking after every 15 to 20days as soon as 30% of the buds are ready to harvest. Each system has its advantages and disadvantages. Table 6 shows the advantages and disadvantages of the two harvesting system

Table 6 Advantages and disadvantages plucking system

Plucking system	Advantages	Disadvantages
1. Plucking after every 30 to 45 days, harvesting most of the buds.	Take less labour that is pickers have to go to the fields only 7 to 8 times in a year.	Tea yields will be lower than if plucked after every 15 to 20 days.
	Simpler to organize that is fewer dates on which you must schedule your labour.	1. Tea quality will be lower than if plucked after every 15 to 20 days 2. Does not help reduce damage from insect pest since the insects have enough time to lay eggs, hatch and grow to maturity.
2. Plucking after every 15 to 20 days as soon as 30% of the buds are ready to harvest.	Tea yield will be higher than if plucked after every 30 to 45 days,	Take more labour (pickers have to go to the fields 15 to 20 times in a year)
	Tea quality will be higher than if plucked after every 30 to 45 days	More complicated to organize. More dates on which you must schedule your labour force.
	Helps reduce damage from insect's pests since plucking every 15 to 20 days removes insect's eggs and young insects before they can grow enough to cause a lot of damage.	To often plucking have a negative effect on the health of the tea plant.

Results from interview shows that Tole is using the first harvesting system in table 6 above which is harvesting every 30 to 45 days. However the system has some advantages as showed in table 6. For Tole to produce good quality tea and reduce pest infestation, it must invest in system 2 shown in the table above.

Insect pests and diseases of tea

There are many insect pests found in Tole Tea Estate like green leafhopper, mosquito bug and caterpillar. However green leafhopper and mosquito bug are the most common as seen in chapter 3. They damage the tea plant by sucking sap from the youngest tea leaves and buds that produce the best quality of tea. The tea bud or shoots with many sucking stain become curled, dried, and black and may result to low quality tea if processed. Some pickers could not identify the cause and thought the damage was due to foggy weather but research from Konning showed that the damage had nothing to do with foggy weather rather the damage was due to insect pests. Badly damaged buds and shoots cannot be plucked, which affect the next flush of shoots. In addition, affected buds and shoots become infected with disease of tea stem leprosy, in which the stem becomes covered with many small dark pimples or with swollen trunk disease.

How can pest and disease be prevented?

Result from chapter 3 and also from Hampton (1998) showed that pesticides and natural enemies can be introduced in Tole to combat these pests but pesticides should be avoided as much as possible in order to reduce the maximum residue of chemical in tea which is one of the major problems that Tole Tea is facing now. In addition the labourers are not trained to apply pesticides and it adversely reduces the population of natural enemies. Results from field work also showed that one of the major causes of low tea quality in Tole was pests infestation of tea leaves and the only way Tole had used to combat them was chemical pesticides which do not only adversely affect quality but it also make the pest to be resistant. "*We used to spray and kill many mosquitoes but now we spay and they do not die. They are increasing in number".* Spider, dragon flies, praying mantis and some kinds of ants are natural enemies of mosquito bug and feed on them. Therefore integrated pest management seems to be a way out to combat these pests.

4.3 Tea processing

Tole is using the CTC method of tea manufacture because it yields more cups of tea as seen in chapter 2. They had paid much attention in quantity rather than quality. In order to be competitive on the market, they have to invest in the orthodox method of tea manufacture since it is preferable in the export market as shown in section 2.6.3

The first step to produce high quality processed tea is growing healthy fresh tea. High quality dry tea can be produced when the following conditions are met.

- Plant a good variety of tea bush
- Care for the tea bush and the soil to produce healthy vigorous crop
- Pluck it correctly

4.4 Grading, Packing and Labeling

Tea is graded to separate the higher grade from the lower grade. The criteria that are used to judge tea quality is grade in other words the physical size and form of the pieces to tea. Usually the estate makes more money by sorting the product by quality instead of mixing all the qualities together. Also tea is classified to ensure that all the specific grades have similar size. Tole is using mechanical classifier called grading machine. The most valuable grade is the medium sized buds and are mostly exported to USA. The largest leaves have lower value and are sold in the local market. The broken leaves have the lowest value and are brewed in a tea pot. Tea is packaged into packages of different weights depending on the preference of the customers. Wrapping needs two layers. The outer layer prevents humidity from entering. The outer layer protects the inner layer and also gives an opportunity to label the tea.

How customers judge quality

Most customers use the cost of the tea to help them decide which tea to buy. But many customers do not buy the cheapest product instead they are willing to pay a little extra for good quality. Therefore understanding how customers judge quality is an important step towards marketing. There are three criteria that customers used to judge tea quality and therefore to decide how much they are willing to pay for the tea:

- The nature of the processed tea (flavor, colour and size of the dried leaves and bud)

- How the fresh leaves were processed (orthodox or CTC, clean, organic, variety of tea bush, type of plucking) and
- The way the tea is packaged (labels and brands, loose or in bags).

As shown in chapter 2 Tole has used price war to combat competition with coffee which is a close substitute of tea. This strategy is not a good way to gain the market. Customers will benefit from the competition since the price is low and may even go lower that the cost of production. Rather investment in producing high quality is imperative..

Producers and marketer of tea must fulfill the hygiene indicator required by the department of phytosanitary in the Ministry of Agriculture. Also all green leaves must comply with internationally established limits of pesticides residues (maximum residual limit) otherwise it will be rejected on the market. The CDC was responsible for quality control in Tole Tea Estate but after privatization it ceases its activities. The table below shows some indicators for classifying tea in Tole.

Table 7 Indicators for classifying tea into quality grade

Grade	**Appearance of tea**	**Kind of liquor**		
		Color	**Smell**	**Taste**
Special type	Grey, long leaves, equal in appearance and curl with little velvet.	Yellow and grey, little light in colour.	Natural strong smell with the fresh smell.	Gentle heavy taste having taste after swallowing.
Orange Pekoe (op)	Grey, long leaves, equal in appearance and curly.	Yellow dark green.	Natural and rather strong smell.	Gentle bitter taste.
Pekoe (P)	Grey leaves and shorter than OP tea rather curly.	Yellow and dark.	Natural smell.	Gentle bitter taste having taste after swallowing.
Broken Pekoe (BP)	Natural grey, broken pieces are smaller than the P tea rather curly.	Yellow and dark.	Not having the typical natural smell.	Gentle bitter taste having taste after swallowing..
Fanning (F)	Grey and yellow, small and rather equal in size.	Yellow and dark.	Light smell.	Strong bitter.

When judging the quality of fresh unprocessed tea, tasters measure the quality characteristics called “A” and “B”. ‘A’ quality refers to how easy is it for the taster to break the stem of the shoot by bending it between his two hands. Buds with high ‘A’ are soft, shiny and fresh and have a stem that are easily broken and produce good quality tea. ‘B’ quality refers to how mature the shoot is. Shoot with high ‘B’ quality have thin stems with no more than two leaves below the bud. ‘A’ produces a better quality of made tea than ‘B’.

4.5 Organizational structure of Tole Tea Estate

The organizational structure of Tole Tea Estate shows some inconsistencies as observed by the researcher and from information presented in section 2.5. The technical branch in figure 2 shows that the estates master, the field officer and the supervisor works both in the field and factory. This is not logical adding to the fact the tea field is 5km from the factory. In order

for this structure to be effective, they have to share their time equally in the field and in the factory. The structure has many shortcomings. There is no horizontal spread of departments meaning there is no specialized department to implement quality management which has greatly contributed to Tole Tea's failure to produce quality tea.

4.6 Social issues

Working conditions are often generally poor in Tole. The majority of workers has no job security but is trapped in low-paid temporary labour with little or no prospects of finding a better job in the region. Being a seasonal labourer means no income when you are ill, pregnant or otherwise unfit to work. It often also means less pay and fewer social benefits such as medical care, housing, education and pensions.

4.6.1 Health and safety

Tea bush management and plucking is difficult and labour intensive work. Workers are on their feet for hours, spraying poisonous pesticides or carrying tea-collecting baskets on their backs; respiratory diseases and back problems are therefore common. The uneven terrain and sometimes steep slopes on which tea is picked raises the risks of accidents and as a result fractures due to falling (from height) are quite common. In addition they are exposed to harsh weather conditions (hot, cold, and wet), pesticides, mosquitoes and other insects, and poisonous snakes. Studies from Konning (2008) have revealed that two categories of illnesses are common in Tole - respiratory and water-borne diseases account for 60 to 70 percent of the diseases affecting Tole Tea workers.

4.6.2 Education and declining workforce

As mentioned above, most of the workers in Tole are pickers and the majority of them are female. According to results from this research, they have often had very little education, but they have the skills for picking, handed down to them by the previous generations. The management of Tole Tea Estate acknowledged that for a number of years they have not been hiring permanent workers but had instead relied extensively on temporary labour. Tole Tea Estate has been using a loophole in the previous labor legislation that did not explicitly state the employment duration of temporary workers. This loophole encouraged her to retain temporary workers for periods as long as 10 years. In Cameroon, for example male literacy rate is 67%, while in Tole Tea Estate males, it is 25%. The female literacy rate is 55%, while in Tole Tea Estate women, it is 15%. This low literacy rate has made it practically impossible for Tole Tea Estate to design a classic training program as well as efficient application of the Codex Alimetarius guidelines. Most workers interviewed had worked for more than 5 years at the plantations without any letter of appointment to which they were entitled. In spite of all the legal measures to protect worker welfare, it is clear that plantation work is no longer attractive. The labour situation in Tole has gone from one of surplus to deficit, with an annual decline of 10 – 20% of the workforce Konning (2008). This poses considerable problems for the tea sector.

4.6.3 Gender distribution

Women constitute more than 70% of work force in Tole Tea Estate. This is mainly because tea plucking is a major routine work and it is traditionally assigned to women because they have small and nimble fingers. Unless mechanized plucking becomes common, the present ratio between men and women will continue in future. It follows that women empowerment by training and educating them in fields of integrated pest management and modern harvesting techniques should be given priority in human resource management and planning in Tole.

Table 8 Gender distribution

SN	Gender	No of persons	Percentage
1	Women	228	70
2	Men	97	30
Total		**325**	**100**

4.6.4 Nature of work of worker

The male workers are usually employed in work like pruning, manure application and other field work. Originally they complete the work at 2pm. The rest of the time is wasted as they do not have any landed property of their own to work. As the estate is isolated, there are no chances for supplementary work in nearby area. Moreover there are good numbers of temporal workers who work seasonally. Underemployment at time causes unrest amongst them. There are different kinds of work carried out in Tole and the relative manpower needed as shown in figure 5 below.

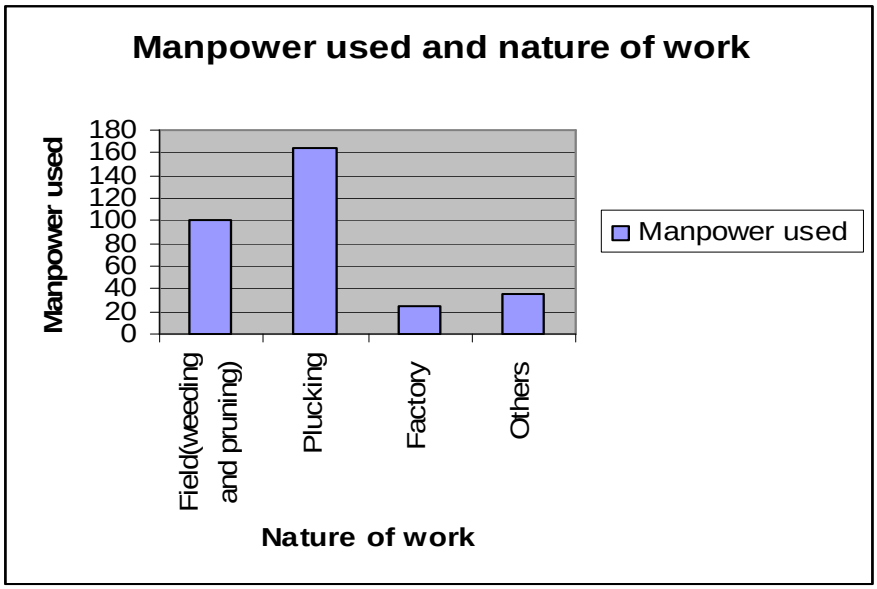

Figure 5. Manpower and nature of work

4.7 Challenges for applying Codex HACCP systems

The application of the Codex HACCP means additional costs in upgrading facilities before the system is applied. This is an insurmountable barrier for Tole unless support is provided

by governments or trade associations. Furthermore, hygiene management is hindered by the local infrastructure (inadequate power supply, water, sewage disposal and transport facilities) There is no resources to provide on-site solutions (e.g. sewage treatment). Again, governments have an undeniable role in resolving some of these difficulties.

Basic hygiene

Good hygienic practices tend to be lacking in Tole Tea Estate more than in other food businesses. It is common for her to face a variety of problems ranging from inadequate location, layout or size of facility, non-cleanable structures, old non-cleanable equipment and poor staff training. It also faces basic sanitation problems, such as easy access to potable water and safe disposal of waste.

Education and training

For successful HACCP implementation, the concept must be understood by food (tea) business owners and managers. Their understanding and commitment is crucial if staffs are to effectively operate a food safety management system (of which HACCP is one aspect). Specific training courses were not available and only recently has HACCP been integrated in university curricula; consequently, many business owners have not been exposed to HACCP at all or have received only cursory instruction. What is more, HACCP is still largely taught by theorists in the formal education system. The Codex HACCP system is often rigidly adhered to and practical implementation issues are not always covered. Literacy levels are low especially in Tole. Training must be tailored to account for this and may have to be more practical (i.e. use of demonstrations) than theoretical. Training area should be suited to the needs of the trainees.

Technical support

Tole tea Estate lack the technical expertise required to implement HACCP and may need external support. In particular, they need help to identify the hazards associated with tea processes.

Communication

Poor communication within Tole Tea Estate and between government and consumers has impeded the introduction of HACCP. Communication strategies covering the content of the communication as well as the channels for communication need to be part of any HACCP policy or strategy. Often the only point of official contact with Tole Tea Estate is through official inspectors; if these people are not resourced, trained and allowed to provide advice as well as conduct official inspections, it can hamper a national strategy aimed at increasing HACCP implementation.

4.8 Consequences of low tea quality on Tole

In comparing results in chapter three and that of chapter two of this study, the following effects of low tea quality was put forward.

- Low income to Tole Tea Estate and workers
- Low price on the market
- Unable to replace old and dilapidated machine and hire professional staff.
- Bad reputation both on the domestic and international market
- Lost of customers
- Fines from the government for selling low and unsafe product.

5 The Institutional Environment of Tole Tea Estate

This research uses the PEST and the SWOT framework to analyze the external and internal environment respectively in which Tole Tea Estate operates. Like any other organisation, Tole Tea Estate operates in a dynamic environment in terms of political economic, social, and technological factors. As such the organisation is subjected to a number of external and internal forces for which a deeper understanding and appreciation of the environment is critical as the organisation endeavours into producing high quality tea. This section shows a critical analysis of selected relevant institutional factors that may influence quality management system and the strength and weakness of Tole Tea Estate.

5.1 External Environment forces influencing quality management system of Tole Tea Estate

This section gives an analysis of how the environmental issues, economic factors, policy factors and actors and partnerships that may influence tea quality in Tole Tea Estate.

Environmental issues

The environmental impacts of the industry are considerable. There is significant biodiversity loss due to high chemicals used. Along with habitat conversion, logging for firewood to process tea, in particular, has caused extensive deforestation in Tole. Energy consumption for tea processing is also high which is aggravated by often inefficient and outdated machinery. The application of pesticides is also negatively affecting the immediate and wider environment (water pollution, soil erosion biodiversity).

Economic factors

Closely observing the domestic and global market scenario, reform and restructuring processes have been inevitable part of development procedures. On the way of analyzing the domestic market, Cameroon have several examples of restructuring processes which ultimately tends to bring positive impact in overall business environment. Formally reform and restructuring in Cameroon agricultural sector begins with the privatization of all state owned organization.

Policy Environment

Tole Tea Estate was operating in an environment which was characterised by a number of policy reforms aimed at poverty reduction and enhancing gender equality. However after its privatization in 2002 followed by the removal of subsidies and other fringe benefits, the above policy reform was abandoned. Due to the above ramification, High tax was instituted on Tole Tea Estate which made it to cut cost by down sizing it work force which led to unemployment in the region.

Actors and Partnerships

Tole Tea Estate's main target clientele are military, hospital, restaurant and foreign consumers like Nigerian and USA, low income civil servants and businessmen. To reach out to this target group, Tole Tea Estate in its specific environment collaborates with a number of actors who are crucial for the effective delivery of high quality tea. These include; government, CDC, commercial banks, NGOs and input suppliers. In response to the incorporation of globalisation it has recently been registered in the Codex Alimentarius

quality management system. Tole Tea Estate's has applied to joint the international tea producer association and is still pending for approval.

5.2 SWOT Analysis of Tole Tea Estate

5.2.1 Strength of the Tole Tea quality management system

This study compared the information from interviews and the requirements from the checklist of Codex Alimentarius quality management system. The study of the Tole Tea quality management system resulted in a list of areas that offer strength as follows;

i. Availability of sufficient capital to invest into the quality program development.
ii. Presence of professional employees involved in tea production and processing.
iii. Obtained certification for water and soil aspects of the plantation

5.2.2 Weakness in the Tole Tea quality management system

This study also compared the information from interviews and the requirements from the checklist of Codex Alimentarius quality management system. The study of the Tole Tea quality management system resulted in a list of areas that offer weakness as follows;

i. The entire tea crop is not registered for Codex Alimentarius certification yet. Only the factory is certified. This mean that Tole have not yet got certification for agricultural practices like hygiene practices in the field. Only the factory is certified.
ii. The duties and responsibilities of all personnel in Tole Tea Estate involved with the compliance of Codex Alimentarius requirements are not yet documented. Training and qualifications for key staff are not yet documented as per requirements laid down in the Codex Alimentarius standard.
iii. The internal auditor(s) and inspector(s) have not undergone training and evaluation for example by documented shadow audits to ensure consistency in their approach.
iv. Tole Tea Estate has not documented a quality manual yet. Procedures for the identification and evaluation of non-compliances to the QMS are not documented yet.
v. A copy of all relevant documentation is not available at any place where the QMS is being controlled. The records from the QMS related to compliance of Codex Alimentarius requirements are not kept on-line or electronically valid.
vi. There is no documented procedure that describes how complaints are received, registered, identified, investigated, followed up and reviewed. There is no record of the internal audit plan, audit findings and follow up of corrective actions.
vii. The internal auditor has not yet completed a short (2 days) internal auditor-training course related to QMS.
viii. Hygiene risk analysis and risk assessment has not been documented.
ix. Workers have not received basic instructions on hygiene before handling produce.
x. Signs are not clearly displayed in the packing facilities with the main hygiene instructions for workers and visitors.
xi. Temporal workers are not given a sense of belonging meaning they are exempted from social benefits like health and insurance.

6. Conclusion and Recommendations

6.1 Conclusion

This study attempts to explore the causes and the effects of low tea quality on Tole Tea Estate. Field research results indicated that the main causes of low tea quality on Tole Tea Estate can be classified under four major heading.

1. **Cultivar**. This includes the fermentation ability, chemical components and agronomic characters vary with cultivar. For black tea, quality is more important than yield.
2. **Environment.** Soils and climate are two major factors affecting the quality of tea. High elevation is considered to be the most favorable for production of high quality tea.
3. **Agricultural practices.** These include tillage, weeding, fertility management, irrigation, drainage, plant protection and harvesting and transportation management. These factors have a considerable effect on tea quality though their effects on yield may also be very significant. Amongst the management practices affecting tea quality, leaf age, harvesting seasons and harvesting rounds are the most considerable.
4. **Processing technique.** The processing technique of black tea involves a series of complicated operations (withering, maceration, oxidation and drying) which indeed can be regarded as an art. Slight changes or manipulation of one step can affect the final quality including appearance, liquor aroma and taste. It is not surprising that the quality of made tea from the same batch of fresh leaves may vary greatly.
5. **Quality management systems.** This includes the way Codex Alimentarius was implemented, GH practices, quality control and quality improvement.

However it was found that pests and diseases infestation and coarse plucking were issues that require urgent intervention. Green leafhopper and mosquito bugs were the pests identified in Tole Tea Estate. Managing these pests remains a major challenge to Tole Tea Estate. The only way that have been used to combat these pests was spraying chemical pesticides which the researcher saw it as solving a problem by introducing another problem. High pesticides residue in tea will result in rejection on the market. The above ramification made Tole Tea Estate to be very pessimistic in accessing high value market like the EU. Also one of the main causes of low tea quality was high percentage of course to fine plucking that is 60% to 40% respectively. This means that more coarse plucking was done as opposed to fine plucking which produces low quality.

The implementation of Codex Alimentarius QMS in Tole is not effective. This is because it is only implemented at the level of the factory not in the field. Poor processing equipments was one of the major problems hindering the implementation of QMS. In addition poor working condition and lack of social benefits coupled with the fact that temporal workers are paid below the minimum wage also limit Tole Tea's ability to effectively implement the QMS and produce quality tea.

However the causes of low tea quality led to the following effects on Tole Tea Estate.

- Low income to Tole Tea Estate and workers
- Low price on the market
- Unable to replace old and dilapidated machine and hire professional staff
- Bad reputation both on the domestic and international market
- Lost of customers
- Unable to access the EU market.

6.2 Recommendations

Based on the conclusion drawn as discussed in the previous section, the following recommendations are made to make Tole Tea Estate's quality management system improved so as to produce high quality tea which may be accepted on the EU markets.

Agricultural practices

- For Tole Tea Estate to manage pests using pesticides it is recommended that workers be trained on pesticides application or the operation manager may organize briefing sessions on pesticides application where workers are briefed before they apply pesticides.
- In order to prevent soil erosion, it is recommended that Tole tea should plant living barriers of eucalyptus which will greatly reduce water speed in the fields thereby preventing soil erosion.
- It is recommended that Tole Tea Estate improves working conditions and earnings of workers especially the temporal workers. Tole is making profits and for fair trade to prevail, workers should be at least paid above the minimum wage.

Harvesting

- One of the main causes of low tea quality was high percentage of course to fine plucking that is 60% to 40% respectively. This means that more coarse plucking was done as opposed to fine plucking which produces low quality. Therefore for Tole Tea to produce high quality tea and access EU market, it is recommended that the percentage of coarse to fine plucking be reverse from 60% and 40% respectively to 40% and 60%. Also it is also suggested that if operation manager organize the labourers in to two groups; one group responsible for course and the other for fine plucking in the ratio given above, the quality of tea may improve.
- It is also advocated that if Tole change its plucking system from 30 days to 15 days this will partly solve the problem of pests and improve tea quality.

Processing

- Pests are serious problems in Tole. This calls for a modern sophisticated way to combat these pests. Integrated pest management is a way out since pesticides have proven not to be effective and also has negative effects on the environment. This is a new idea for Tole and require that management of Tole invest in training of field staff.
- It is also suggested that if Tole process tea the same day of harvesting, quality may improve significantly. This can be possible if the harvesters are organized and harvesting session start as early as 6 am and close at 12 noon. Transportation and other checks can be done for two hours so that the first processing step which is withering start immediately which require less energy. This process can last for 12 hours meaning the whole night will be used for withering and the second processing step which requires more electrical energy start in the morning. This will solve the problem of keeping the leave the whole day and there will be no complaint of voltage shortages. This strategy will require more manpower to work overnight.
- For Tole Tea Estate to be competitive on the market and reduce cost of production, it is urged that the old dilapidated processing machines be replaced with new and efficient ones. This investment requires large amount of money but Tole may recover this money within a short time.

Quality management system

- It is proposed that Management of Tole Tea should invest in quality management by implementing the Codex alimentarius in the field and improving on general hygiene in the factory. Posters and pictures should be pasted on the walls instructing workers on what need to be done like washing of hands, wearing outer garment and how equipments

should be handled. This will also help inform visitors on what need to be done when they visit the factory.

- For Tole Tea to improve its quality management system, it is advised that specialized department be created for quality control and quality improvement which is independent and answerable only to the general manager. This is because if this department is under the production department, it may be influenced especially when the quality fails to satisfy the market, it might not be disposed.

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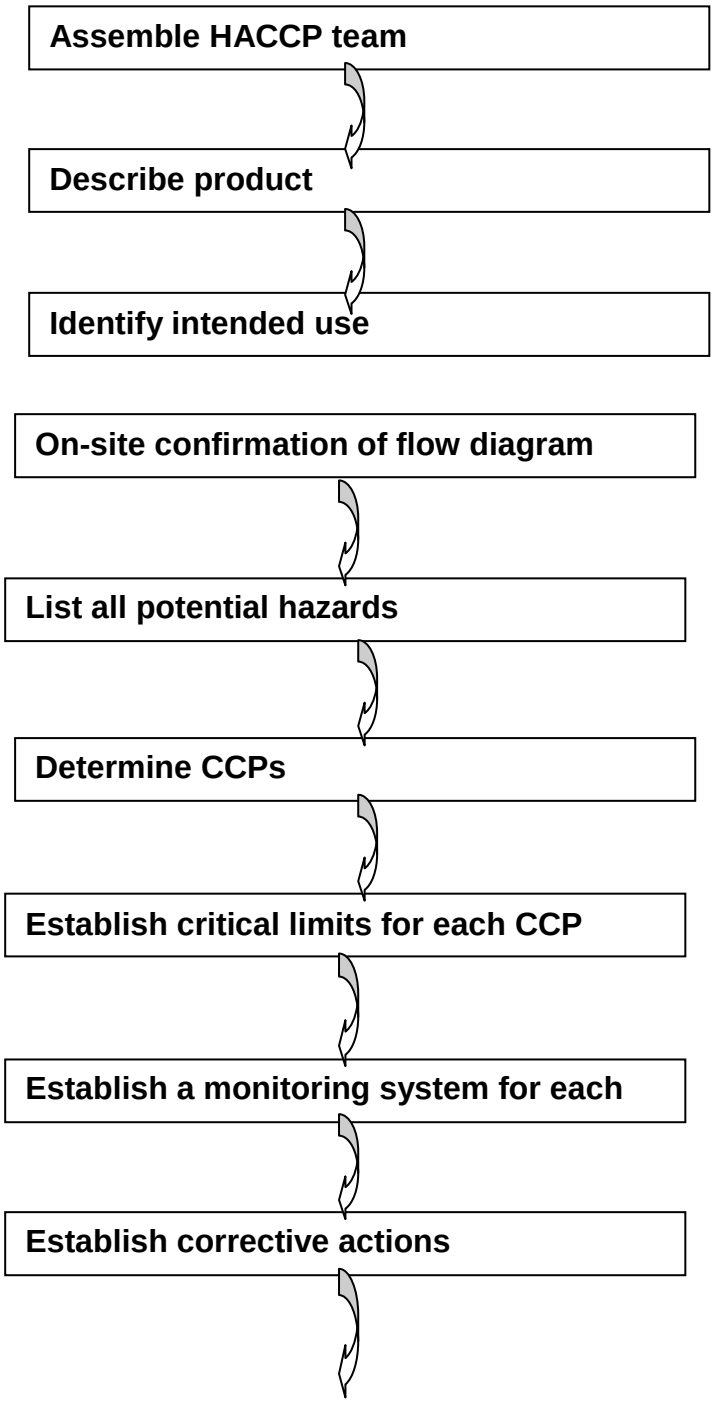
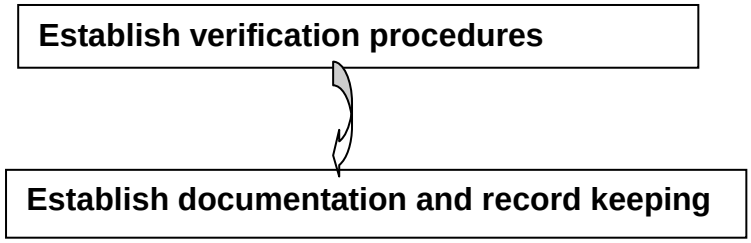
8.Annexes

Annex 1
Codex Guidelines on the implementation of HACCP in tea production and processing

The Codex HACCP system (FAO and WHO, 2003) has several features that characterize it. Seven basic HACCP principles are established and then elaborated into a logical sequence of 12 steps for implementation as shown in Figure 4. Guidance in the form of a decision tree is provided for the identification of CCPs

Figure 4 12 *steps for the implementation of HACCP*





Source: FAO 2003, p. 42.

Appendix 2

Checklist for full, part time and supporters of Tole Tea Estate.

Date: ……/……/2009
Staff Name: part/ full time
Gender: male/female
Which position do you occupy?

Questionnaire Cultivation practices

For laborers

How long have you worked in Tole? 16 years

- Do you weed? if yes,
- How do you weed?
- How many times do you weed per year?
- What is the interval between each weeding?
- Do you get training on weeding?
- How does weeding influence quality?
- Do you irrigate? yes
- How do you irrigate?
- How many times do you irrigate?
- What is the interval of irrigation?
- Do you get training on irrigation? no
- How does irrigation influence quality?
- Do you drain?
- How do you drain?
- How many times do you drain?
- What is the interval between drainage?
- Do you get training to drain?
- How does draining influence quality?
- Do you prune?
- What do you use in pruning?
- How do you prune?
- How many times do you prune
- What is the interval between pruning?
- Do you get training to prune?
- How does pruning influence quality?
- Do you use fertilizer?
- What kind of fertilizer do you use?
- How do you apply fertilizer?
- How many times do you apply fertilizer?
- What is the application interval?
- Do you get training to apply fertilizer?
- How does fertilizer influence quality?
- Do you spray with chemical?
- What chemical do you use to spray?
- How do you spray?
- How many times do you spray?
- What is the spraying interval?
- Do you get training to spray
- How does spraying influence quality?

- How many hours do you work per day?

- Do you get any welfare from Tole?

Quality improvement:

- What is your idea about quality improvement on tea?
- Does your boss asked feed back from you?
- What kind of communication channel do you prefer?

Harvesting (harvesters)

- Do you get training to harvest?
- How many times do you harvest in a year?
- What is the interval between harvesting?
- When do you harvest?(morning or afternoon or evening)
- How many leaves do you pick at a time?
- What do you use in harvesting? (hand, knives, stick, machine)
- What are the criteria for payment (per day or on quantity picked?
- What quantity of leaves do you pick per day?
- Are you being supervised when picking?
- Do you transport the leaves to the factory?
- How do you transport the leaves to the factory?
- What is the distance from the farm to the factory?
- How does the type of leave you pick influence quality?
- How many hours do you work per day?
- Do you get any welfare from Tole?

Quality improvement:

- What is your idea about quality improvement of tea?
- Does your boss asked feed back from you?
- What kind of communication channel do you prefer?

Tea manufacture (processing technician and operation manager)

- How many types of tea do you produce? (black green, oolong and white tea)
- Which technique do you use to process tea? (CTC/ orthodox)
- Why do you process that type?
- How do you carry out the process?
- What are the preconditions for the process?
- How do you ensure that the preconditions are met?
- What many types of tea making process do you use?
- What are the steps taken when the leaves arrives the factory?
- Is the leaves checked to see the type of leaves that was plucked?
- What is the first step in tea manufacture?
- What is done? And why?
- Is the leaf temperature, moisture and color checked when it arrives the factory?

What is withering? (Processing technicians only)

- What are the types of withering?
- How is it done?
- What is the equipment use in withering?
- How does it influence quality
- What are the most delicate points during withering?

- Is there any corrective action to take when some thing go wrong?
- Is it documented? Code of conduct in the time of processing
- What are the factors that influence withering?

Maceration (technicians)

- How is it done?
- What are the equipments used in leaf maceration?
- How does it influence quality?
- How is it monitored?
- What are the factors that influence maceration?

Rolling (technicians)

- How is it done?
- What are the equipments used in rolling
- How does it influence quality?
- How is it monitored?
- What are the factors that influence rolling?

Oxidation (technicians)

- What are the types of oxidation?
- Why is that particular type used?
- What is difference between the types of oxidation?
- How is it done?
- What are the equipments used?
- How does it influence quality?
- How is it monitored?
- What are the factors that influence oxidation?

Drying

- How is tea dried?
- What are the preconditions for drying?
- How is it monitored?
- What are the equipments used in drying?
- What are the factors that influence drying?
- What are types of dryer?
- Which one do you use?
- Why do you use it?
- Does the quality of tea depend on the dryer used?
- How many hours do you work per day?
- Do you get any welfare from Tole?

Quality improvement:

- What is your idea about quality improvement of tea?
- Does your boss asked feed back from you?
- What kind of communication channel do you prefer?

Tasting (tasters)

- How do you taste tea?
- When do you taste tea (morning, afternoon etc)
- What do you determine when tasting?
- What happened when the taste is not good?

- Who do you report to?
- What happened with the bad tea?

Grading (tasters)

- How is grading done?
- What are the different tea grades?
- What are machines used in grading?
- How does it influence tea quality?
- What are the guides you use for grading?
-

Sorting (tasters)

- How is sorting done?
- What machine is used in sorting?
- How does it influence quality?
- What are the guidelines for sorting?

Packing (tasters)

- What are the equipments used in packing?
- How does the equipment influence quality?
- How many hours do you work per day?
- Do you get any welfare from Tole?

Quality improvement:

- What is your idea about quality improvement on tea?
- Does your boss asked feed back from you?
- What kind of communication channel do you prefer?

General Manager (semi-structured)

- What are the critical control points in tea production and processing?
- What is done at each point?(how)
- Which quality management system do you use?
- How do you implement it?
- Do you have documentation of the code of practice?
- Do you follow this practice as outlined in the document?
- What is the influence of these practices to quality of tea?
- What are the challenges that you face in applying these practices?
- Are your staffs trained to apply these practices?
- What other market do you want to access?
- Do you know the quality requirement for different market?
- Can you meet the requirements?
- How can you meet it?

General Manager (open question)

- How does you organizational structure influence quality control system (Decision making, linking pins, internal communication, span of control)

Supporter open questions

WINHEEDCAM (open question) training on pests and diseases control, ASCODA, South West Regional delegation of agriculture, department of phytosanitary, technical director and chief of Tole

What type service do you offer to Tole tea estate as concern quality of tea?

- Do they implement what you offer to them?
- What are the challenges they face implementing it?
- Do you monitor the implementation process?