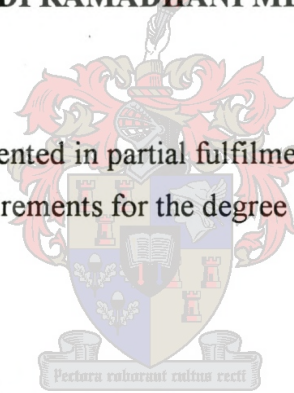


**APPLICATION OF HAZARD ANALYSIS CRITICAL CONTROL
POINTS (HACCP) IN IMPROVING THE GLOBAL
COMPETITIVENESS OF THE FISH INDUSTRY WITH SPECIAL
REFERENCE TO THE NILE PERCH (TANZANIA)**

By

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requirements for the degree of



Master of Philosophy in Agriculture System Management

At the

University of Stellenbosch

STUDY LEADER: Dr LC HOFFMAN

March 2000

DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

Signature :

Date.

ACKNOWLEDGEMENTS

I should also like to acknowledge

My sponsors, Winrock International, for the financial assistance, which enabled me to carry out the research and complete the project;

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My children, Nkuli and Msua.

Mwanaidi Mlolwa... 

Date: 24-DEC-1999

CLARIFICATION OF TERMS

- CCP:** Critical Control Point is a point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to an acceptable level (Corlett 1998).
- Corrective Action:** Procedure followed when a deviation occurs.
- Deviation:** Failure to meet a critical limit.
- HACCP:** Hazard Analysis Critical Control Point is a systematized, documented method of food safety control utilizing rules and guidelines designed to prevent, eliminate or detect hazards through all stages of growing, harvesting, production and distribution to the final use of the product by the consumers.
- Hazard Analysis:** The process of collecting and evaluating information on hazards associated with food under consideration to decide which are significant and must be addressed in the HACCP plan (Corlett 1998).
- Hazard:** A biological, chemical or physical agent that is reasonably likely to cause illness or injury in the absence of its control.
- Prerequisite programmes:** Universal steps or procedures that control the operational conditions within a food establishment allowing for environmental conditions that are favourable to the production of safe food.
- SSOP:** Sanitation Standards Operating Procedures are written procedures determining how the processor will meet sanitation conditions and practices in a food plant (Corlett 1998).

ABSTRACT

Not only have non-trade barriers been applied in Europe and the US to agricultural products from developing countries, but protective policy is also likely to continue. Owing to the omission of fish from the discussions in the final round of agreement at Uruguay, where tariffs were significantly reduced for other agricultural products, the fish industry has not had any non tariff barrier relief in recent years. The failure of the November 1999 World Trade Organisation Meeting at Seattle to reach any agreement, has again shattered hopes of international relief for fishery products.

The main assumption underlying the study was that the production of fish in Tanzania could improve significantly if the HACCP (Hazard Analysis Critical Control Points) principles were applied rigorously. It was believed that neither the prerequisite programmes, nor HACCP principles were probably applied as stringently as international standards require.

The aim of the study was to review the literature on HACCP, programmes that are prerequisite for HACCP and factors that determine competitiveness in business and to examine the Tanzanian Nile perch industry against this background. The overall goal was to determine how the industry could become more internationally competitive. This was achieved by comparing the socio-economic reality of Tanzania with factors that are considered in the literature to affect competitiveness in general and in the fish industry specifically. To achieve the first of these aims, Tanzania's socioeconomic position as a developing country was examined. To achieve the latter, the commitment of fish processing factories to the application of HACCP principles and their compliance with prerequisite programmes were evaluated in a field study.

The literature study confirms that HACCP has received international recognition in the fish industry as a factor to prevent hazards and gain competitiveness in the global fish market. However, conditions in Tanzania were shown to be insufficient to support the fisheries sector in attempting to gain such a competitive advantage. Although, Tanzania has the comparative advantage of a fishery resource base, a favourable trade policy and foreign technology and management, the macro-factors that include the infrastructure, human resource capital, foreign policy environment and the supporting industries are not supportive. For the time being, therefore, improvement can only come from the government and from the industry itself.

There are several factors to which the government needs to pay attention in order to support this industry – and others – in achieving international success. These include the provision of infrastructure and facilities, the improvement of the transportation network, technological capabilities, human resource capital and the provision of safe water and electric power.

However, the fish industry cannot rely on the government alone. The improvement of their product is also dependent on their own efforts. According to the findings of this study, the industry needs to comply with the basic sanitation factors and provide the necessary training to the employees and fish suppliers.

Having examined the situation more closely, the assumption is proved to be correct. The fish industry in Tanzania does indeed appear to have the potential to become internationally competitive. Such success, however, will be heavily dependent on cooperation between the government and the industry

OPSOMMING

Handelsbeperkings op landbouprodukte vanaf ontwikkelende in Europa en die Verenigde State toegepas. Daarbenewens sal beskermende beleidsriglyne waarskynlik in stand gehou word. Bespreking van sake met betrekking tot vissery is nie by die finale rondte van ooreenstemming te Uruquay, waar tariewe vir ander landbouprodukte betekenisvol verlaag is, ingesluit nie, en daardeur is daar gedurende die laaste aantal jare geen belastingverligting vir die visindustrie gebied nie. By die World Trade Organisation se vergadering om internasionale verligting vir visprodukte te verkry, weereens beskaam.

Die hoofveronderstelling wat hierdie studie ondersteun, is dat visproduksie in Tanzanie betekenisvol verbeter kan word indien die HACCP (Hazard Analysis Critical Control Points) streng toegepas word. Dit is veronderstel dat nóg die voorvereiste programme, nóg die HACCP-beginsels wat ten opsigte van internasionale standaarde vereis word, streng volgens voorskrif toegepas word.

Die doel van die studie was om 'n oorsig van die literatuur oor HACCP, programme wat as HACCP-voorvereistes geld en faktore wat mededingendheid in die besigheidswêreld bepaal, te verkry en om die Tanzaniese Nyl-baarsbedryf teen hierdie agtergrond te ondersoek. Die oorkoepelende doel was om vas te stel hoe die bedryf internasionaal meer mededingend kan word. Dit is gedoen deur middel van vergelyking tussen die sosio-ekonomiese werklikheid van Tanzanië en die faktore wat mededingendheid in die algemeen, volgens die literatuur, en die visbedryf in besonder, affekteer. Om die eerste van hierdie doelstellings te bereik, is die sosio-ekonomiese posisie van Tanzanie as 'n ontwikkelende land ondersoek. Om die tweede te bereik, is 'n veldstudie uitgevoer om die mate waartoe fabriek wat vis verwerk daarop ingestel is om HACCP-beginsels toe te pas en hul gewilligheid om die programme wat as voorvereistes dien, na te kom, te evalueer.

Die literatuurstudie het bevestig dat HACCP internasionale erkenning geniet as 'n faktor om risiko in die visbedryf uit te skakel en mededingendheid op die wereldmark vir vis te verwerf. Daar is egter bewys dat toetstande in Tanzanie ontoereikend is om die visserysektor in die verwewing van 'n mededingende voorsprong te ondersteun.

Alhoewel Tanzanië oor die relatiewe voordele van vissery as 'n hulpbron, gunstige handelsbeleid en buitelandse tegnologie en bestuur beskik, bied die makrofaktore soos infrastruktuur, kapitaal in die vorm van menslike hulpbronne, die buitelandse beleidsomgewing en die ondersteunende bedrywe nie genoeg ondersteuning nie. Vir die hede, kan ontwikkeling dus slegs deur die regering en die bedryf self bewerkstelling word.

Daar is verskeie faktore waaraan die regering aandag moet skenk om hierdie bedryf-en ander bedrywe-in die verkryging van internasionale sukses te ondersteun. Sulke faktore omvat die daarstelling van infrastruktuur en fasiliteite, die verbetering van die vervoernetwerk, tegnologiese vermoens en menslike hulpbronskapitaal, en voorsiening van onbesmette water en elektriese krag.

Die visbedryf kan egter nie net op die regering steun nie. Die verbetering van die product is van die bedryf self afhanklik. Die bevindings van hierdie studie dui daarop dat die bedryf die basiese faktore betreffende sanitêre beginsels moet onderhou en die vereiste opleiding aan diensnemers moet verskaf.

By die nadere ondersoek van die situasie is die oorspronklike veronderstelling korrek bewys. Die visbedryf in Tanzanië beskik oor die potensiaal om internasionaal medegend te word. Sodanige sukses sal egter uiters afhanklik wees van samewerking tussen die regering en die bedryf.

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CHAPTER ONE: INTRODUCTION AND GENERAL ORIENTATION

1.1 INTRODUCTION

It is generally believed that, apart from their major aim of preventing hazards in processing plants, the application of the international programme, Hazard Analysis Critical Control Points (HACCP), can reap excellent benefits if planned well. For example, HACCP can direct the resource and energy in areas where risk is highly threatening (Pearson and Dutson, 1995; Spencer, 1995). The programme can also increase customer satisfaction and trade.

Some forty years ago, when they were asked to produce safe foods for astronauts in the United States, the Pillsbury Company was the first to apply the HACCP principles. HACCP programmes identify the potential hazard, which may be associated with any food from its growth, through harvesting, processing, storing and distribution to the consumer's hands (Scott, 1993). Although the concept was successfully transferred to canned low acidic food, it has not been applied by all food manufacturing firms. HACCP was, for example, not made mandatory in fish and fishery products until recently when the incidence of food-borne diseases began to increase.

This thesis responds to the need for a holistic evaluation of some prerequisite programmes of HACCP regarding their implementation of the HACCP principles in fish processing factories in Tanzania. These programmes include the sanitation standards operating procedures for areas where risk of product contamination is likely to occur. It is important for factories to have Sanitation Standard Operating Procedures (SSOPs) in place before HACCP is implemented. Given the limited resources normally available, effective SSOPs reduce the chance of having too many Critical Control Points (CCPs), which are difficult and expensive to manage, in a HACCP plan. In this chapter the location and perspective of the industry, as well as the problem and purpose of the study are described.

1.2 LOCATION AND BACKGROUND OF THE STUDY AREA

Mwanza Region lies in the Northern part of Tanzania, located between a latitude of 1° 30' and 3° south of the equator (Figure 1.1). Longitudinally the region is located between 31° 45' and 34° 10' east of Greenwich (Planning Commission, 1997). Regions bordering on Mwanza are Kagera to the west and Shinyanga to the south and south-east.

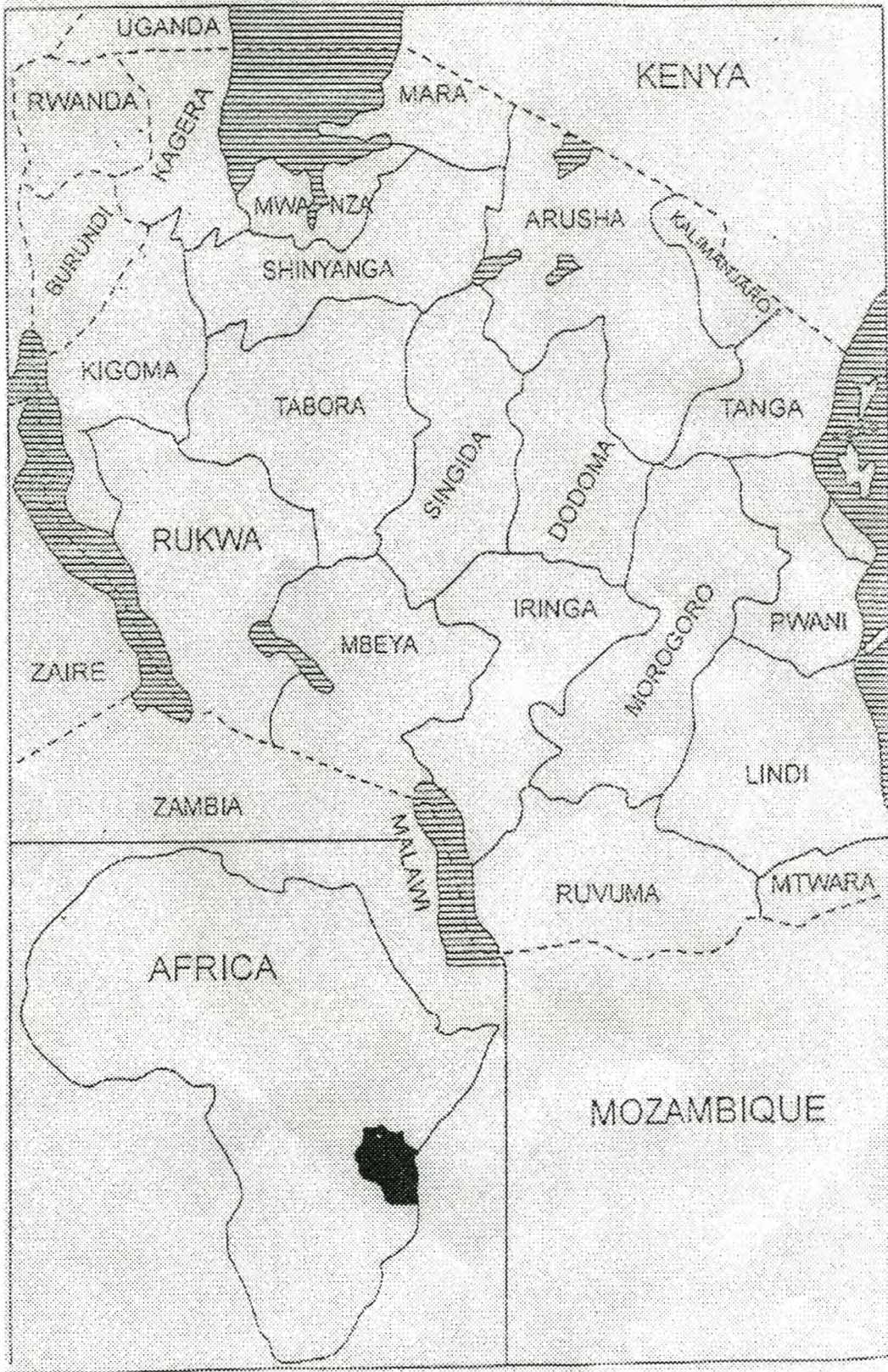


Figure 1.1 Location of Mwanza Region in Tanzania (Map not to scale).

Source: Planning Commission 1997

In the north-east Mwanza borders on Mara Region. The northern part of Mwanza is surrounded by the water of Lake Victoria, which separates the region from the neighbouring countries of Uganda and Kenya. Lake Victoria lies at an altitude of 1135 meters above sea level. It is situated on the great plateau, stretching between the western and the eastern rift valley. It is a basin with a maximum depth of 84 meters, a mean depth of 40 meters and a maximum width of 240 Kilometers.

One of the major occupations of the inhabitants along the shores of Lake Victoria in Mwanza Region is fishing. The fishery resources of the lake are exploited by an estimated 16 385 artisanal or small-scale fishermen, using 3369 wooden boats and dugout canoes (Anonymous, 1998). The main fish caught are the Nile perch (*Lates niloticus*) and sardines (*Rastineobola argentius*). Other important species, which appear in smaller proportions, include Tilapias, African lungfish (*Protopterus aethiopicus*) and catfish (*Clarias gariepinus*) (Planning Commission, 1997). The potential yield of fish in Tanzania is estimated to be about 730 000 metric tons of which 200 000 tons is expected to be from Lake Victoria (Ministry of Natural Resources and Tourism) (MNRT, 1997). The fisheries sector therefore has economic and social significance in the country and contributes around 6% to the Gross Domestic Product (GDP) (Planning Commission, 1998).

In the period during which the field work for this study was done, seven fish processing factories were in operation with a production capacity of between 20-70 tons of fish per day (Figure 2). Three factories were foreign owned, two were local and the other two had joint ownership. The relatively high foreign ownership is a result of the fact that, when the industry began, foreign investment in the fisheries sector enjoyed investment incentives such as tax holidays, remission of import duties and sales tax on capital equipment, 100% foreign exchange retention, automatic access and leases on land for intended investment sites.

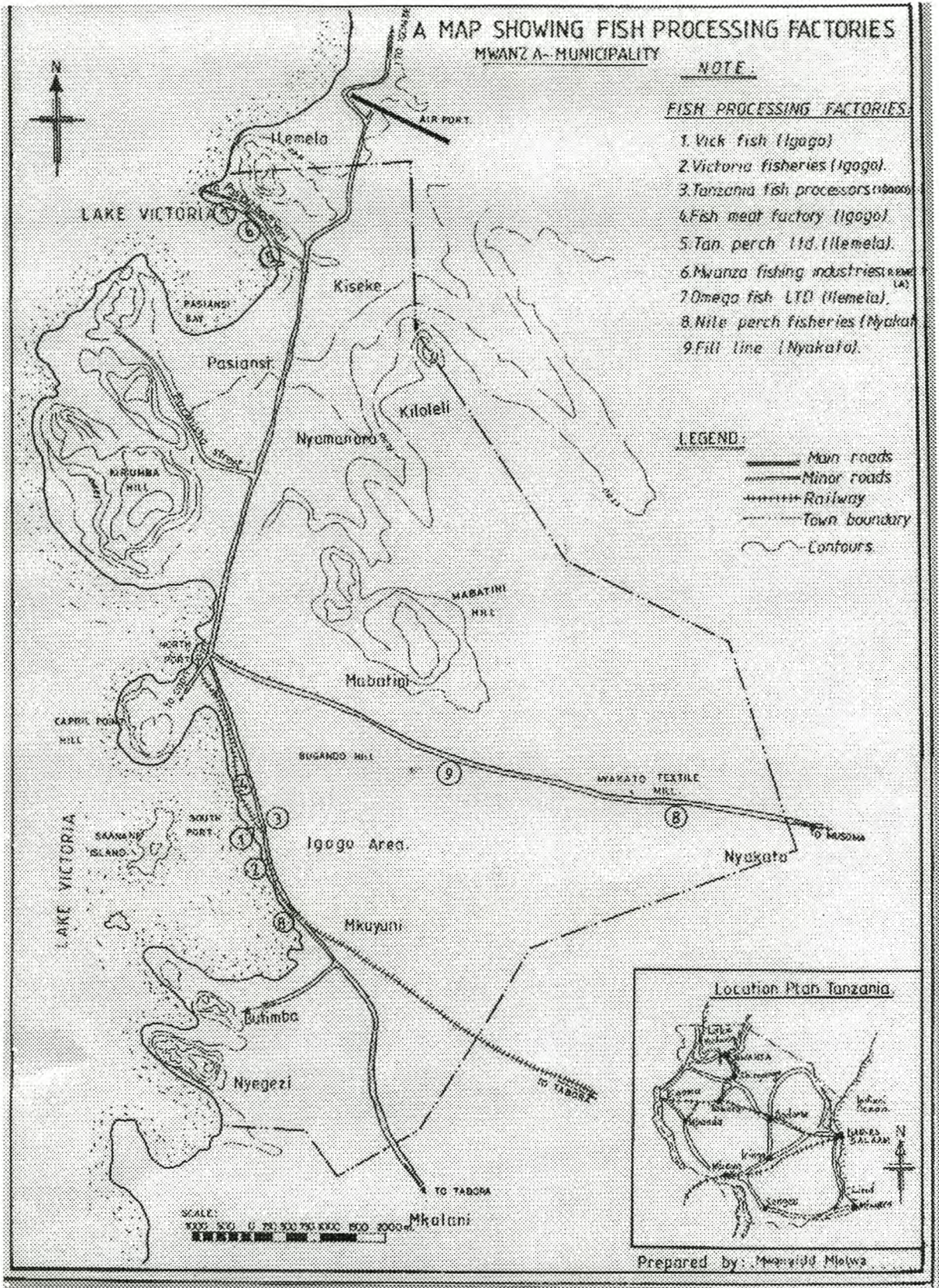


Figure 1.2 The Study Area: Mwanza Municipality in Mwanza, Tanzania.

Source: Lands Department, Mwanza

The export of Nile perch from Tanzania has developed and become organised since 1993, when the government banned the export of whole and semi-processed fish. The Ministry of Natural Resources and Tourism (1997) has indicated that Nile perch exports occupy 75% of the total fish exported from the country. The main importers are Holland, Belgium, Greece and Germany. Other countries include Israel, Australia, Japan, USA and the Far East.

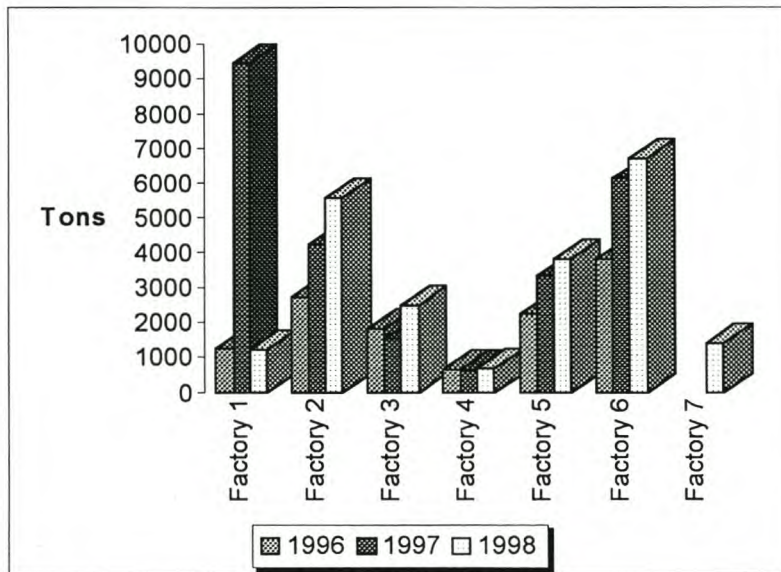


Figure 1.3 Nile Perch Exports by Factories: 1996-1998.

Source: Researcher's data

Small-scale fishermen using outboard engine motor boats of capacity between 3 and 20 tons carry out Nile perch fishing for commercial purposes around various islands. Gillnetting and longlining are also commonly used to catch Nile perch. While some fishermen are employed by companies, powerful vessel owners engineer the fishing and collection activities in the islands. The whole catch is brought to the landing sites in the islands where it is weighed and iced into the fish holds, ready for the journey to the factory jetties. Independent suppliers or company fishing boats, or both, collect the fish from the islands. At the jetties fish are off-loaded by hand and loaded into the insulated truck as displayed in Plate 5.1. The fish is then taken to the factory receiving area where it is washed, weighed, processed and graded to market specifications. The common specifications are frozen fillets with skin on, skin off, or chilled fillets. Fillets, which vary between 300 gram to 1500 gram, are individually packed in polyethylene bags and placed into waxed boxes of six kilogram each, ready for freezing in plate or blast freezers. The air bladders are cleaned, dried and sold to Far East countries.

On account of allegations of the use of poison (thiodan and diazinon) for fishing, the European Union (EU) imposed a ban on all Nile perch export from East Africa during the

period of this study. The ban became effective on March 25, 1999. Since the allegation has not been proved yet, other small markets such as Australia, Saudi Arabia, Africa and Japan are still open. The ban is still in effect upon completion of the investigation.

1.3 THE NEED FOR THE STUDY

The demand for Tanzanian Nile perch fillets from other parts of the world has increased substantially since the early nineties (Table 1.1). Tanzania now exports about 200 tons of Nile perch fillets every week (Anon, 1998). However, although exporters have managed to penetrate the competitive markets in the world like the USA and Europe, where the product is accepted for its inherent characteristics, they face stiff competition in terms of quality and safety.

Years	Nile perch Exports		Country Total Fishery Exports	
	Weight in Kg	Value in T.shs	Weight in Kg	Value in T.shs
1993	6,096,819.00	2,513,779,862.50	7,958,079.75	5,117,711,838.75
1994	8,453,506.40	4,007,468,118.70	12,,611,915.80	9,772,874,233.90
1995	12,404,862.40	7,127,043,427.10	17,269,903.40	11,932,001,204.88
1996	20,296,124.40	19,338,404,278.70	25,544,863.00	24,837,660,718.50
1997	23,075,904.63	33,125,889,871.53	32,098,151.00	41,786,110,963.20

Table 1.1: Nile Perch Exports compared to Total Exports of Fish from Tanzania.

Source: Fisheries Statistics (Tanzania). T.shs: Tanzanian shillings

Despite the socio-economic contribution of the Nile perch industry to Tanzania's economy, questions of fishery safety have not been given the attention they deserve. It is evident from the literature that microbial contamination of fish is the most frequent threat to Nile perch exports.

Concerned about the safety of their consumers, the markets demand the incorporation of Hazard Analysis Critical Control Points (HACCP) practices in the production system of Nile perch fillets. De Beer and McLachlan (1998) suggest that HACCP compliance will give the exporters an edge over their competitors. A recommendation from the Food and Agriculture Organisation (FAO) expert meeting (FAO, 1995) also emphasised the need for prerequisite programmes to be applied before HACCP. Further reports from the National Advisory Committee on Microbiological Criteria for Foods (NACMCF) (1998) and Huss (1994) emphasise that HACCP should be developed by each food establishment and tailored to individual products.

The researcher's encounter with these theoretical concepts and practical experience as a food technologist in the Fisheries Division of Tanzania led to the identification of the need for the evaluation of the prerequisite programmes. The research was undertaken to investigate the effectiveness of the prerequisite programmes in Nile perch fish processing factories in Mwanza and to recommend ways in which the programme could be implemented successfully. The study was conducted in April and May 1999. It was hoped that its qualitative approach would lead to a better evaluation of the SSOPs, which form the foundation of the HACCP programme.

1.4 UNDERLYING ASSUMPTIONS

The main assumption underlying this thesis is that the production of fish in Tanzania can improve significantly if the HACCP principles are applied rigorously. It is believed that neither the prerequisite programmes nor HACCP principles are probably applied as stringently as international standards require. Further, if specific shortcomings could be identified and corrected, Tanzania has the potential to become internationally competitive in this regard. By examining the situation more closely, this study hopes to contribute to the expansion of the fish industry in Tanzania.

1.5 PROBLEM STATEMENT

It is estimated that food-processing plants contribute 3% of total foodborne illness in the USA (Holy, 1989), and that about 81 million cases of disease per annum are food-borne (Miller and Kvenberg, 1986). If this is the case in an advanced country such as the USA, the situation in developing countries must raise concern. Many deaths and illnesses caused by foodborne illness still occur unreported and uncontrolled. In 1980 alone, 1000 million cases of diarrhoeal diseases were reported from developing countries (WHO, 1989).

In addition to disease, the WHO (1997) notes many negative consequences of foodborne illness, the most important of which is reduced economic productivity. Through microbial contamination about 25% of the world's food supply is, for example, lost annually. Despite the worldwide progress in food science and technologies, therefore, the problem of food processing requires a great deal of research.

Tanzanian fish processors are still relying on traditional methods of testing the final product for safety assurance. Since these methods are effectively used for monitoring purposes, they do not emphasize food safety. Fish export from Tanzania has been challenged for its low

quality and safety (Goulding, 1997), for example, despite the increase in the trend for fish exports indicated in Table 1.1. The strong demand in the markets of developed countries, which has coincided with the depletion of stock in the North Atlantic Sea and the weakening image of meat, has promoted Nile perch exports. Goulding (1997) reports, however, that the future of the trade is not clear while it is threatened by the problem of quality and access to the European and foreign market, which is the biggest market.

It is from a safety perspective that fish-importing countries like the USA and Europe have imposed strict conditions on fish imports. Exporters to the USA must produce a written HACCP plan as proof of implementation of HACCP in their production system (McLachlan and De Beer, 1998; Harvey, 1994). The minimum requirement for companies to export to Europe is contained in EU council Directive 91/493/EEC, which also requires the implementation of HACCP principles. Under this directive, processors are required to self-inspect their production system based on the identification of the critical control points, monitoring and record keeping for the purpose of verification by the competent authority in their establishment (Barker and Mckenzie, 1996). In addition to this directive, however, the European Union Commission issued Directive 97/274/EEC, which requires fishery products entering the European market from East Africa to be subjected to bacteriological examination for salmonella and other pathogens.

Although the global food demand and the development of the free trade policies and markets have boosted cross-border trade, they have also caused markets to take strong measures to protect their customers against unsafe food. A lack of compliance with the prerequisite programmes and HACCP in Tanzania will therefore positively contribute to product contamination. The fact that the competent authority has recently closed two factories is therefore disturbing.

The global fish market has made it very clear that in order to remain in business, companies must observe the SSOPs and apply the HACCP principles in their production system. Since Gharajedaghi (1985) and Twist (1980) point out that the survival of any organization in a turbulent environment depends on its ability to actively adapt to the changing needs of its members, Tanzania has clearly been challenged regarding its ability to participate full in the world market.

The focus of this study, which is to evaluate compliance to the prerequisite programmes springs from these concerns.

1.6 AIM OF THE STUDY

The overall aim of the study is to review the literature on HACCP, programmes that are prerequisite for the application of HACCP and factors that determine competitiveness in business, to examine the Tanzanian Nile perch industry in this context and to describe how safe fish products can be produced. In the field study the commitment of fish processing factories to the application of HACCP principles and their compliance with prerequisite programmes is evaluated.

Detailed objectives of the field study are described in Chapter Four.

1.7 SEQUENCE OF CHAPTERS

The study is divided into six chapters. After the general introduction, above, Chapter Two reviews theoretical perspectives underpinning HACCP principles and describes determinants of competitiveness as found in the literature. Chapter Three describes the need for the application of HACCP in Tanzanian fish processing factories in terms of these determinants of success in business. The methodology applied in this study is described and motivated in Chapter Four, while Chapter Five presents the analysis and interpretation of the data. This is followed by a discussion of the main findings, conclusions and recommendations in Chapter Six.

CHAPTER TWO: HACCP AND OTHER DETERMINANTS OF COMPETITIVENESS

2.1 INTRODUCTION

In this chapter the literature on the development and application of HACCP in food production is reviewed. The emphasis is on the successes and problems experienced globally in the adoption and running of the programme. The goal is to set out the major issues underlying HACCP and global competitiveness in order to create a basis for evaluating the findings from the assessment of the prerequisite programmes and the application of HACCP in the Tanzanian fish industry. The second section therefore concentrates on theoretical perspectives on factors that determine the level of competitiveness of companies.

2.2 HAZARD ANALYSIS CRITICAL CONTROL POINTS (HACCP)

2.2.1 THE DEVELOPMENT OF HACCP

The literature reviewed shows that the HACCP concept was first used 40 years ago. Many authors (WHO, 1997; Pearson and Dutson 1995; Forsythe and Hayes, 1998 and Corlett, 1998) report that the Pillsbury Company, together with the National Aeronautics and Space Administration (NASA) and the U.S army laboratory at Natick, was the first to conceive the system to ensure the safety of astronauts' food. The aim was to produce food that would not cause any illness that could jeopardise space missions. Since the food had to approach a 100% safety assurance, it needed to be uncontaminated with pathogens and free from chemical, microbiological and physical hazards.

Bauman (1990) noted that, before that safety was not guaranteed if a standard method of quality control was used. In addition, a large amount of testing had to be done in such a method to come to a reasonable decision regarding whether a food was acceptable. The earlier work of scientists (Buchanan, 1990; Huss 1992; Cloete, 1996 and Corlett, 1998) criticised the traditional practice of end product testing as unsatisfactory, uneconomical and not leading to proper risk management. Standard quality control methods also wasted a great deal of food used for testing, since the number of samples required to accept or reject the lot statistically required a huge amount of food. Ten thousand units out of a one million lot was,

for example, necessary to obtain a statistical level as low as 1%. As only a small portion of food was left for a space mission after the tests, this was a very costly programme.

It was therefore agreed that a programme would be used, which would approach a 100% assurance level that the food produced was not contaminated with chemicals, physical hazards or bacteria of public health significance. To establish this, the programme was required to have control over raw material, the environment, the processing of food and even people at all stages of preparation, from the production to distribution stage.

It was from this idea that the HACCP system was developed and from here that it spread throughout the food industry. In comparison with standard programmes, this type of a programme is preventative in nature. It therefore instilled a high level of confidence in consumers. Since testing was also not required in this programme, except for monitoring purposes, there was less wastage (Bauman, 1990).

Initially HACCP was used to control microbiological risks only in the processing of low acid canned food. In the mid 1980s, when the inefficiency of the final product tests, which aimed towards detection of quality loss rather than prevention of food hazards, led to high incidences of food-borne diseases, HACCP received a great deal of attention. However, it was not until the late 1980s that a number of regulatory agencies developed an interest in HACCP as a tool for use in food safety.

Later, the interest of food scientists and the quality control fraternity in the HACCP principles and systems grew significantly as revealed by many expert bodies which have been actively involved in promoting the adoption of HACCP in food processing, production and distribution industries.

In 1994 the Food and Agricultural Organisation (FAO) of the United Nations reviewed the HACCP application system in food control activities worldwide in the Expert Meeting at Vancouver, Canada and assessed the potential impact on international trade. Based on acceptable scientific and risk analysis, they examined and recommended methods to harmonise HACCP food control systems internationally and assessed the potential application of HACCP systems to different sectors of the food industry.

The Codex Alimentarius Commission (CAC), which was formed in 1962 and chartered by the FAO and WHO of the United Nations with the aim of protecting the public health and harmonisation of international food and hygiene has also endorsed the HACCP system. The Codex guidelines for the application of the HACCP system, which were published in 1993, have been revised. The revised text was entitled Hazard Analysis and Critical Control Point

and the guidelines for its application were adopted by the CAC in June 1997. This text emphasises the importance of the prerequisite conditions and management commitment and reiterates that the decision tree, which is used for risk assessment (WHO 1997; Barker and Mckenzie, 1996), be industry specific.

The newly born World Trade Organisation (WTO), which was established in 1995, has recognised the standards of the Codex Alimentarius Commission as an International reference. The WHO (1998) reports that the WTO agreement on the application of sanitary and phytosanitary measures (SPS) is to ensure that countries apply measures to protect human, animal, and plant health based on science.

HACCP has been reported to work well when applied to low acid canned food with regard to *Clostridium botulinum*, which can be fatal (Pearson and Dutson, 1995). Notwithstanding this, the principles were not applied to the seafood industry until the late 1980s. Even in the USA where the system was conceived the concept has therefore only recently gained popularity. Gombas (1998) and Brooks (1997) report, for example, that HACCP became mandatory in the fish industry in the USA as recently as December 18, 1997, when Congress mandated the National Oceanic and Atmospheric Administration (NOAA) to conduct a study to design an improved seafood surveillance based on HACCP.

In attempting to see how small and medium fish enterprises perform under HACCP in the USA, De Beer (1998) revealed that firms were still unclear in 1998 on exactly what needed to be done, and had neither written HACCP plans nor implemented HACCP. Enterprises were faced with a lack of resources both to pay for the expertise to plan a HACCP system and to provide time for management to attend compulsory courses in HACCP. On the status of HACCP implementation in South Africa, Westoll (1995) confirms that few companies have implemented HACCP and many have not even heard of it.

The Canadian fishing industries are the most advanced in matters of HACCP application and regulations. It is reported that the Canadian fish processing industry was the first in the world to be regulated through a HACCP based programme (Spencer, 1992 and FAO, 1995). The Canadian Quality Management Programme (QMP) was designed to prevent food hazard, quality and economic fraud. The findings of Barker and Mckenzie (1996) revealed that in the effort to focus more closely on safety issues, the Canadian government was in the process of reviewing its QMP system so as to align it more closely to HACCP. The European Union has also implemented a number of measures in an effort to harmonise HACCP implementation in their member states (FAO, 1995). Fish exports to the European Union market were restricted

to comply with the European directive 91/493/EEC (Anonymous, 1996). However the directive was harmonised to fit in the HACCP principles for safety assurance.

In the last decade there has been a growing recognition of the importance of implementing HACCP principles as a safety measure in food processing and manufacturing. For this reason, and the related trade and economic reasons, the demand for the application of HACCP has increased globally. In line with this development HACCP has been made mandatory by all the biggest fish importers lately, especially those in the developed countries. It has also been incorporated into inspection philosophy; because a system analysis approach such as HACCP allows the agency to use its resources more efficiently by dealing only with problem areas, that is, by applying the specificity rule (Lindert and Pugel, 1996). In addition, many case studies have shown that in the long run HACCP brings about lower operating costs, a better use of resources and a more timely response to problems (WHO, 1997). HACCP therefore increases the confidence of customers in importing countries, reduces the potential for product recall, and therefore strengthens factory competitiveness at the market.

2.2.2 A DEFINITION OF HACCP

Buchanan (1995) suggests that HACCP, being a systems approach, can be used to control the full range of physical, chemical, economic and biological factors that may affect the safety of a food product.

An up-to-date definition for HACCP is that of Pearson and Dutson (1995), which reads as follows:

"HACCP is an industry driven concept that provides a preventive system for hazard control. It is based upon a systematic approach to define hazard and critical control points based on scientific evidence within the system. It requires both industry and government participation, with the industry's role primarily being to design and execute the system and the government's role being that of approving the industry system design, verification and technical assistance."

Figure 2.1 gives the latest logical sequence for the application of HACCP as adopted by the Codex Alimentarius Commission (WHO, 1997).

1. Assemble the HACCP Team
2. Describe the product
3. Identify intended use
4. Construct flow diagram
5. Confirm the flow diagram on site
6. List all potential hazards
 - Conduct a hazard analysis
 - Determine control measures
7. Determine CCPs (Critical Control Points)
8. Establish the critical limits for each CCP
9. Establish a monitoring system for each CCP
10. Establish corrective action for deviations that may occur
11. Establish verification procedures
12. Establish documentation and record keeping

Figure 2.1 Logical Sequence for the Application of HACCP.

Source: The Codex Alimentarius Commission (WHO, 1997)

According to Tompkin (1990; NACMCF, 1997), the programme should initially entail the assembly and training of a HACCP team, preferably a multidisciplinary team consisting of factory members from each department in a factory and a consultant who is knowledgeable about food technology issues. This is intended to instill a sense of ownership of the plan by workers. Success in HACCP application can therefore only be achieved if a whole industry acknowledges the importance of having HACCP in a production system. Tompkin (1990) observes that a HACCP developed by outsiders will be poorly conceived, regardless of the possible expertise involved. Support from management is equally important in the implementation of the programme. They need to understand the benefits of HACCP as well as the cost of implementation. They are the ones who need to plan for training, which is also critical in the application of HACCP, for example. Training of the HACCP team as well as the industry employees is necessary to ensure that the programme is run as required.

The first task of the team is to describe the product. This would include the environment and temperature of the product. The team should make clear for whom the food is intended, for example the elderly, infants, or whole families, and whether there is any special allergenic or religious condition for the processing of the food. Then a clear flow diagram of the process is required that includes the steps before and after the processing. After this, confirmation of the accuracy of the operation should be obtained on the site. Once the team is satisfied with the preliminary tasks undertaken, the seven principles below can be applied.

- **List Potential Hazards**

Corlett (1990) suggests that the hazard analysis be conducted bearing a definition of a hazard (see Clarification of Terms page iii) and the appropriate control measures. If the control measures should be overlooked, the plan cannot be effective.

- **Determine CCPs**

The CCPs should be determined by the use of the latest decision tree (a technical sketch of checkpoints) provided by WHO (1997). The CCPs differ from industry to the industry depending on differences in the process, product, layout, equipment used, etc.

- **Establish Critical Limits for Each CCP**

Critical limits should be derived from the national regulatory standards, results of the experiments, experts' advise etc. and set by the team.

- **Establish a Monitoring System for Each CCP**

There is a high chance of unsafe food if a process is not properly controlled (NACMF, 1998), which is why is important to monitor the process. Monitoring is a planned sequence of measurements that assess whether CCPs are under control. For verification purposes, record-keeping is advisable during monitoring. In many cases physical and chemical measurements are recommended for monitoring rather than the microbiological tests, since the latter have been found to be long and ineffective. Training is also necessary for personnel who monitor the CCPs.

- **Establish Corrective Action**

Although HACCP is designed to identify health hazards and strategies to prevent, reduce and eliminate their occurrence, deviation sometimes does occur. The industry is therefore also required to prevent hazardous food from reaching consumers. This necessitates corrective action. Corrective action should be designed to bring the

process back into control, to dispose of the food and to keep record of the action taken. It is advisable that personnel who are thoroughly conversant with knowledgeable with regard to the process, product and HACCP should be assigned to this task. In this way further potential health hazards can be prevented if the production system can be brought back to safe control (Corlett, 1998).

- **Establish Verification Procedures**

This includes activities that determine that the system is operating according to plan. Occasionally an independent auditor should verify the HACCP system. HACCP review is also recommended when there is a change of ingredient, product formulation, process or equipment.

- **Establish Documentation and Record Keeping**

Record keeping is also an important aspect of a HACCP programme. The development of the programme should be carefully recorded for verification and auditing purposes as well as to determine whether the operating system conforms to the initial plan (Corlett, 1998).

2.2.3 CRITICISMS OF HACCP

As shown above, several authors (Stevenson, 1990; Anonymous, 1992; Taylor 1994 FAO 1995 and NACMCF, 1998) have endorsed HACCP as a systematic approach to ensuring food safety incorporating measures that are taken to prevent hazards. A number of criticisms have, however, also been raised.

Surak *et al.* (1998), have criticised HACCP because it addresses only known food safety problems and does not consider unknown problems and the statistical variation. They propose that HACCP can be more effective if it takes into consideration process variation, which occurs above or below the process control limits, as it may indicate a source of a specific problem. If this suggestion is accepted, HACCP will have wider application.

The Vancouver technical expert meeting (FAO, 1995) has challenged HACCP principles for its dependence on the HACCP team. The teams are difficult to assemble in developing countries and lack expertise in most cases. According to the FAO (1995), the governments of many developing countries have limited budgets for the training of food control officials. Technical assistance is therefore needed to monitor compliance. This, too, is a valid criticism.

One of the most critical recommendations of the FAO expert meeting held at Vancouver (1994) on the use of HACCP in food control was that industries should ensure that sectors are able to implement HACCP. They therefore recommended that, if the infrastructure and the prerequisite programmes were inadequate, these had to be corrected first. If this proposal is applied, the quality of food processed in developing countries, is likely to improve substantially.

In addition to the problems mentioned above, the slow progress in adopting HACCP, as revealed by both developed and underdeveloped countries, has caused concern among many food scientists. Although problems differ from country to country and according to the size and type of food produced, common problems that were pinpointed by earlier researchers (Forsythe and Hayes 1998; FAO, 1995) are:

- a lack of commitment by management;
- a lack of understanding of the principle;
- a lack of training;
- a lack of resources and;
- a lack of scientifically validated risk assessment procedures.

A commitment by management will, for example, indicate an awareness of the benefits and cost of HACCP, as a result of which they will educate and train employees. Since none of these concerns are insurmountable, however, all deserve the attention of exporters.

A common problem in earlier attempts to institute HACCP has been the identification of too many critical control points which need monitoring. Excessive CCPs are unmanageable, expensive to implement and could result in a less safe product, precisely because the monitoring function of the prerequisite control points will be reduced (Anonymous, 1992). Baker and Mckenzie (1996) confirm that excessive CCPs can lead to inadequate monitoring and the ultimate failure of the system as resources will not be targeted to resolve hazards in the process. For the successful implementation of HACCP, exporters should therefore be encouraged not to over-extend their resources by implementing more control points than would be effective and efficient.

The most fundamental criticism of HACCP is probably the argument of Huss (1992; 1994), who suggests that routine quality assurance programmes can control most hazards that might occur in the production of fresh and frozen fish, especially where fishing and processing methods are mechanised. There is sufficient doubt as to whether the theory can hold for non-mechanised, labour intensive factories such as those in Tanzania, however. The author seems to have overlooked the fact that the fishing methods applied and the environmental conditions

where the fishing is done in developing countries, are different from those in developed countries. Neither did he consider that countries differ with regard to level of technological development, automation and mechanisation, as a result of which types of risks and decisions regarding the application of HACCP plans also differ. Where small-scale fishermen and fish collectors are involved, there is more handling of the fish and therefore the likelihood of temperature and product handling abuse (Lorenzo, 1995), for example.

Despite these criticisms, exporters who wish to enter the market or to remain competitive, are obliged to apply the principles contained in HACCP. If they fail to do so, some other exporter will simply fill the gap left by the withdrawal of their product. Exporters are therefore required to forecast opportunities and threats more efficiently, based on the needs of complex knowledgeable consumers, who dictate the market today. Failure to meet these needs means a lack of competitiveness in the global market.

Since HACCP aims to ensure the safety of food products, it can enhance trade by meeting the demands of customers who are aware of the need for safety precautions. However, HACCP cannot by itself provide any industry with a competitive advantage, either locally or globally. Unless an enabling environment reinforces HACCP, the survival of any business is at stake. It is therefore important to examine the factors that are thought to bring about an enabling environment for global competition.

2.3 PREREQUISITE PROGRAMMES FOR THE IMPLEMENTATION OF HACCP

It is an international requirement for the fish industry to develop, document and implement programmes that support the HACCP plans. The prerequisite programmes ensure that the food is wholesome and fit for human consumption, while HACCP plans are limited to safety assurance. The prerequisite programmes therefore need to be effectively monitored and controlled before HACCP is put into place (NACMF, 1998; Corlett, 1998). The first step is to review and verify existing prerequisite programmes for their conformance to minimum international requirements. If any part is inadequately controlled, a new CCP will be instituted. As a high number of CCPs has been found to be a limitation (see paragraph 2.2.3), it is better to ensure that prerequisite programmes are effective. This, in turn, will ensure the integrity of a HACCP and consequently the safety of a product. Effective prerequisites will therefore form a strong foundation to HACCP as both safety and wholesomeness would be achieved.

There are many prerequisite programmes, from which a selection can be made to suit a specific industry. Corlett (1998) and NACMF (1998) provide examples of such programmes and guidelines to assist inspectors in the food industry to evaluate their own process. On the basis of these guidelines the researcher, who is an inspector in the fishing industry, identified the following existing prerequisite programmes in the Nile perch industry in Tanzania to evaluate for the purpose of this study.

2.3.1 Premises and Facilities

Corlett (1998) recommends that establishments should be located, constructed and maintained according to sanitary design principles. Access should be restricted. Laboratories should be available for the evaluation of raw materials, water, finished products, etc. Facilities that encourage cleanliness, such as hot water and handling equipment, should be available. Waste should be disposed of appropriately and toilets should be sufficient and clean. Product flow should be in a straight line to minimize cross contamination. Von Holy (1989) suggests microbiological sampling and testing of foods at various steps of processing and finished products to provide additional monitoring of the control points.

2.3.2 Awareness of Managers and Training of Employees

To ascertain whether employees function under competent and knowledgeable leadership, it is also necessary to determine whether managers have the necessary awareness of the necessity for safety measures in their factories.

It is also critical to any HACCP program that regular training of employees should take place (Corlett 1998; FAO 1995; WHO 1998; Forsythe and Hayes, 1998). A well-constructed training programme will reap benefits such as reducing the number and intensity of supervision points and the increase of productivity (Forsythe and Hayes, 1998). All personnel in a food factory should receive training in personal hygiene, cleaning and sanitation, good manufacturing practice and their role in the HACCP programme as well as training in skills needed in the specific industry.

2.3.3 Receiving, Storage and Transportation

Requirements regarding the handling of products are particularly pertinent to the fish industry. The speed with which fish is brought from the fishing grounds to the receiving point is critical for the retention of wholesomeness and safety. The exposure of fatty fish to the sun, air and

room temperatures during catch handling is sufficient to introduce severe quality loss and cause early spoilage (Huss, 1994).

Raw materials and products should also be stored under sanitary conditions and the proper temperature (Corlett, 1998). Proper packaging and handling of fish during transportation is therefore crucial to ensure safety and wholesomeness of the product. The use of stacked crates has been recommended, since the fish remains undisturbed in the containers until they reach the processor where more ice can be added to the containers on landing. The process of unloading is also simplified in this way and the fish is protected from damage by the shovels or hooks (Burgess *et al.* 1965; FAO, 1983).

It is recommended that ice should be made from portable water. It should be properly handled and stored to protect it from contamination. Bacteriological testing of ice is recommended. In order to cool the fish rapidly, Burgess *et al.* (1965) note that the distance between the fish and the ice should be reduced. Since the cooling of fish is slow if the layers of fish are thick, insufficient quantities of ice are considered to be used if the fish is not completely surrounded by ice at the end of a voyage (FAO, 1983). Burgess *et al.* (1965) observe, for example, that there is no temperature change detectable in fish 13 inches from ice after 18 hours.

Earlier work (Burgess *et al.*, 1965; FAO, 1983) has established that the amount of ice required for cooling fish during transport should be worked out by the specific industry with consideration of the duration of the journey, the state of the climatic temperature and the type of insulation. However, in warm areas it is necessary to use greater proportions of ice than in cooler climates. The Association of Food Scientists and Technologists (AFST) (1975) has recommended a 1:1 ratio of ice to fish by weight, although the ratio can go as high as 3:1 during summer.

Chill storage is used as a short-term preservation technique for many perishables, including fish. Chilling aims to keep the fish in good condition for several days during transportation and delivery. The preferable temperature in chill rooms is between 0⁰ C and +3⁰ C (Kyzlink, 1990). AFST (1975) and Huss (1994) report that at a temperature below -18⁰C, the shelf life of most frozen fish products has been found to be more than 6 months.

Several factors such as the size and shape of fish, fishing ground, season of the year, location, oil and fat contents, affect the storage life of fish too. Hoffman *et al.* (1974) indicate that at 25⁰C, *Lates sp.* and *Bagrus sp.* are completely spoiled after 24 hours. The point of incipient spoilage occurs after 12 hours. The early application of ice extends the storage life for more than 30 days in several species. This is confirmed by Gram *et al.* (1989) reporting that tropical fresh fish can keep for approximately 4 weeks if iced properly. They also confirm

that Nile perch spoils rapidly when exposed to tropical temperatures, which is why rapid processing is necessary, within 8-9 hours after fish has been caught. Since studies on spoilage have been done under experimental conditions rather than commercial conditions, Santos (1981) warns that results of the experimental work on storage life must be read as a maximum.

2.3.4 Sanitation and Water Safety

It is the responsibility of management to ensure that a sanitation schedule is in place. Forsythe & Hayes (1998) and Von Holy (1996) emphasise that cleaning should not be left to inadequately trained employees, irrespective of whether a cleaning crew or production workers are used. Procedures for cleaning and sanitation of the equipment must therefore be written and followed.

Water in fish processing is one of the important critical control points (Huss, 1994). Troller (1983) emphasises that water safety is critical in a processing factory, as untreated water will cause contamination. Portable hot and cold water is required in food processing, handling, packaging and storage areas at the adequate temperatures and pressures and in quantities sufficient for all operational and clean-up needs.

2.3.5 Pest Control Programme

Chesworth (1997) noted that pests could make a product unwholesome if their hair or droppings come into contact with the food produced. Establishments are therefore required to have an adequate pest control programme to monitor and exterminate pests. The maintenance of records is required for verification.

2.3.6 Suppliers' Control

Each industry is required to assure that its suppliers have a food safety programme that would be subjected to continuing verification.

2.3.7 Personnel Hygiene

All personnel and visitors entering the processing factory should follow the requirements for personal hygiene. A pre-employment medical examination is a requirement to ensure that all fish personnel are clear of contagious diseases that could pose a threat to the safety of a product.

2.3.8 Traceability and Recall

The recall programme outlines the procedure that a company will take in case a product has to be removed from the market. It is a requirement that all the material should be coded in order to be easily traceable in case of a recall. Distribution records should be well maintained for a period of time that exceeds the shelf life of the product and the regulations.

The application of HACCP cannot be evaluated without reference to broader aspects of a society that affect the success that industries achieve. While the factors described above could be termed intra-industrial, those discussed below refer to national and international situations that directly affect the success that industries are able to aspire to.

2.4 DETERMINANTS OF GLOBAL COMPETITIVENESS

2.4.1 Theoretical Perspectives

The traditional comparative advantage theory of Ricardo was based on natural resources endowment and factor proportion (capital/labor) ratios. As it assumed that factors of production were homogeneous between countries, this theory did not fully explain competitiveness (Porter, 1998).

Today some authors define the term 'competitiveness' differently, depending on whether the competitiveness of a firm, national or international competitiveness refers. The competitiveness of a *firm* is defined as meeting customers' needs more efficiently and more effectively than other firms do (Anonymous, 1994). The competitiveness of a *nation* is defined as the degree to which the nation can produce goods and services that meet the test of international markets under free and fair market conditions, while simultaneously expanding the real incomes of its citizens. According to this definition competitiveness at the national level is based on superior productivity performance (Clyde, 1994). Wangwe's (1995) view of *international* competitiveness as a multi-dimensional concept embracing the ability to export, the efficient use of the resources and increasing productivity, which ensures a rising living standard for a nation, supports this perspective.

Krugman (1994) and Porter (1998), however, consider competitiveness a meaningless concept when applied to national economies, arguing that countries are not at any significant degree of economic competition with each other. The notion behind this perspective is that while major industrial countries sell products that compete with each other, they are also each other's markets and suppliers of imports. Since trade is a relatively small part of the Gross National

Product (GNP) in these countries, living standard is determined by how well the economy works rather than by international performance. From this Krugman (1994) concludes that firms trade and determine competitiveness, rather than countries.

The conceptual framework adopted in this study is derived from Porter's recent book, entitled "The competitive advantage of Nations" (1998). In the book the influence of determinants of competitiveness ("Porter's diamond") is explored. Determinants are examined individually and jointly as a system with regard to their ability to create a context for a firm to achieve a competitive advantage in a particular industry (Porter, 1998). The results of the study show that the success of industries is dependent on the interrelationship of a set of determinants rather than individual determinants *per se*. These determinants, which are discussed below, are factor endowment, firm strategy structure and rivalry, demand conditions and related and supporting industries. The government and chance effect has been also found to affect competitiveness.

2.4.2 Factor Endowment

2.4.2.1 Physical Resources

Several authors (Porter, 1998; Cockburn *et al.*, 1995) have mentioned an abundance of and accessibility to quality natural resources as factors that can create a competitive advantage if they are reinforced by other factors such as technology, skilled human capital, infrastructure, etc. This refers not only to competitiveness regarding minerals, but also to agricultural resources such as fish, which is the main focus of this study. While physical resources played an important role in economies in the past, however, it has now been established that the sustainability of natural resources is temporary (Madeley, 1996). As witnessed by the falling prices of such products as oil and gold, sisal and rubber, economies cannot depend on physical resources alone. Lindert and Pugel (1996) note that by 1986 the relative prices of primary products were about half of what they were in 1900. In addition, from the mid 1950s to 1990 Sub Saharan Africa's share of global exports fell from 3.1 percent to 1.2 percent, a decline which implies an annual export loss to the equivalent of \$65 billion in 1990 (Amjadi *et al.*, 1996).

The fact that natural resources are generally non-renewable might be seen to affect the sustainability of firms that depend on physical resources for their income. Due to development in biotechnology and breakthroughs in microeconomics, computer hardware and software, the products of natural resources, however, today are easily replaced in the market by similar products created by means of new technology, which can be located anywhere in

the world and generate above average rates of return. Rather than secure the market for firms and countries that depend on the physical resources for their wealth, therefore, modern technology has pushed natural resources out of the competitive equation (Clyde, 1994) by reducing the cost of labour and time and increasing productivity (Wangwe, 1995).

Against this background, Brown and Tiffen (1992) report that Africa imported \$400 million worth of fish between 1985 to 1987, while exporting \$725 million worth, which indicates a potential market for fish in Africa. If processors could add value to the fish produced in Africa, they could gain a competitive advantage over external competitors. For this challenge to be met technological improvement and innovation are necessary. Companies that depend on natural resources for their comparative advantage would therefore be in a better position if their main source of income were reinforced by other determinants of success.

2.4.2.2 Infrastructure

According to Porter (1998), to sustain the advantage of cheap and abundant resources, firms need to have a supportive environment with a good infrastructure, skilled labour and the ability to innovate and forecast business opportunities and counter threats. The type, quality and cost of the infrastructure available affect a position of competitiveness. This includes a communication system, transportation, a banking system, the availability of clean water and electricity, and housing. Communication was the driving force for globalization, for example. It is communication that has allowed the Transnational Corporations (TNCs) to decentralise their production process by locating industries in any country where the cost of production is low for that type of production and transporting parts to an assembly factory in another country later (Lipsey and Courant, 1996; Agmon and Drobnick, 1994).

Schwab *et al.*, (1996) has also cite an adequate infrastructure as one of the critical factors that determines the competitiveness of a country. Brown and Tiffen (1992) as well as Porter (1998), add that infrastructure has been one of the key determinants for foreign investment, which in turn promotes competitiveness. The multi-national companies (MNs) are attracted to those countries that offer the best infrastructure. They also prefer countries where their innovative activities will not be interfered with by communication problems. The quality and quantity of the infrastructure of a country therefore not only raises the productivity of the private sector, but makes a country more attractive to foreign direct investment. As a result, private sector involvement in infrastructure has been widely adopted in the East Asia/Pacific region, Western Europe, Latin America and the USA. This involvement has accounted for

95% of the \$450 billion of private infrastructure financed over a 10 year period (Donaldson *et al.*, 1997).

Poor infrastructure is mentioned as a major problem hindering African states in trade (Madeley, 1996). Since the entire power generation, transmission and distribution system is inefficient, for example, Donaldson and others (1997) view the lack of electricity and water in Sub Saharan Africa as an infrastructural problem. They mention that in 1991 only 44% of Southern and Eastern Africa had safe water. With regard to transport, net payments for African services are also higher than those in other developing countries and have increased over the last two decades (Amjadi *et al.*, 1996). As a result, foreign exchange that might have been used for capacity building investments is being used for extra payment of transport services. The problem becomes worse where perishable products, among which fish, are concerned. Any delay in distribution increases cost and consequently price, which limits competitiveness.

As a result, developing economies appear to be receiving a small share of foreign investments (Haque 1995; Maasdorp, 1996). The World Bank private infrastructure project database indicates that from 1985 to 1995 it has financed a total of 1170 privately financed infrastructure projects of which only 17 were located in Southern and East Africa. These were moreover in the form of management contracts, which did not lead to more investment. Since direct investment is one of the primary requirements for technological inflow, the lack of foreign investment further prevents technological innovation in developing countries (Haque, 1995). This shows that the level of competitiveness of firms is determined, not by a single factor, but by a web of factors that are related across the world.

2.4.2.3 Human Resources

Porter (1998) has also positively correlated competitiveness with the availability of skilled labour for production. Without it an organization can fail to use its material, financial and other resources effectively to achieve higher productivity and gain a competitive edge over its competitors (Henry, 1993). Human resource qualities, such as specifically skilled and knowledgeable personnel, provide a more decisive and sustainable base for competitive advantage than a higher percentage of personnel with a general education, even though they may be well motivated (Porter, 1998). The quality of human resource used in a specific task plays a decisive role in the quality of products. Any improvement in the production process or product technology needs to be accompanied by a labour force that has the fundamental skills to utilise such technologies efficiently (Henry, 1993; Wangwe 1995). Haque (1995)

points out that technology consists of bundles of coded tacit information that requires highly skilled human resources that would translate and improve the blueprints into specifications and procedures. Human capital is therefore indispensable for creating and sustaining competitive advantage.

As technology grows more complex, the role of employee training and retraining becomes more important in maintaining competitiveness. In many cases the provision of basic formal education and the maintenance of its quality are accepted as government responsibility (Haque, 1995). However, as the industrial structure develops, companies need to share the responsibility for more advanced and specialised training, especially in technical areas. Balasubramany and Lall (1991) and Haque (1995) propose that government should intervene only where firms under-invest. The government can assist through the provision of training facilities or in securing technical assistance. Firms should be guided in line with planned needs. Firms should also strive to develop higher order advantages through sustained and cumulative investment in physical facilities, human resource development and learning (Wangwe, 1995).

Most small firms in Africa tend to ignore or under-invest in training. Reasons given for under investing include the following:

- the fact that firms cannot legally enforce the workers to remain in their employment after the training period
- financial constraints
- lack of foresight or information
- lack of facilities for provision of training
- the fact that managers are sometimes risk averts (Rothwell and Zegveld, 1982).

What is clear from the description of factor endowment above, is that competitive advantage depends not on a single factor, but on a set of factors and how efficiently they are deployed, as well as on the technology used to mobilise them (Porter, 1998).

2.4.3 Related and Supporting Industries

Another method mentioned by Porter (1998) according to which firms can create a competitive advantage is by innovating (Porter, 1998). As innovation is costly, risky and often disruptive, it requires wide involvement from management, but the advantage is that it can be manifested in product changes, process changes, new approaches to marketing and new forms of distribution. Innovation can therefore simply be described as the process through which technology can be leveraged to attain the goal of competitiveness.

As mentioned above, it is difficult to refer to innovation without mentioning technology and *vice versa*. Technology is an engine of growth. As such, it has an important role in the increase in the share of trade. Technology has, for example, led to a reduction in transportation cost and communication expenses that have been trade barriers. Technology has also increased the range of products, and has made production more efficient. It has also forced industries to look for foreign markets by allowing for the production of large quantities of products that exceed domestic demand.

Rothwell and Zegveld (1982) maintain that innovation, particularly radical innovation, requires the use of qualified engineers and scientists. If enterprises in developing countries are to grow and prosper, their technological capabilities will have to develop, both in scope and in complexity, over time. Balasubramany and Lall (1991) suggest that enterprises should master those technologies that are essential to their efficient operation and growth. At the same time they should buy those capabilities provided more efficiently by specialised agents. As an added incentive, innovators under the Trade Related Aspects of the Intellectual Property Rights (TRIPs) agreement at the General Agreement on Trade and Tariff (GATT) Uruguay 1994, have made provision for innovators to capture the profit of their innovation, which is an additional advantage.

Kumar and Siddhartham (1993) are of the opinion that enterprises in developing countries are unlikely to achieve competitive advantage on the basis of their own technological activities in high technology industries at present. This is due to their inability to compete through product innovation, shorter product life cycles and firm-specific knowledge systems. In addition, few small and medium enterprises (SMEs) commit sufficient funds to technical development or possess formal research and development (R&D) departments. Porter (1998) argues, however, that since much of innovation is incremental, resulting from organisational learning, research and development, rather than radical, SMEs should also attempt innovation.

2.4.4 Demand Conditions

Both size and sophistication of buyers play a key role in creating or sustaining the competitiveness of a firm. These factors motivate firms to meet high standards in terms of product quality, features and service (Porter, 1998). Buyers and consumers provide useful market information which producers may use to improve the product or service offered. One example which is discussed in more detail below with specific reference to Tanzania, is the fact that sophisticated European and US buyers demand uncontaminated food products. Producers have no choice but to use this information to improve the quality of their product.

Benchmarking has also been found to be effective in developed countries such as Japan to improve the standard of a product. The purpose of benchmarking is to elevate standards (Krugman, 1994) in order to make the product more marketable.

In developing countries most regional and local buyers are unsophisticated. They are still attached to the traditional tastes and methods of presentation, which does not encourage innovation and the development of new technology. As a result, it also does not challenge competitors. While enterprises from developing countries do compete in international markets, through price-cutting and focusing on the lower end of markets or by selling to the multinational buyer groups, they are not able to break into new markets. Since breaking into new markets requires resources in marketing research and promotion services and developing countries have no resources to engage in non-price rivalry with multinational enterprises, they fail to compete significantly (Kumar and Siddharthan, 1993).

2.4.5 Firm Strategies, Structure & Rivalry

The fourth set of determinants of competitiveness mentioned by Porter (1998) includes the context in which firms are organised and managed and their relationship with domestic competitors. Due to the differences in the management practices and approaches in areas such as training and orientation of leaders, the strength of individual initiatives, relationships with customers, ability to coordinate across functions and the relationship between labour and management, management systems differ (Porter, 1998). Notwithstanding the various factors in the environment in which managerial decisions are made and the fact that they are constantly changing and unpredictable (Henry, 1993), the long-term success and survival of any organisation is contingent upon the level of competence and effectiveness of its managerial personnel. Firms benefit significantly from skilled management that is capable of making the right decisions and responding to the opportunities found in the market. (Zairi, 1997). Highly skilled management is, for example, responsible for the selection of priority areas of work and staffing, a good combination of which would enhance the competitiveness of any enterprise.

The organisational structure and the relationship between managers and the employees are also important for sustaining the competitive advantage of industries (Porter, 1998). Rigid hierarchical organisations with limited integration between departments and a top-down approach prevent the smooth flow of information, which is recognised as an important factor in success. Firms can only gain a competitive position if they manage the entire business system, including suppliers and distribution channels. Managers who optimise and coordinate the linkages among the activities undertaken by the company gain competitive advantage over

their rivals. High quality management is therefore needed in the private as well as public sector to set clear objectives and formulate policies that achieve customer satisfaction, and consequently improve the level of competitiveness of a company (Anonymous, 1994).

The need for extensive managerial skills originated and developed in economically established countries. Since the inflow of such developments to developing countries depends on trade (see the argument regarding technological development in developing countries above), the level of management in developing countries generally varies with the extent of trade between them and their trading partners. Companies from developed countries could therefore make a significant difference with regard to the development of a more satisfactory comprehensive infrastructure in developing countries.

2.4.6 The Role of Governments

2.4.6.1 Country Policy

The macro- and sector policy environment in which exporting firms operate, influences the decision taken by firms and consequently the competitiveness of enterprises (Wangwe, 1995). The role of government is to improve the quality of the factors that enterprises can draw upon, to support a competitive environment and to develop the rules and institutions that will stimulate innovation and development in enterprises (Anonymous, 1995). This is usually done through increased motivation, incentives and by building the capabilities of enterprises.

The way in which governments can support companies, is by entering into partnership with business. By fully understanding how companies function and which problems they face, by taking into account how its actions affect them and by finding solutions that will enhance competitiveness (Anonymous, 1994), governments are in a position to increase their level of competitiveness significantly. A clear investment policy, with elaborate convertibility and transferability terms, for example, reinforced by a good infrastructure, could lead to an increase in foreign investment, from which learning and technological capability can follow. In turn, government policies can be influenced by factors that determine success in business. For example, an increased demand for education and safety measures could lead to education investments and the enforcement of safety standards.

There are conditions for a successful relationship between governments and business, however. A stable economy is essential for minimising uncertainty and encouraging entrepreneurs to take financial risks inherent in long term investment (Helmsing and Kolstee, 1993; Haque, 1995). Macro-policies and sector policies can therefore help enterprises to

become competitive only when a country is economically and politically stable. Wars and chaotic situations disrupt production operations and directly and instantly reduce competitiveness. Since Africa has been wracked by internal strife for the duration of the century, business has not generally found governments supportive enough.

2.4.6.2 Incentives

Tax concessions have been widely used as an inducement for industrial development, specifically, for example, to establish new industries by foreigners or to encourage the establishment of industries in problem areas. They have become popular in some developing countries.

While incentives have worked well in countries such as Puerto Rico to stimulate trade, however, they have been abused in others, such as the Philippines. Heller and Kauffman (1963) therefore warn that the adoption of tax incentives in one country on the grounds that it has been successful in another, may prove to be insupportable. Without a thorough comparative analysis of the many and unique circumstances in which the incentives have operated, it cannot be inferred that what worked in one country will work in another. Since the setting in a success country may be different from that in the target country, the policy planning may not be applicable. Another criticism of this incentive is that tax incentives drain away revenue that could be invested in education and human capital (Anonymous, 1998). Africa can hardly afford mistakes of this nature.

2.4.6.3 Foreign Policy Environment

Foreign policies can enhance or destroy the competitiveness of a firm, according to Porter (1998).

Despite the agreements reached in international bodies like the General Agreement on Trade and Tariff (GATT), the United Nations Conference on Trade and Development (UNCTAD) and the Lome Convention, tariffs, protectionist policies and standards have been used extensively to protect developed economies (Madeley 1996; Stevens 1983; Frimpong-Ansah *et al.*, 1991). While these bodies aimed to implement significant cuts in tariffs for industrial and agricultural products, they also encouraged free trade from the developing countries. Despite this, the non-trade barriers on food exports from African countries are higher relative to those on manufacturing with the coverage ratio of food being 23% against 5.7% for manufactured goods (Amjadi *et al.*, 1996).

The first United Nations Conference for Trade and Development meeting in 1964 tried to assist developing countries to diversify from primary products to manufacturing products. UNCTAD proposed a General System of Preferential Treatment whereby industrialised countries were requested to lower the tariff applied to manufactured products in order to favour developing countries. As goods, such as processed foods and textiles that were manufactured by developed countries were excluded from tariffication, the move was not practical (Helleiner, 1976). Since higher tariffs were imposed on processed goods than on primary commodities, the plan prevented the growth of processing industries in developing countries, which could not afford to pay the higher rates. (Wangwe, 1995). In addition, those products that were included were subject to quantitative restrictions. An agreement under the Lome Convention of 1975, that African Caribbean Pacific (ACP) countries could sell their manufactured goods and processed agricultural goods to EU countries without any barriers, was not honoured, despite the optimism expressed at the signing of the Convention between the ACP and the EEC.

Developing countries were further discriminated against by the formation of regional and trade arrangements such as the EU, the North Atlantic Free Trade Area (NAFTA) and the Australia-New-Zealand block under the Organization for Economic Cooperation and Development (OECD). These arrangements provide duty-free access for members to each other's markets for most goods and limit access for other countries. Both Stevens (1984) and Wangwe (1995) are of the opinion that this development has affected industry growth and diversification in developing countries, as also indicated by the decline in Africa's market share in world exports from 4.7 per cent in 1975 to 2.0 percent in 1990.

In the last Uruguay Round (1994) it was agreed that quotas and import restrictions have to be converted into tariff equivalent to make the protectionism more transparent (Merican, 1996). Special provision was also made for differential treatment for developing countries and the least developed countries. A significant cut in tariff for agricultural products from the least developed countries was, for example, negotiated. In addition, trade and trade-related policy agreements (TRIPs) were finalised. The outcome of the Uruguay Round was therefore a new optimism regarding the possible increase in trade.

Since fish and fishery products were not discussed, they are still faced with non-trade barriers. However, policy environment has to be reinforced with other determinants to effectively increase performance of the industry and therefore enhance competitiveness. Competitive advantage in an industry rarely results from a single determinant. The determinants reinforce to create a context on which a nation's firms succeed internationally (Porter, 1998).

2.4.7 A System of Determinant Factors

The analysis of factors that determine competitiveness reveals that a comparative advantage is unsustainable if it is based on natural resources alone. However, competitiveness can be achieved if a resource is exploited in a sustainable way and reinforced by other determinants of success. This is true of most other factors. The market has, for example, been a driving force behind innovation, but if firms wish to respond on time, a constant forecast of opportunities and threats is required. In developing countries firms are often financially constrained and incapable of investing in the necessary technology for this purpose. It is therefore not enough that the factors identified by Porter (1998) and others as significant for the development of competitiveness in firms be present. Instead they need to be woven together to form a network of support.

2.5 SUMMARY

In this chapter an attempt was made to describe the development of HACCP as a concept and its application in the food industry. The review covers the development of HACCP, a definition and problems, criticism of the HACCP principles and the supporting programmes. The second section reviews the literature on factors that determine the level of competitiveness of companies in the global market. The literature indicates that, for a firm to create and sustain a competitive position, it is necessary that the factors that promote competitiveness be present, not individually, but as a network of support for the company. The creation and maintenance of such a system of support calls for an integrated effort as well as commitment from the responsible institutions, the industry and governments.

CHAPTER THREE: CONTEXTUALISATION OF THE STUDY

3.1 INTRODUCTION

This chapter provides a brief overview of the factors that influence the Tanzanian fish processing industry in which the research in this study was located. In addition to HACCP, the system of support factors mentioned by Porter (1998) and other writers, which could enhance or limit the fish export trade, are discussed in context. As indicated in Chapter Two, the fact that HACCP directs resources to where they are most needed and saves cost in doing so, together with the support of the factors mentioned, can give producers who apply HACCP an advantage over those who do not. The combination of factors could therefore elevate the competitive position of the fishing industry in Tanzania significantly.

The chapter also describes the choice of methodology of the study in more detail.

3.2 BACKGROUND

As indicated before, the current position of Africa in the world trade market is characterised by a declining share, except for fishery products, which doubled in value in the 1980s with prices rising by over 10% (Brown and Tiffen, 1992). One of the reasons for the decline is that Africa is still confined to the exportation of primary products and the importation of non-primary products (Wangwe 1995; Brown and Tiffen, 1992). The increase in tariff imposed by countries importing from Africa with each additional stage of processing makes it difficult for the continent to get beyond this situation. For example, the EU charges 3% on cocoa beans, 12% on cocoa butter, 15% on cocoa paste and 16 % on cocoa powder and chocolates (Madeley, 1996; Balasubramanyam and Lall, 1991). With this trade pattern, African firms have little or no control over the cost of their exports. Many African countries therefore find themselves exporting only in order to repay their debts (Madeley, 1996).

In addition, protectionist policies have increased to protect local producers in developed countries. The EU has restricted the entry of products that are considered a threat to their own industries. Temporary import barriers have at times been erected at short notice to protect domestic industries that are at risk (Stevens, 1984). The Daily Mail Tanzania (1999/08/23) recently observed, for example, that the EU imposed the ban on Lake Victoria fish because of pressures from the European fishing industry, which sees Nile perch as a threat to its white hake fish catch. Wangwe (1995) also reports that as soon as developing countries progress in

industries, quotas are revised to limit previously favourable market access. The EU has also been known to advocate selectivity in the application of safeguards. Although the final round of the Uruguay agreement resulted in a decision on tariff reduction and transparency in trade, it did not include fish, which limits the benefits to countries that are major exporters of fish and fishery products. It is against this background that Tanzania's wish to become more proactive should be considered.

After independence in 1961, Tanzania opted for a socialist society through its Arusha Declaration in 1967. The public sector was given a full mandate to control the economy. This government intervention in all sectors of the economy undermined the development of private sector through price controls, a restrictive market and policies that reduced the incentives to producers. The government invested in parastatals, which were inefficient and reduced private sector competition. This led to the decline of social services and the economy.

In the early 1980s the country introduced structural adjustment policies, which encouraged private sector participation in the economy. Today the Tanzanian economy is dependent on the agriculture sector. Sixty percent of the GDP comes from the cultivation of crops such as coffee, cotton, tea, tobacco, sisal and cashew nuts. The manufacturing sector is still small. It processes a few ranges of products such as textiles, food and chemicals. In addition, the mining sector has shown good potential from recent discoveries of gold in the lake zone. Tourism has also grown significantly in recent years (Anonymous, 1994). The Nile perch industry was established when the Tanzanian government adopted the structural adjustment policy. A clear and attractive investment policy was given.

Since fishing is a traditional source of wealth, which contributes 6% to the country's GNP, the industry is both socially and economically significant in Tanzania. The Nile perch industry, the exact location of which has been described in Chapter One, was established in the early nineties. Today it forms 75% of the fishing industry and, since it is commercially operated, has created many job opportunities for fishermen and fish collectors in the fish processing plants. On average these factories produce between 20 and 70 tons of fish per day, although the production can go as high as 100 tons when the catch is good. It follows that growth in the fish industry in Tanzania will positively affect its whole economy.

The goal of this study is therefore to evaluate whether the programmes required for export are conducted adequately in the Tanzanian Nile perch industry. If this is not the case, the industry will identify more Critical Control Points (CCPs), which will increase the complexity and the

cost of the plan (Sperber *et al.*, 1998). Worse, importers may again increase their use of standards as barriers to trade.

3.3 ENABLING FACTORS

3.3.1 Factor Endowment

3.3.1.1 Physical Resources

The Nile perch boom can be explained as purely chance, in the sense that when scientists introduced Nile perch to restock the lake in 1950s, it was not foreseen that an industry could be established that would dominate fishery in Lake Victoria. According to Porter (1998) chance events can contribute to the competitive advantage of an industry, but it depends on the capacity of a nation whether such events will be exploited to the advantage of the country.

The Nile perch boom coincided with the diminished stocks from the North Atlantic and North East Asian Pacific fishing industries due to over-fishing. Added to this, was the increase in industrial demand for large-scale international fish meals well as the formation of vertical integrated corporations in the United Soviet Socialist of Russia (USSR), Japan, Korea and Taiwan, whose factory freezing fleets had depleted world fish stocks (Gibbon, 1997). The scarcity of fish created in these ways benefited the Nile perch industry, which could fill the gap immediately, exactly because Lake Victoria had been restocked in time.

This event shows that the government of Tanzania has learnt from the mistakes of others and is taking measures to ensure the sustainability of the Lake Victoria fishery. The Tanzania regulation on the prohibition of the use of specified vessels or tools is one of the measures. In addition, Government Notice Number 370 of 7/10/94 has been enforced to ensure that only non-destructive fishing methods are applied. The Lake Victoria Environmental Management Project (LVEMP) was also launched to rehabilitate the ecosystem of the lake for the benefit of the people, the national economies as well as the global community (World Bank, 1996). The programme is in its first five-year phase (1997 to 2001) of capacity building, information gathering and institution establishment. It is the aim of the project to ensure the continued sustainability of the fish resource in Lake Victoria.

The abundance of natural fishery stock by itself cannot ensure competitiveness in the global market. For a stronger enforcement of regulations, the harmonization of the legislation of the three riparian states is therefore under way (World Bank, 1996). This should lead to a

sustainable exploitation of the resource, which is important if the industry is to remain competitive.

3.3.1.2 Infrastructure

Tanzania is only one of many African countries where the lack of infrastructure has been an obstacle to the attainment of competitiveness in domestic and export markets (Wangwe, 1995; Hansom, 1992). As for every other product, infrastructure is a prerequisite for Nile perch competitiveness in the global market. The quality and safety of the product is highly threatened by long deliveries and delays and worse, if the road is not tarmac sealed, as shaking bruises the product and reduces the quality. The unit cost of the product also increases with increased distribution time.

Tanzanian roads are in poor condition. The network, which consisted of about 54000 kilometers in 1982, of which 6% were paved, had deteriorated down to 50000 kilometers by 1988. The railway network, which consisted of the colonial-built line and the post-independence Tanzania Zambia Railway network built in the 1970s, has deteriorated to such an extent that it cannot handle the existing traffic. The reasons for the under-performance of the Tanzania Railway Corporation include the poor availability and reliability of transport operating equipment (Planning Commission, 1997). As their industrial operations were highly affected, the poor transport network has led to the closure of some factories. The Friendship Textile Mill in Dar es Salaam, for example, had to close down its operation in 1984 due to the irregularity in cotton delivery from the Lake Zone (Marandu, 1995). The transport network has been worsened by the 1997 El-Nino rains and floods, which washed away bridges and submerged portions of rail lines (Planning Commission, 1998). Donaldson *et al.* (1997) report, for example, that, owing to the poor road network, only about half of all diesel locomotives were in use in Kenya and Tanzania in 1993.

Constant power and water supply interruptions were also found to be a serious problem in Tanzania. This has led to the closure of some factories that could not bear the increasing cost of working under their capacity (Wangwe 1995; Helleiner 1994; Marandu, 1995). In the case of Nile perch factories, the unreliability of power and water has forced factories to install standby generators and water purification plants. Since this has led to increased overhead costs, it limits the competitiveness of the industry. In addition, The Guardian Tanzania (1999) has reported that power tariffs in Tanzania are among the highest in the east and within the Southern African Development Community (SADC) countries. Whereas power tariffs in other East African and SADC countries averaged 6\$ cents per unit and below, the Tanzania

Electric Company charges 14\$ cents per unit, making production costs high and decreasing competitiveness in business. While there is some optimism that the discovery of gas fields in Songo-Songo Island off the shore of Dar es Salaam will improve the power situation in the near future (Donaldson *et. al.*, 1997), the investment in capital equipment and fixed capital generally continues to decline in Tanzania (Planning Commission, 1997).

The landing beach infrastructure has also been reported to be in a poor condition. Facilities such as portable water and jetties with proper shade, which are necessary for handling fish hygienically, are lacking (World Bank, 1996). Only the cold storage facilities for processed Nile perch are adequate. This calls for a risk assessment and HACCP plan for the Nile perch industry in Tanzania, rather than the acceptance that the fish industry can be controlled by a quality assurance system.

The Tanzanian government is taking some measures to improve the infrastructure. Reforms under a privatization policy have a positive effect in sectors such as telecommunication. After the government had awarded licenses to private cellular telephone operators, for example, the Planning Commission (1997) noted an improvement in the telecommunication services. The telephone exchange capacity increased by 17% from 155866 lines in 1996 to 182379 lines in 1997 due to the commissioning of two digital exchanges. Generally, however, the infrastructure is inadequate, and restrains the competitiveness of firms in the Nile perch industry.

3.3.1.3 Human Resources

Tanzanian industry is characterised by labour intensive primary production. This trend does not offer a challenging opportunity for creating a specialised base for human resources. The Planning Commission (1998) noted that the type of training given by the technical vocational education centers in Tanzania did not adequately respond to the requirements of the changing job market. After training graduates could neither be employed in the formal economy, nor create their own employment opportunities.

In addition, Tanzania has experienced an economic recession for the past two decades, which contributed to the low human resource capital. Cornia *et al.* (1992) report a reduction in the enrollment for primary schools from 90% in 1982 to 66% in 1988. Along with this, pupil dropouts due to truancy have increased. Rural areas face a shortage of Grade A primary school teachers, desks and textbooks (Planning Commission, 1998). While there has been a slight increase of secondary school enrollment from 205150 in 1996 to 219812 in 1997, the

increase in numbers occurred at the same time as the increasing shortage of educational resources such as laboratories, qualified teachers and staff houses.

The poor learning and teaching environment obstructed the expansion of secondary technical schools. The Planning Commission noted that higher learning institutions in the country have continued to operate at a higher unit cost owing to low enrollment and dependency on the government budget as the main source of financing. The academic teacher student ratio was 1:7 in 1997, which was very low compared to the international accepted standard ratio of 1:12 and that of Sub-Saharan Africa, of 1:10. In addition, the Fisheries Institute that is responsible for teaching specialised courses in fisheries is constrained by the lack of funds. Since government sponsorship was removed from the fisheries institutes in the early nineties, the falling number of graduates led to the cancellation of some specialisation courses. As a result the skills profile of the labour force continued to be skewed relative to that of other Sub-Saharan countries, with possible negative effects on the prospects of industrialisation and export diversification (Cornia *et al.*, 1992).

One positive result is that the policy of the Ministry of Natural Resources and Tourism (1997) has established the need for national training for the fisheries sector and for educational programmes based on assessed needs.

3.3.2 Related and Supporting Industries

Most industries in African developing countries lag behind technologically. Firms are small and do not have the capability to invest in technology. Failure to automate the production process has contributed to the production of inferior products, which cannot meet the demand standards. In addition, most firms in Tanzania are still too small and ill-equipped to make a meaningful expenditure on R&D. However, the government, through the Tanzania Commission of Science and Technology (COSTECH), is coordinating and promoting scientific and technological research in the country by giving grants to local scientists who have shown satisfactory progress in their projects. COSTECH has also implemented a project to establish an information system for science and technology. This should help to disseminate new technological development, which would increase the competitiveness of business. To improve this process, Marandu (1995) suggests that the state, initially, while stimulating R&D activities among industries, mobilises and pools resources before decentralising them to individual firms.

3.3.3 Demand Conditions

Over three-quarters of the Nile perch produced by the fish factories is for European export. As shown above, the commercialisation of Nile perch coincided with a high demand for the product (Gibbon, 1997). The preference of European consumers for white meat over red created a demand and, therefore, an opportunity for Tanzania to export Nile perch.

In Tanzania itself the demand for Nile perch fish is relatively low, compared to other freshwater species such as *Oreochromis niloticus* and *Tilapia sp.* Locals find Nile perch unattractive due to its high oil content. The lack of a reliable infrastructure and conservative habits in food consumption also limit competition and expansion in local trade.

Because changes do occur in both product development and processing technology, Tanzanian producers should try to improve in product development, method of presentation and distribution. Although the Nile perch has established a niche of its own abroad, there is always room for improvement. The Tanzanian market, however, has not been exploited to the full. Firms need to maintain and improve their positions once a market has been captured by forecasting opportunities, facing threats of the new entrants and coping with the rivalry among the existing competitors (Wangwe, 1995). It is suggested in this study that HACCP would give them a competitive advantage over those who do not apply the programme.

3.3.4 Firm Strategies Structure and Rivalry

As companies have local, foreign or joint venture ownership in the Tanzanian Nile perch industry, management is composed of both local and foreign personnel. Most factories started as small family businesses exporting raw iced fillets to Kenya, which lasted until the government banned exportation of raw fish in favour of value added products. After that many foreigners, whose processing factories had been established in Kenya, moved to Tanzania and established fish factories here (Gibbon, 1997). They benefited from the incentive package such as the tax holiday for a five-year period and automatic access to land that was introduced by the government parallel to the adjustment policy and economic reform. The country, in turn, benefited from highly skilled leadership and foreign technical assistance.

Today management personnel from all companies interact through their association known as the Lake Victoria Fish Processors Association (LVFPA). Their competitors are fish exporters at the world market. Meetings are held twice a month to discuss issues related to their markets, the quality of their products, pricing, raw material, etc. Since the small-scale fish processors in Tanzania export sundried and smoked Nile perch to the neighbouring countries of Zaire, Zambia, Burundi, and Rwanda, commercial fish processing in Tanzania is not faced

by any competitors inside the country. Since no official figures of any description have been published on regional or local trade, this is an area for further research. Association with the world market may be blinding management to potential market opportunities on their doorstep.

3.3.5 Role of the Government

3.3.5.1 Country Policy

The Nile perch boom in the early 1990s coincided with the adoption of the structural adjustment policies mentioned earlier (Gibbon, 1997). Tanzania adopted a Structural Adjustment Programme in 1986 after a decade of economic recession. The programme represented a fundamental shift in the basic philosophy of economic management at the national level and encouraged private sector participation, both for local and foreign business. This boosted trade and, consequently, the foreign exchange reserves. The economy responded positively. The availability of external resources increased and non-traditional exports rose. During 1986 to 1992 both the GDP and total exports grew at an average of about 4% a year in constant prices. Inflation declined from a high of 36% in 1984 to slightly above 20%, which resulted in more predictable cash flows for businesses and therefore reduced business risk (Anonymous, 1994).

All the fish processing factories were built after the adoption of the adjustment programme. The sector policy on the establishment of fish factories and trade policy was made clear. The export of raw Nile perch fillets to the neighbouring countries was banned. State-owned parastatals that were incurring losses and being subsidised by the government were reformed. According to Liganga (1999) the Public Sector Reforms Commission has divested a total of 263 out of 395 parastatals since the body became operational six years ago. Emphasis was put on increasing efficiency by selling some shares to the private sector and restructuring. The government developed a clear investment code policy, and established an agency (The Investment Promotion Center) for promoting investment in Tanzania (Tanzania Investment Act, 1997).

Tanzania has therefore embarked on a reform programme to change the approach to the economic development system. The privatisation of state-owned enterprises has stimulated investment. A greater number of investors has increased the credibility of the reform policies, which has in turn led to more foreign investment. One spillover has been the improvement of the infrastructure, which has led to an increase of competitiveness. Despite the progress, the economy faces considerable difficulties with regard to poverty, a rapid increase of the

population, the breakdown of infrastructure and an increased number of refugees from the neighbouring countries of Rwanda and Burundi (Anonymous, 1994).

Further to the liberalising policies, trade liberalisation was introduced in the 1980s. This stimulated firms to build capabilities to cope with the new situation. The policy also adopted a market-determined exchanged rate and the removal of quantitative restrictions on many tradable goods (Wangwe, 1995). Although this exchange rate tends to be unfavourable in the short term, because it raises the cost of imported machinery and intermediate goods, it has been favourable in the long term. Devaluation has stimulated expansion in tradable sectors. It has also increased competition from imported goods, forcing firms to search for new markets, which, in turn, has stimulated growth.

3.3.5.2 Incentives

Tanzania has a clear investment policy and has established a body that grants certificates of incentives under the authority conferred upon it by part 3, section 17 (1-8) of the Tanzania Investment Act 1997. Tax incentives in Tanzania, are applicable in the lead sectors such as mining, petroleum and some priority areas such as the natural resource sector (The Tanzania Investment Act, 1997). The incentive for priority sectors includes:

- a reasonable corporate tax of 30%
- a low withholding tax rate on dividends (10%)
- a low loan interest (0%)
- the right to transfer capital and 100% of the profit gained to other countries
- a straight line accelerated depreciation allowance on capital goods and a reduced import tariff on project capital items
- automatic access and leases on land for foreign investors (Gibbon 1997; Wangwe 1995).

Wangwe (1995) and Frimpong-Ansah *et al.* (1991) report that the export scheme offered to firms by the government, according to which they could keep export earnings outside of Tanzania in order to pay for imports, was effective. It certainly made it easier to import the required goods. However, they also noted that the lengthy bureaucratic procedures for licensing and the many institutions involved in export documentation put investors off, since they imposed extra cost on exporters. Perishable products such as fish were more vulnerable to such delays than any other product (Wangwe, 1995).

Given the problems mentioned above, the Tanzanian government will have to assess whether to give tax incentives to industries to increase competitiveness or whether to use the available

taxes to invest in the infrastructure. A marriage of the two would probably be most profitable in the long run.

3.3.5.3 Foreign Policy Environment

Almost all Nile perch handled by the factories is exported to the European Union market and the USA, in chilled state or as frozen fillets. The sophisticated consumers in these countries have recently become more conscious of the need for safety measures in food processing plants to prevent food-borne illness. They are also aware that “in global food trade, pesticides banned in one country may enter the food chain from abroad” (Archer, 1990). As a result HACCP has been endorsed by many regulatory agencies and is increasingly being required by fish importers.

The national fisheries regulation, which was harmonised with EU Directive 91/493/EEC of July 22, 1991 and according to which Tanzanian fish processing factories have been processing Nile perch, emphasises the testing of the final product rather than of the processing procedure. Because a threat of pathogens has accompanied the increase in production of perch in Tanzania, neither the quality nor the safety of the product has been considered satisfactory (Goulding, 1997). Additional safety restrictions have therefore been imposed on Tanzanian fish. Directive 97/274/EEC of April 4, 1997 prescribes specific measures for fishery products from Tanzania. According to this directive, members are required to use a suitable sampling plan to subject each consignment of Nile perch imported to the EU to a test for the presence of *Salmonellae*.

The EU directives have not been the only standards with which Tanzanian fish exporters have been forced to comply. The USA Food and Drug Act, which is based on HACCP, and the Quality Management Programme (QMP) of the Canadian Food Inspection Agency have also set requirements to ensure the safety of fish products (Sperber *et al.* 1998; Corlett 1998; FAO 1994). The new HACCP regulations for seafood, meat and poultry in the United States, for example, require that every processor producing seafood for the US market conduct a hazard analysis to determine whether food safety hazards are likely to occur. Where HACCP is not required, the Standard Sanitation Operating Procedures (SSOPs) must be applied and adhered to (De Beer and McLachlan, 1998).

Frimpong-Ansah *et al.* (1991) has recommended that efforts should be made to estimate the level of protection afforded by the newly formed World Trade Organisation. The WTO has recommended that members base their sanitary measures on the international standard guidelines, but has also suggested that an equivalent standard be accepted from the exporting

country if a member objectively demonstrates measures taken to ensure safety. The problem with this recommendation is the fact that nations may use this as a non-tariff barrier.

3.3.6 The System of Determinant Factors in Tanzania

Both country and foreign policy environments can positively or negatively affect competitiveness of the industry. While the Nile perch fish industry in Tanzania coincided with an increased demand of the product and favourable country policy, the industry has suffered from the protective foreign policy. On account of the omission of fish and the fishery products from the finalised GATT Uruguay Round agreement, for example, the trend is likely to continue. The agreement to cut tariffs significantly, become more transparent, remove protective policies and favour the Least Developed Countries (LDCs) with regard to their agricultural products did not apply to the fish industry.

In addition, the Tanzanian fish industry has been severely affected by the added restrictions. Since it is expensive to implement different sets of standards required by different countries, there is little hope of external relief in the near future.

It is clear from the analysis of conditions in Tanzania, that export industries are not strongly supported by factors that determine competitiveness. Even if the application of HACCP bears hope for improvement in the fish industry, therefore, this network of support will have to be extended if the government and supporting institutions are committed to an improved economy.

3.4 CONCLUSION

As shown above, the Tanzanian fish industry is constrained by the inadequacy of the supporting factors mentioned in the literature as indispensable for the development of competitiveness. This not only shows that Porter's theory has substance, but that many of the factors mentioned are not present in Tanzania, as in other developing countries, and that, where they are, they do not generally form a support system on which companies can depend. Since established countries further seem to discriminate systematically against developing countries in their attempt to protect their own interests, it appears that special efforts are needed to help developing countries to establish sustainable industries.

What has also been shown in this chapter, is that, unless the Tanzanian government and other relevant institutions support the Nile perch industry by improving the infrastructure on which business depends in the country, the fish industry is not likely to develop into a major international industry, as hoped. In the next chapter the methodology for the field evaluation

is described and the fish factories are evaluated for their compliance with international standards, while Chapter 5 considers what the industry itself can do to improve competitiveness.

CHAPTER FOUR: METHODOLOGY

4.1 INTRODUCTION

Field research is a comprehensive strategy for data collection. Nachmias (1987) defines field research as “the study of people acting in the natural courses of their daily lives”. The research was conducted in the seven fish factories which were found to be operational. The Fisheries Division had closed down two factories on account of the fact that they had not complied with factory hygiene conditions. Bailey (1990) indicates that the correct size for the sample is dependent upon the nature of the population of the study. For a small population, 100% is desirable. In this study all seven factories (100 %) in Mwanza were evaluated. The information collected from the seven factories is therefore of great value to the industry.

Since the information on the implementation of each prerequisite factor is interwoven with information on others, and only examples of behaviour that represents each factor were studied, the factors have been grouped together for the purpose of reporting results. Owing to time constraints, the premises of only three factories were assessed. In order to contextualise the study in more detail, the physical features of these selected factories are described and evaluated in the second section of this chapter, while other results of the field study are discussed in Chapter 5.

4.2 THE FIELD STUDY

4.2.1 OBJECTIVES OF THE FIELD STUDY

Detailed objectives of the field study are as follows:

- Audit the factory buildings, both interior and exterior, check whether access is controlled as required, examine laboratories, equipment and utensils, check adequacy of waste water disposal, plant layout and check product flow as specified in the checklist (Appendix 2,3 & 4).
- Awareness of Managers and Training of Employees
- Receiving, storage and transportation: To assess the handling and preservation of fish by both the fish suppliers and factory workers, for which purpose the following factors will be probed:

- Ice supply and the icing practice
- Fish transportation
- Freezer store capacities and temperatures
- Sanitation, pest control and water safety
- Choice of suppliers
- Evaluate the level of training of the shop-floor workers and factors related to personnel as specified in Appendix 3
- Identify the institutional and social support related to the fish processing factories
- Evaluate the infrastructure, facilities and hygiene conditions of the landing sites.

4.2.2 JUSTIFICATION FOR SELECTION OF METHODS

The goal of this research was to evaluate HACCP in the context of the fishing industry in Tanzania, more specifically, the Nile Perch industry in Mwanza. In order to do so, both qualitative and quantitative methods were used to gather information from the fish processing industry. This choice of approach is supported by Patton (1990) and Babbie (1995), who strongly believe that a variety of data collection techniques and design approaches may be used together to contribute to methodological rigor. Mouton (1996) and Neuman (1997) also support the application of multiple methods and techniques to improve the quality of research. A qualitative approach was used in the research, also because of the flexibility it allows for gaining understanding of attitudes, behaviour and social processes over time.

In order to achieve the goal, the prerequisite programmes applied in the fish processing factories in Tanzania needed to be understood. A holistic approach, which assumes that the description of the context of a programme is essential for understanding a programme (Patton 1980), was used. In line with Gharajedaghi's (1985) insistence that a system as a whole cannot be understood by the analysis of separate parts only, the fish industry was observed from several viewpoints. Employees, managers, fish suppliers and officials were therefore interviewed. A detailed checklist is added to this scenario.

Fielding *et al.* (1991), De Vaus (1996) and Neuman (1997) share the view that the intention of descriptive research is to gain insight into a human phenomenon or situation. The social, economical, political, institutional and technological factors, which negatively or positively affect the fish industry, were thus probed in a questionnaire. In order to gain the most comprehensive picture of the context in which the principles of HACCP are applied in the Nile perch industry in Tanzania, the first section of the questionnaire sought to provide a

description of the prerequisite programme. This method helped the researcher to understand the day to day activities of the fish factories.

Not all prerequisite programmes were evaluated. Since the programmes are arranged to suit the needs of a given plant, programmes are rearranged depending on the individual activities of plants (Sperber *et al.*, 1998). Those programmes that were evaluated, were selected on the basis of their applicability to the industry in Tanzania.

4.2.3 DATA COLLECTION

The following tools were used in the data collection process:

- A semi-structured questionnaire;
- Qualitative interviews;
- Document study;
- Direct observation and field notes;
- Photographs that were taken to reveal product handling and personnel at work
- Schematic drawings of the factories' layout.

Five days were spent in each factory for evaluation and data collection. The following techniques were used:

4.2.3.1 Questionnaires and Structured Interviews for Managers

A semi-structured questionnaire was used to obtain detailed information during interviews with one of the members of the management staff in each factory (Appendix 1). Since an element of resistance was expected from companies, a covering letter from the Department of Fisheries, which explained and justified the purpose and relevance of the study, was distributed prior to interviews. This helped the researcher to gain access to the factories. In addition, an official from Nyegezi Freshwater Fisheries Institute Laboratory, who is a competent authority on products from the Lake Zone, introduced the researcher to all the factory managers, and explained the purpose of the visit.

Bailey (1982) notes that respondents might give erroneous information or fail altogether to answer questions if they feel that the information will be used against them, or that it is an invasion of their privacy. The questionnaire was therefore carefully designed to omit sensitive questions, without losing content reliability and validity. Factory auditing was done

against the identified prerequisite programmes in fish processing plants and personnel standards evaluated (Appendix 2 & 3). In addition, to obtain a comprehensive picture of the system, and meaningful results, transportation and the handling of raw material was also evaluated.

The questionnaire was drawn up for management to gather information on ice and production capacity, the availability of a quality policy statement, sanitation and training programme (Appendix 2) and implementation of the prerequisite programmes, which include the SSOPs. Respondents were interviewed and filled out the questionnaire in the presence of the researcher, who provided clarity on questionnaire items. All respondents were hesitant to answer the question of annual turnover until the assurance was given that the data would be treated confidentially. This was in accordance with Yates' reports (1981) that accurate information could only be obtained if full and willing co-operation was obtained. In technical surveys of agriculture involving interviews with farmers, the percentage of deliberate non-responses is small, unless the amount of information required places too heavy a burden on the respondents (Yates, 1981). A great deal of care was therefore taken to set the respondents at ease.

Bless and Higson-Smith (1995) observe that primary data are more adequate than secondary data. The questionnaire, which is semi-structured, aimed at gathering primary data. Great care was taken with the formulation, content and design of questions to gain an in-depth understanding of the programmes evaluated. The questionnaire and the checklists were given to an independent evaluator for critical content validity assessment. In line with Yates's (1981) insistence that careful attention should be given to the detailed design of the various forms used in the course of research, attention was paid to the wording, both of the questionnaires and of the explanatory notes, so that respondents would clearly understand what was required.

Bailey (1982) recommends open-ended questions whenever accuracy, detail and exhaustiveness are more important than time or the simplicity of coding and data processing. Although most of the questions were open-ended, the questionnaire also contained closed questions (Appendix 1).

Yates (1981) is of the opinion that the first trial could serve to determine whether the questions are in the form most suitable for eliciting the required information from respondents. As a preliminary trial, the questionnaire was therefore given to three co-workers from the Fisheries Division and a quality manager in one of the fish factories. This revealed unexpected duplication and difficulties that were rectified.

4.2.3.2 Qualitative Interviews

Seidman (1998) states that qualitative interview helps to understand the meaning and experiences made by interviewee. It helps to understand their action and put behaviour in context.

In the field study data obtained from qualitative interviews supplemented the data gathered by means of the questionnaire. The interviews were conducted with staff from the headquarters of the Department of Fisheries, officers from Mwanza Fisheries Regional Office, members of the Nyegezi Freshwater Fisheries Institute and officials of the Tanzania Investment Center processing workers and suppliers. Social, economic, institutional and technical information was gathered in order to explore all the major factors that could negatively or positively affect the fish processing industry system.

4.2.3.3 Survey of Literature

The information gathered in the qualitative interviews was supplemented by a survey of the literature at the Investment Promotion Centre, Bureau of Statistics, Fisheries Department and the Bank of Tanzania. This provided the researcher with economic and export data, information on incentives, infrastructure and data on training, personnel development and quality control, which could confirm or negate the information supplied by respondents to the questionnaire.

4.2.3.4 Document Study

As part of the assessment of the factory, a document study was undertaken. Since document analysis provides a hint with regard to items that may have been overlooked by the researcher (Patton, 1990), access to each factory's programme document on quality, pests, training, organisation charts and sanitation manuals was negotiated when the researcher was introduced to management. Documents on the quality policy, sanitation manual, training programme and pest control manual were checked to verify their applicability and used to counter-check some questionnaire items, which required the confirmation and evaluation of programmes.

4.2.3.5 Observation and Field Notes

What was stated in the documents was monitored. Auditing of the factory infrastructure and personnel hygiene was done against a checklist throughout the time spent in factories (Appendices 2 and 3). Pest bait locations were counter-checked as described in each factory pest control manual (Appendix 2). In addition, the researcher inspected the jetties and observed the practice of off-loading fish from the collection boats to the trucks.

Observation is one of the fundamental techniques relied on by the qualitative researcher for gathering information (Marshall and Rossman, 1989). Because Bailey (1982) cautions that the presence of an outsider/observer can disrupt or slow down the daily routine of work activities and can damage morale if employees think that the observer is a management spy, special attention was paid to this factor. It was established that in Mwanza employees are used to being visited regularly by Fisheries Department personnel. The presence of the researcher was therefore not perceived to be an interruption, and copious field notes could be taken.

Nachmias (1987) points out that observation enables the collection of first hand data which is uncontaminated by factors standing between the investigator and the object of the research. The researcher therefore did many *in loco* evaluations. In this study data gathered during the observation was used to interpret findings obtained from the questionnaire.

Personnel hygiene was observed three times a day (morning, afternoon and evening) in three factories for three consecutive days (Appendix 3). Behaviour of workers that contravened the work ethics was recorded during the observation. By watching, the researcher could assess the housekeeping behaviour of the shop-floor workers, such as general cleaning, the washing of hands, how objects were picked up from the floor, etc. This notion is supported by Patton (1990) who argues that, by watching patterns of behaviour and describing what people are doing in different situations, the evaluator-observer will be able to isolate those behaviours that have particular significance in particular programme settings.

Many landing beaches are located on the offshore islands, which requires special travelling arrangements. Due to time, financial and transportation constraints, therefore, only two landing beaches (Nyamikoma and Mwaloni) were assessed by direct observation of beach conditions and compared to the national standards (MNRT, 1998).

4.2.3.6 Photography

As Marshall and Rossman (1989) are of the opinion that film is valuable for discovery and validation of the information, some data was captured on photographic film. Photographing was allowed after confirmation that the photographs were for academic purposes only. Permission was given to take photographs only inside the buildings and only of the processing flow. The photographs show methods of transport, handling procedure and the hygienic standards of personnel.

4.2.3.7 Schematic Drawings

To determine whether the layout conforms to required standards as recommended by Chestworth (1997) and Forsythe and Hayes (1998), schematic drawings of the factory layout were made for the three factories (Appendix 4) and checked against official designs.

4.3 DATA HANDLING

According to Patton (1990), the rigor of qualitative analysis depends on the presentation of solid descriptive data. The data from the questionnaire, observation and other collection methods were therefore carefully entered onto a spreadsheet for the purpose of statistical analysis. A comparative analysis was done by grouping together answers to each interviewed question from different respondents. Similarities and differences were noted and measurements of frequencies and percentages were calculated. Tables and graphs were drawn from the categorized data followed by the description of the data.

4.4 LIMITATIONS OF THE STUDY

- 4.4.1 The time for investigating each factory was very short. Only four to five days were available for this purpose.
- 4.4.2 Two factories were closed down during the study, which decreased the population.
- 4.4.3 On account of the distance of the beaches from the factories, only two beaches were evaluated. A thorough evaluation could therefore not be made of the infrastructure of the landing beaches and the handling practices on the sites.
- 4.4.4 The use of the semi-structured questionnaire limited the collection of some information, which would have been useful to the study. According to Bless and Higson-Smith (1995), unstructured interviews might have resulted in a more detailed and extensive list of reasons.

4.5 ATTITUDE OF RESPONDENTS

Generally all the respondents were very cooperative and responded to most questions, especially when they established that the researcher, apart from being a student from the University of Stellenbosch, also worked with the Fisheries Department. This added credibility to the survey.

4.6 QUALITATIVE FACTORY AUDIT

To contextualise the study in more detail, this section provides the first results of the field study, which were obtained through the checklist on Sanitation Standards Operating Procedures (Appendix 2). The items were rated from A to C, where a score of A stood for excellent, B stood for a serious deficiency and C stood for an unacceptable situation which needs immediate corrective action. The results are from the three factories that were randomly chosen, except for the waste water practice; this finding is applicable to the seven factories.

4.6.1 Building Exterior and Interior

Two of the three factories visited were located in buildings not originally designed for processing fish. They have been modified for this purpose as revealed in Appendix 4. This finding is consistent with that of Goulding (1997), who reports that most of the processing factories meet the standard design and construction criteria as specified in the European market Directive 91/493/EEC. All factories have installed water purification plants and power generators to cope with the erratic power cuts.

Tight-fitting automatically operated self-closing double doors are appropriate in food factories, especially in toilets (Forsythe & Hayes, 1998). The evaluation revealed that one of the three factories had fewer toilets than those stipulated by the FAO (1983) for the number of personnel. The toilets had no hand dryers or disposable paper. All factories had glass doors that were not self-closing. Door handles posed a risk in fish factories as hands are considered to be a threat of cross contamination if not cleaned and sanitized.

4.6.2 Controlled Access

Access to the production factories was well controlled. No irregularity was noted in these areas. Only fish processing workers were allowed in the processing hall. The workers had to take a shower before entering the processing areas. Workers were provided with lockers that were used to store their home clothes and items that were not allowed in the fish plants. Footbaths and hand dips were put in all the entrances to prevent contamination.

4.6.3 Laboratories

One of the three factories evaluated had no laboratory. Another was expanding its laboratory. Both laboratories had trained and competent staff. Samples of the finished products and raw materials were tested microbiologically. Swabs were also taken at various points to check the

effectiveness of sanitation by the two factories. Microbiological tests were done as recommended by the EU standards on total plate counts, total coliforms, staphylococcus, *E. Coli*, *Vibrio cholera* and *Salmonella*. Water samples were taken from the processing hall, hand dips, melted ice, reserve tanks and from the utensils. Additional samples were taken from the whole fish washing containers, fillets containers and foot dips.

4.6.4 Equipment and Utensils for Sanitation

The hand washing facilities were not adequate in all the factories evaluated. Hot water taps and hand dryers were not available. Hot water supply for cleaning at the end of the day was available in two of the three factories only. However, all the equipment was made of stainless steel and hard plastic that was easy to clean and sanitise. Utensils and the equipment used were cleaned and sanitised well at the end of each shift. Machine rooms were clearly separated from the processing halls to prevent cross contamination.

4.6.5 Waste Disposal

Responses on how a factory disposed of its liquid waste are reflected in Table 4.1 below.

Waste water disposal system	Response
Effluent semi-treatment by oxidation ponds	4
Municipal collection	2
Effluents pumped to textile factory for further treatment	1

Table 4.1 Different Systems used for Waste Water Disposal in Fish Factories

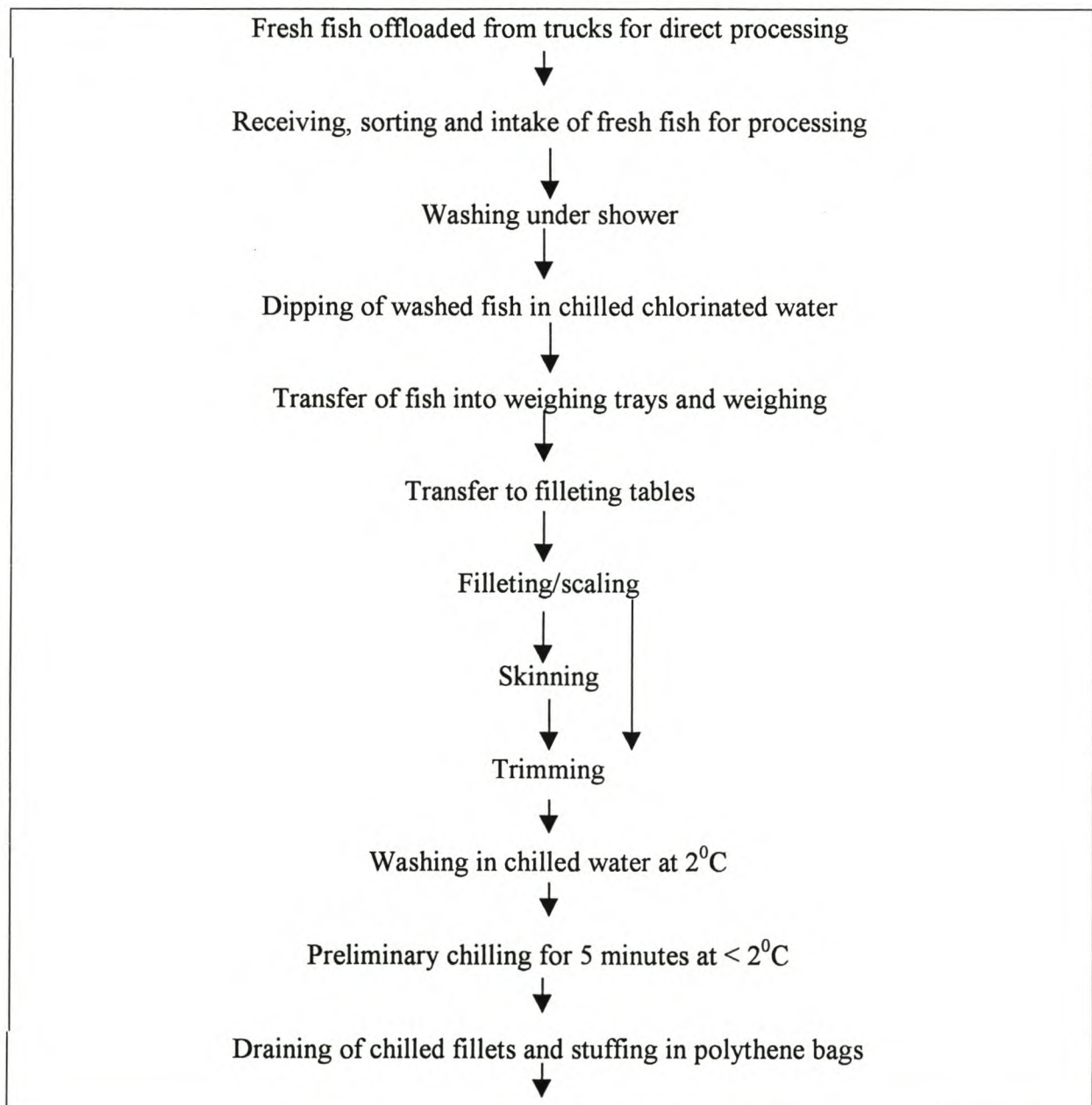
All seven factories had a common problem of handling waste water. The factories had few oxidation ponds, which semi-treated the water before it was allowed to be discharged into the lake. One factory had its waste water pipe connected to a nearby textile factory which was connected to the municipal collection pipe. Municipal trucks collected waste water from two factories. The investigation revealed that wastewater produced surpassed the capacity of the collection trucks. The waste water disposal system was not considered when the factories were built, probably because most of the factories were transformed from warehouses and do not have sufficient space around the buildings for the construction of waste water purification plants. However, even the factories that were built for fish processing did not have effective and efficient mechanisms. The World Bank (1996) reports that the Municipality lacks both personnel and equipment, which results in overloading of the treatment plant. It is evident that untreated waste water ends up in the lake, from the fact that most of the factories are

located less than 100 meters from the lakeshore. Solid waste was collected and transported to a burial site by the factory trucks on a daily basis.

4.6.6 Product and Product Flow

All factories produce either “skin on” or “skin off” frozen Nile perch fillets of sizes varying between 300 and 1500 gram, depending on the market. These were transported in refrigerated containers by road and rail to Dar es Salaam port from where they were shipped to Europe. Some factories also produced Nile perch fillets of between 1 and 2 kilograms in chilled state. Chilled products were airlifted by chartered cargo flights twice per week to the European markets.

The product flow for both frozen and chilled fish that was traced and examined on site conformed to international standards (Figure 4.1 and 4.2).



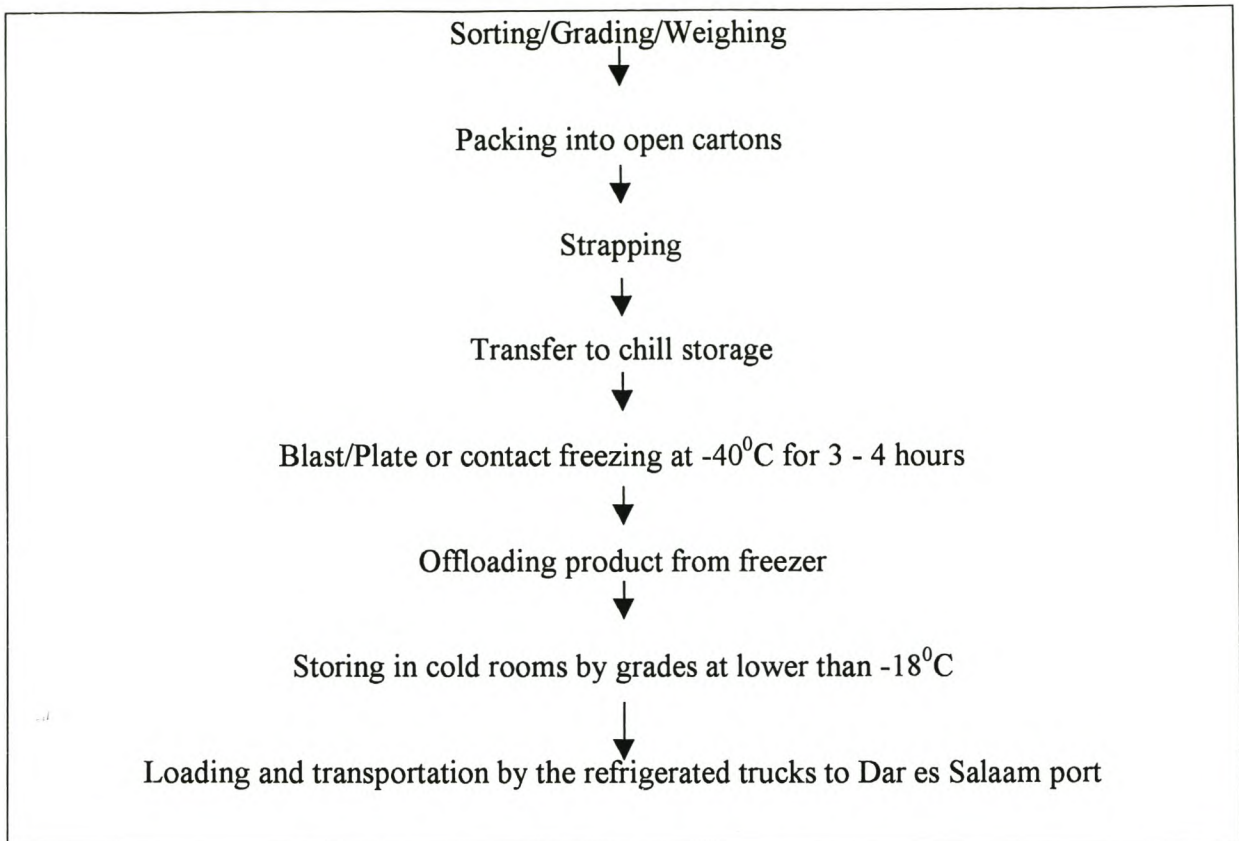


Figure 4.1 Product Flow for Frozen Fillets

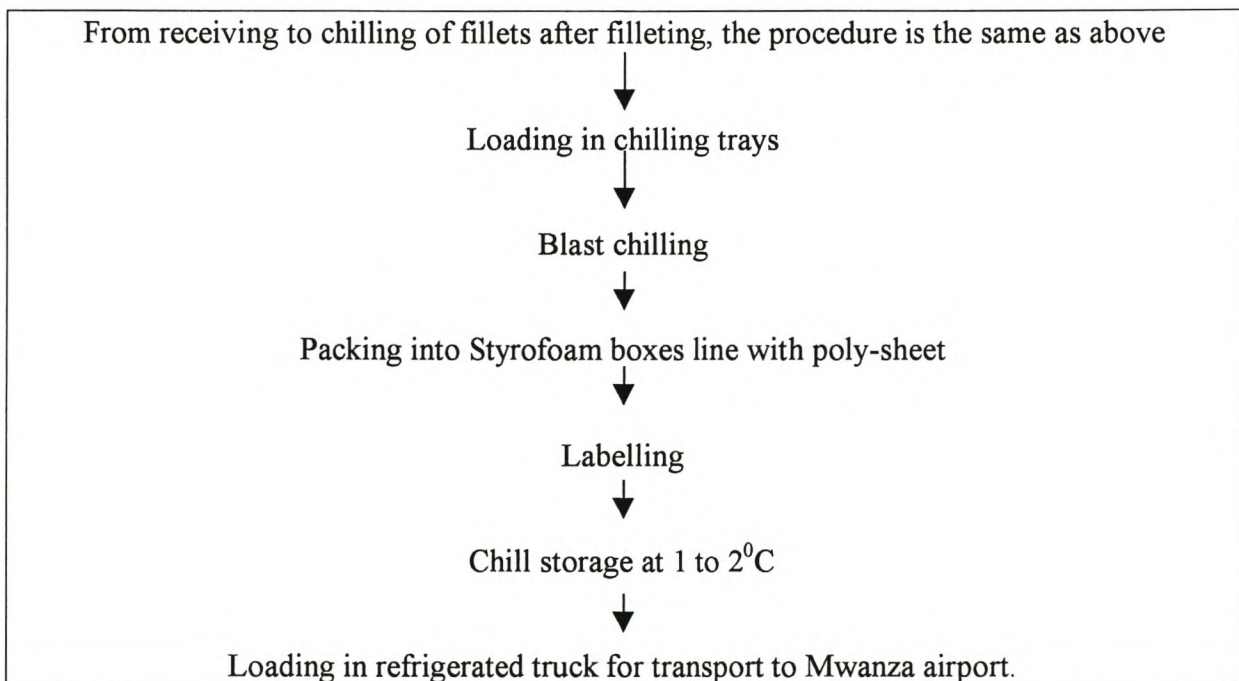


Figure 4.2 Product Flow of Chilled Fillets

4.7 CONCLUSION

The rest of the results of the field study are reported in Chapter 5.

CHAPTER FIVE: ANALYSIS AND PRESENTATION OF DATA

5.1 INTRODUCTION

The broad objective of the study was to evaluate compliance of the Nile perch fish processing plants with the prerequisite programmes whose aim are to ensure that sanitation is observed and the fish produced through the application of HACCP principles in Tanzania is safe for export. For this purpose the factories were evaluated (see previous chapter) with regard to their physical infrastructure. This chapter adds to the analysis in the second section of Chapter 4, by providing responses to the questionnaire, which was administered at the seven fish processing plants, information based on the document study done in the factories, results from observation and further information from the qualitative analysis and photographs.

5.2 MANAGEMENT AWARENESS TO HACCP PRINCIPLES

5.2.1. Awareness of Managers

As described in Chapter 2, the HACCP system is designed to control hazards by monitoring that the production is within the identified critical limits. Deviation or failures of the programme may, however, occur, in which case potential health hazards can be prevented if the production system can be brought back to a safe control. After the destruction of the product, corrective action and a review of the programme are necessary to prevent further product contamination.

Part of the questionnaire was therefore aimed at assessing management's awareness of HACCP principles. They were asked which measures they would take when a product was declared unfit, and had to be recalled from the market on the assumption that a deviation had occurred. Six out of the seven respondents said they "would only destroy the product", while only one said he would "[d]estroy the product, stop further processing, take corrective actions, review Good Manufacturing Practice, SSOPs and HACCP."

It is therefore clear that managers also need to be trained in HACCP.

5.2.2 Measures for Non-reoccurrence and Non-adherence

When asked which measures they would take to prevent the reoccurrence of deviation from the programme, the response was: "We would review the SSOPs, CCPs, HACCP plan and reinforce training". On measures that would be taken when HACCP had not been adhered to, six out of seven respondents said they would take corrective action. One respondent

misunderstood the question. The general impression gained from personal interviews is that the managers are aware of the HACCP programme although the HACCP principles were not clear. This could lead to inefficient action in case of a process deviation that would necessitate recalling of the unfit product.

5.2.3 Training of Employees

The responses to the question “How frequently do you train your employees regarding food safety and quality related issues?” indicated that four out of the seven factories trained their employees every three months. The other three provided training in less than three months, every six months, three times a week at in-plant seminars, or if there was an urgent issue to be addressed. These responses were not correlated with the field observation and programme study evaluation. However, three factories had brief summaries of a training programme and subjects that had been covered by the personnel only since 1997. The rest had no training manuals or any documentation on training. One respondent admitted that they were still to start compiling the training programme manual. Training was not conducted on any of the five days during which the researcher audited the factory that said that it trained workers three times per week.

The investigation revealed that most factories did not offer training for production workers as scheduled, arguing that the long working hours of 10 or more prevented training. This provides a reason for the fact that production workers, who are the key players in the factories, have not received any on the job training in matters of sanitation and hygiene. Personal observation revealed that, owing to lack of training, close supervising of the employees was necessary. Production managers, quality managers, and the line supervisors were therefore supervising the production workers on a full-time basis. The researcher observed that the workers had to be reminded to do some basic activities such as changing cleaning water, cleaning the floor, and changing the water in the dip. Qualitative interviews with the processing workers confirmed that no training was provided.

The investigation also revealed that no training on better practices of fish preservation, transportation and handling had been conducted for fishermen and fish suppliers in matters pertaining to preservation and handling during transportation. This should be seen against the background that suppliers would like to receive training. When asked what support they expected from the government, some of the respondents replied that they wanted “a mass training programme for fishermen and handlers at the beach”. Qualitative interviews with suppliers confirmed that, in this regard, also no training was done.

The only training that was reported was the training that production and quality managers received on the application of quality principles to food safety and on quality management and implementation of International Standard Organization 9000 in 1997. This was funded by the United Nations Industrial Development Organization (UNIDO) and organised by the Tanzania Bureau of Standards. Supervisors had also received basic training on sanitation and hygiene.

Since training is a crucial aspect of HACCP implementation, these results show that management has not given their full support to the issue of training, which confirms the lack of commitment to and understanding of the HACCP concept.

5.2.4 Quality Policy

Although HACCP is based on the prevention of hazards rather than on quality control, the researcher wanted to obtain some information on how companies viewed the issue of quality. A safe and high quality product would find a niche of its own, and would have a differential competitive advantage at the market place.

Responses to the question, “Do you have a quality policy?”, as well as the document study, revealed that two out of the seven factories had not written a quality policy. Of the five, two indicated that the management committee had formulated the policy, the other two had their policies formulated by the managing directors, and one factory had its policy written by the managing director and the quality manager.

The researcher was further interested in knowing whether there was representation from other departments when issues of sanitation were discussed, since HACCP programme has to be understood and owned by the whole company, as described in Chapter 2. The results indicated that four companies had full representation, while in three only some other departments were represented (Table 5.1). The result did not match the responses (above) that revealed that only two companies had a fully representative management committee for the formulation of the quality policy. It appears that the respondents may have wanted to please the researcher or tried to be politically correct. Participating in the formulation of the policy would improve the manager’s awareness of the company’s objectives.

Representation	Response
Fully	4
Partial	3

Table 5.1 Number of Factories with Full Representation from Other Sections

Responses to the question, “How is the policy communicated?” indicated that, out of the five, three factories communicated through training and one through in-plant seminars, while the other said that the policy was displayed in the factory area and in regular meetings with personnel. However, no quality policy could be found displayed in the factory. Since training was not conducted at shop-floor level and because two factories did not have any policy there is serious doubt as to whether the management understood the effectiveness of policy communication. It appears that, although companies have documented their quality policies well, the message does not reach the key players, as there is no effective communication system.

It can be generalized that, although companies had spelled out objectives, only a few of the companies understood the value of a teamwork approach in policy formulation. The majority consisted of distinctive and divided tasks. In addition, there is little representation of members from other departments regarding matters of quality and safety. These results also show that the management is not conversant with the principles of HACCP.

5.3 CATCH PRESERVATION

5.3.1 Fishing and Transportation

As noted before, the fishing of Nile perch is done by small-scale fishermen who are either employed by companies or fishing privately. Four of the factories that were involved in the study owned the fishing boats (See Table 5.2 for a distribution), but they bought additional fish from the small fish suppliers. Three factories did not operate their own fishing boats. Instead, they bought their raw materials from the fishermen or depended on suppliers or both. The fishing boats belonging to the factories varied in number between 5 to 260. The fishing boat capacity was from 3 – 20 tons. Most of the fishing was done at night by using gill netting or long-lining methods which were set overnight.

Operate boats	Response	%
Yes	4	57.14%
No	3	42.86%

Table 5.2 Number of Factories Operating Fishing Boats

Collection of fish was mostly done during the day. The average time taken from the fishing grounds to the landing site was between 4 to 6 hours depending on the distance covered and the speed of the boat. All the catch was landed at the landing sites that were scattered in various small islands where fish collectors were based. The fish collectors did the icing after

weighing the fish. It was the responsibility of the fish collectors to adequately preserve the catch and ensure that the product was safe and fresh before it entered the factory. Various means of transportation were used, as revealed in Table 5.3.

Means of transporting fish	Responses
Insulated trucks	7
Boats with insulated containers	7
Fiber glass boats	1
Pickups with insulated containers	2
Refrigerated vans	2

Table 5.3 Types of Transporting used in Fish Collection

All seven factories used wooden boats to transport fish from the islands to the factory. In addition, one factory had a fibreglass boat. The factories had between 5 and 55 collection boats. All factories used insulated trucks to transport fish from their jetties to the receiving area. Two factories used refrigerated vans and pickup trucks to collect fish from the landing sites that were accessible by road.

Direct observation at the jetties revealed, however, that the boxing recommended by Burgess and FAO (See Chapter 2 Paragraph 2.5.3) could not be practiced. Fish was partially iced in the insulated containers that were more than one cubic meter in size. The size of the boxes resulted in the bottom fish being squashed by the weight of the fish and ice from the upper layers. Fish was offloaded by hand from the fish hold to the insulated truck, and taken straight to the processing receiving area. Fish transported in the insulated trucks and vans normally lay on the truck floor, as depicted in Plate 5.1.

In summary, it can be stated that the small-sized boats used affected the method of transporting and the quality of preserving fish. The traditional boats do not have enough space to carry ice and fish in stacked boxes. It is evident that better preservation methods and handling were not practiced during transportation, as depicted in Plate 5.1. Fish transportation has to have better handling and preservation methods to assure the safety of a product. The finding is consistent with Hall's 1997 report, in which he noted that, in developing countries fresh fish transportation is often carried out in inappropriate ways that lead to spoilage and quality loss.



Plate 5.1: The Practice of Offloading Fish from the Truck to the Receiving Area in One of the Fish Factories In Mwanza- Tanzania.

Source: Mlolwa M., 1999.

5.3.2 Temperature

The high tropical temperature of Tanzania requires rapid chilling of the product in order to lower the fish temperature and inhibit microbial growth. Of the four respondents who operated the fishing boats (See paragraph 5.3.1), two indicated that they took less than an hour, the other two took between two and four hours to ice their catch after netting.

Time taken from catching to icing (hrs)	Responses
<1	2
1 to 2	0
2 to 3	1
3 to 4	1

Table 5.4 Time Taken from Catching to Icing

As indicated in Table 5.5, most fish collectors reported that they quickly iced their catch once it reached the landing. Time taken to transport fish to the factories from the collection sites took between 2 and 24 hours. Offloading fish from the factory jetty to the receiving area took less than five hours. No difference in the icing regime between fish collected by the factory boats and that of the suppliers was observed.

Time Taken between landing & icing (hrs)	Responses
<1	6
1 to 2	0
2 to 3	1

Table 5.5 Showing Time taken after Landing of catch to Icing

From this investigation, it would seem as if the time taken from netting the fish to delivering the catch to the factory is within the tolerable limits for warm tropical fish. However, the volumes of ice used and time lapse to ice the fish after netting (Table 5.4) cannot but be detrimental to the quality of fish, especially if the high temperature of between 27⁰C and 30⁰C of the environment is considered. Since the nets are set overnight, a considerable amount of time lapses before fish is collected and taken to the shore for icing. It is therefore likely that fish could reach the factory when microbial spoilage has already begun, particularly in the case of the two respondents who indicated that it takes them more than 2 hours to ice the fish after catching it.

5.3.3 The Ice Supply

As indicated in Chapter 2, the amount of ice required for cooling fish during transport has to be worked out by the specific industry with consideration of the duration of the journey, the state of the climatic temperature and the type of insulation. In the Tanzanian fishing industry, the ratio of 1:1 by weight has been found to preserve the fish well, and is a requirement for all fish collectors.

The research findings indicated that all factories made their own ice (Table 5.6) from potable water. Ice production by the factories ranged from eleven to seventy tons. The ice produced consisted of flake and block ice. The block ice was crushed before use. All the block ice produced, and some of the flake ice, was used for icing fish at the collection sites. Ice was supplied free of charge to the fish collectors as a motivation to preserve the catch properly.

Making own ice	Response	%
Yes	7	100
No	0	0

Table 5.6 Number of Factories making their own ice

During the field study, it was observed that fish collectors could not pack fish as recommended by the fisheries department. Describing how they packed their catch, the fish suppliers said, “we make a hole into the ice, dump fish into it, and then seal the hole with ice”. Since this method would prevent fish in the centre from cooling down adequately, spoilage

could occur. In accordance with Burgess' finding that fish did not cool sufficiently if it was too far away from the ice, the researcher observed some fish being rejected by the factory on the grounds that it had rotted. When asked what they would do with the rejected fish, the suppliers remarked that they would sell it "to the local processors, who normally salt, dry and export dried fish to neighbouring countries like Zambia, Zaire and Burundi".

Responses to the questionnaire revealed that ice production in some factories was not sufficient for the factory's fish production rate. One factory with a fish production capacity of twenty-five tons per day produced about eleven tons of ice per day. This clearly showed that the factory could not produce enough ice to attain the icing ratio of 1:1 (ice to fish) by weight as suggested by the fisheries department. However, the factory was in the process of expanding its ice production capacity. The rest of the factories produced an equal amount or slightly more ice than their production capacity.

The research findings also showed that only one factory could process the same amount of fish every day. The rest increased their fish production as the fishermen's catch increased. The finding confirmed that two of the factories could each process more than 100 tons of fish per day when the catch was good, while their average production rate was 70 tons. The figures demonstrated that there was a period when the ice produced would not be enough for catch preservation. This factor therefore posed a high risk of fish spoilage.

As mentioned before, if transported fish is not completely surrounded by ice at the end of a voyage, insufficient quantities of ice have been used. Direct observation of the catch at the jetties showed that very little ice remained in the fish holding containers at the end of journeys. The amount of ice used for preservation could therefore not have been enough.

The small-sized boats used increased the problem of inadequate icing. Most of the boats had a capacity of between five and ten tons. Fish collectors felt that it was not commercially viable for them to carry a smaller volume of fish. To make more space available for fish, they used less ice. Some of the suppliers indicated that they did care about quality, but they wanted to make more money by selling more fish to support their families, and to repay their loans, which was borrowed for the purchase of boats, nets and engines. It might therefore be very difficult to enforce a ratio of 1:1 to inhibit microbial spoilage. Collectors prefer conveying more fish to preserving it safely for a longer period.

There was no temperature abuse once fish entered the factories. Owing to a limitation of financial resource and time, the offshore beaches were not visited. Given the findings above, they do, however, warrant further investigation in terms of the icing regime applied to the fish catches.

5.3.4 Storage Temperature and Capacity of Stores at Factories

As indicated in Table 5.7, four factories alleged that they had cold storage with temperatures between -18°C and -28°C . One had cold storage of between -28°C and -38°C and two factories had colder temperatures ranging between -38°C and -48°C . All factories had temperatures lower than the minimum required temperature of -18°C as stipulated in Directive 91/493/EEC, Chapter VIII.

Cold storage temperatures (Cel.)	Response
<-18	0
-18 to -28	4
-28 to -38	1
-38 to -48	2

Table 5.7 Cold Storage Temperature at Various Factories

This clearly shows that the storage temperatures of factories were adequate to preserve the product. The finding is consistent with that of Burgess (1974) and Da Costa (1974), that in many developing countries, though the fishery is still traditional, the cold stores operate at lower temperatures such as -30°C Celsius. At this temperature the product should have an extended shelf life of more than eight months (Huss, 1994).

Freezer room capacity ranged from 50 tons to 250 tons (Table 5.8) in the factories studied. In responding to the question "How long does your fish stay in the freezer store before export?", five respondents indicated that they stored their product for less than a month. The remaining stored for 1 to 2 months. From observation and distribution records it was clear that almost 25% of the fish exported was in a chilled state. In the case of one factory, 90% of the export was in chilled form.

Cold storage capacity (Tons)	Responses
< 50	0
50 - 100	2
100 - 150	2
150 - 200	2
200- 250	1

Table 5.8 Cold Storage Capacities in Nile perch Factories

The investigation indicated that storage capacities of the factories were sufficient and did not pose spoilage of the product.

5.4 SANITATION PROGRAMMES

5.4.1 Cleaning Programme

As noted in Chapter 2, sanitation is one of the basic prerequisites for producing safe and wholesome fishery products. However, basic training in hygiene and sanitation is also necessary to the producers, as they are responsible for the safety of the product. Lack of training and access to a written sanitation manual could contribute to product contamination. Another question that the research wanted to answer, was whether special cleaning crews were used, as proposed by Forsythe and Hayes (1998). Responses to the question, "Does your company have a sanitation programme?" and information gained from the document study revealed that only five out of the seven factories had the sanitation manuals. These factories had a cleaning crew for general cleaning at the end of the day. Two factories had no sanitation manuals, and used the production workers for cleaning. Sanitation manuals define the schedule, items of equipment and areas to be cleaned, the extent to which equipment should be dismantled, and the areas, which need special care, time and frequency and the person responsible. Responses and qualitative interviews with the processing employees in fish factories that have training manuals, however, confirmed that formal training on sanitation was not conducted, except in one company.

The use of a trained cleaning crew would be proper, considering the high fish production rate of between 15 to 70 tons per day, all of which are manually processed. Although swabs were taken to monitor the effectiveness of cleaning in six factories that had laboratories; this should not be taken as a guarantee of safety. In most cases the microbiological tests are long, they may take 48 hours to get the results, and in the meanwhile the processing of fish continues in the factory. If it happens that the results indicate bacterial contamination, it means that the company will incur some financial loss, as they would have to remove the contaminated product from the market. Holy (1989) suggests the urgent need for rapid and sensitive test methods which are capable of accessing numbers and identities of pathogens in a large number of raw materials, line and finished samples to establish the potential safety hazard.

The finding indicates that, although most of the factory management have realised the importance of having a well-documented sanitation manual, the programme could be crippled by the use of an untrained labour force. Nevertheless they have not put much emphasis on the training of employees. Senior management therefore has an important role to play in changing and maintaining the culture of sanitation and hygiene in the factories. If they show concern, the culture can easily be transmitted to their employees.

5.4.2 Pest Control programme

Chesworth (1997) notes that pests could make a product unwholesome if their hair or droppings come into contact with the food produced. Pests are a potential source of contamination and disease of public health significance. Appropriate facilities for protection of pests such as the lake flies, houseflies, insects, cockroaches and rodents are necessary in fish processing plants to ensure the safety of the product. The fish processing plants complied with the pest extermination exercise. Pest control manuals were documented by most of the factory owners. The manual revealed the location and the type of bait used. At the receiving area and waste holding rooms, air and water curtains were used to keep out flies. All windows had screen-mesh. Insecticutors and ultraviolet lights were placed in different areas in the processing hall and packing hall to attract and kill insects. Spring rat traps, cage traps, and ultrasonic sound transmitters were placed in storerooms to ensure the safety of the packaging materials.

5.4.3 Source, Quality and Safety of Water

In Tanzania, fish processing factories follow the water quality standards recommended by Directive 80/778/EEC, which recommends chlorine levels of 0.2-0.5 parts per million (ppm). Out of the seven factories, four used water from the lake. Two factories get their water from the Mwanza municipality, which also draws its water from Lake Victoria. One factory draws water from both the municipality and a borehole. Almost 99 % of the water used for processing is therefore from the lake (Table 5.9).

Source of water	Responses	%
Lake	4	57.14
Municipal	2	28.57
Municipal and bore-hole	1	14.29

Table 5.9 Showing Sources of water

The fact that the water is drawn from the lake, presents the industry with problems. Firstly, the landing sites do not have potable water, a finding which is consistent with De Beer and McLachlan (1998), who reported that having potable water would be a major hurdle to overcome in most of the developing countries.

Secondly, the municipal water supply system is old and poses a potential bacterial contamination threat to consumers because of under-treatment of the water. This is confirmed by media announcements that people should not drink water straight from the taps without boiling it first. A recent report by the Mwanza Press Club (1999) attributed water

contamination to the mushrooming of squatters close to the pumphouse, as epidemics frequently break out among the people living there.

Another problem is that chlorinating of municipal water is done manually, which leads to uncertainty regarding the regularity and precision with which the water is treated. The water supply system was designed when the lake water was very clean and the pollution level was low. Due to the rapid growth of the population (1.0 in 1977 to 1.8 million in 1988) and the high water consumption, the chlorine in the water is also not given enough time to act on the bacteria and the organic matter in the tanks. Water is therefore pumped directly to the consumers after chlorinating.

The World Bank (1996) and Kirugaga *et al.* (1996) have confirmed that the lake is contaminated. However, all the factories have realised the importance of clean and safe water for processing fish, and have taken strong measures to ensure that the water used for processing plants is safe and potable.

Water is drawn 200 meters in from the lakeshore to the treatment plants. Each factory has its own treatment plant where this water is filtered, chlorinated and later passed through ultraviolet treatment before being distributed to the different lines in the factories. Chlorine levels, color and turbidity are tested daily to ensure that it is within the specified limits. The Regional Water Department analyses the water from all the fish factories twice per month for microbial and chemical contamination. The water for the fishery establishment in Mwanza is therefore within the standards for water stipulated by the Council Directive 80/778/EEC on water standards for fishery establishments.

5.5 SUPPLIERS OF RAW MATERIALS

5.5.1 Number of Suppliers

A potential source of microbiological contamination occurs when factories source fish from fishermen other than their regular suppliers or from other factory owned boats. Factories were therefore asked what percentage of the fish tonnage processed, was bought from other sources.

As can be seen in Table 5.10, all the companies except one purchased additional fish. As the region is characterized by bimodal rainfall, the catch is not consistent throughout the year. It declines during the dry season from December to February, and during June and July.

Percentage additional fish bought	Responses
0 – 20	1
20 – 40	2
40 – 60	2
60 – 80	1
80 – 100	1

Table 5.10 Showing Percentage of Additional Fish Bought by Factories

The number of suppliers per factory ranged between 2 and 25 (Table 5.11). Although the results revealed that the majority had between 5 and 10 suppliers, the researcher found that all the factories increased their suppliers to more than the indicated number when the catch was low, in order to fulfill their orders. The amount of fish bought varied between 20% and 100% of the total fish processed. The fish was brought to the factories by factory or supplier collection boats. Two respondents bought between 60 and 100 % of their fish; the rest buy between 20 and 60%. As revealed by rejection of stale fish in some instances, there was significant variation in the quality of the fish bought (See paragraph 5.3.3).

No. of suppliers for a factory	Responses
< 5	2
5 to 10	3
10 to 15	0
15 to 25	2

Table 5.11 Showing Number of Suppliers Engaged by One Factory

The researcher could not observe how fish was handled at the landing beaches, but handling at the receiving site was poor and could cause spoilage. As the fish bruise easily and the gut content is frequently caused to spill open and contaminate the flesh, the current handling practice is a drawback to the goal of safety and quality attainment.

5.5.2 Choice of Suppliers

Responses to the question, “How do you choose your suppliers?” indicated that three out of seven factories chose their suppliers based on the quality of the product, while four looked into both quality and price offered. Both answers are acceptable, depending on specific circumstances. If there is no product variation, it is worth considering the price. Where variation is high, however, only the quality of the product should be considered. Observation of the rejected fish (See paragraph 5.3.3) confirmed that variation was high. It would therefore be advisable that purchasers buy the material depending on the quality of the product and work with suppliers who are more conscious of quality and aim at consistent and

safe products. Latzko (1995) supports this finding and adds that companies should also look at other factors such as service provided, supplier's knowledge, training capacity, and bank credit.

5.5.3 Handling of Fish by Suppliers

Abbot (1975) reports that, in agricultural production, improved handling practice, presentation methods and transportation are sources of competitiveness. In this study, direct observation at the receiving area showed that the fish were pushed out of the truck by shovels on the receiving tables as depicted in Plate 5.1. While the FAO (1983) discourages the practice of using hay forks, shovel, rakes and hooks in offloading fish, hooks were observed to be used to throw fish out of the truck onto the receiving containers. The physical damage caused by sharp instruments shortens the shelf life of fish, reduces weight of fish during processing. The handlers therefore promoted spoilage themselves.

5.6 FACTORS RELATED TO EMPLOYEES

5.6.1 Gender

The fish factories in the study had more male workers than females. Altogether there were about 1284 full-time workers of whom 75% were men. Female workers had failed to cope with the workload, and absenteeism was high among them. For this reason, companies employed more men. Since training could address this level of gender inequity, it is a problem that should be addressed by management.

5.6.2 Attitude to Cleanliness

In responding to the question "What is the general attitude towards cleanliness?", the answer generally was that it was positive, but some added that "female workers are more conscious of cleanliness than men". Direct observation revealed that female workers were seen to take some time to scrub and clean up their working area, while the men had to be reminded frequently to do so.

The researcher found that there has been some attempt to mechanise some of the work in the factories, like skinning, but the machines did not last long before breaking. All the work was therefore done by hand, from filleting, skinning, trimming and packing, to freezing. This meant that there was more handling, which posed a threat of contamination.

An interesting aspect that surfaced among the results, is that it was not clear whether machines had been sabotaged to create jobs or whether they had been technically faulty.

What was clear, was that the factories were considered to have a positive impact on society, because they had created many job opportunities for fishermen, collectors, suppliers, processors and distributors, for example. The suggestion was even made that the machines were not repaired, because the very unskilled labour was still cheap. A factor that might, however, have contributed to the lack of repair, is that the skinning machines tended to take off some fish with the skin, which decreased the production weight.

From the above, it is clear that cleanliness is a problem in the fish factories. It is therefore one of the areas which will require careful attention. If women are more aware than men in this regard, it follows that men can be trained in matters of hygiene.

5.6.3 Education

Responses from management revealed that all the production workers were primary school certificate holders. Supervisors were secondary school graduates. The management was composed of graduates from higher learning institutions. Responses to the question “What do you consider your weaknesses?” indicated that the task of managing a large number of personnel with a primary level of education only was cumbersome. It was worse when the factories hired casual labourers to reinforce the production team when the catch increased. This situation required closer supervision because the casual labourers were not experienced in hygienic practices, while some did not even have basic formal training. As a result, most respondents ranked the “lack of sanitary and hygiene awareness” as the main source of contamination. Only one respondent thought that the pollution in the lake was most responsible for contamination. The responses are reflected in Table 5.12.

Sources of contamination	Response
Lack of sanitary and hygiene awareness	6
Condition of beaches and pollution	1

Table 5.12 Responses on Source of Contamination

This result shows that having many employees with a low level of education, who were untrained in matters of sanitation and hygiene, increased the probability of product contamination.

5.6.4 Health Conditions

As shown in Chapter 2, good health conditions are a prerequisite for food handling. The study revealed that all the factory workers had a pre-employment medical certificate to confirm that the personnel did not suffer from any contagious diseases. Re-examination was done after every six months. Some factories had a permanent medical officer or a nurse for

treatment of minor injuries and first aid. Records of treatment were kept and reports on frequency of diseases were compiled. However, casual workers, used to reinforce the production unit, were not medically examined, and thus constituted a threat of product contamination.

5.6.5 Protective Gear

The highest possible standard of cleanliness is required for persons handling exposed fishery products. All personnel involved in any stage of production of Nile perch should meet the requirements given in section 2B of chapter 3 of the European Council Directive number 91/493/EEC of 22/7/91 issued by the European Union Community. The finding indicates that, one of the three factories complied with personnel hygiene, as captured in Plate 5.2. Between the other two factories, one had employees without gloves. The other had neither gloves nor mouth covers as captured in Plate 5.3. This practice therefore contributes to product contamination as hands, nose and mouth if not protected contributes to cross contamination.

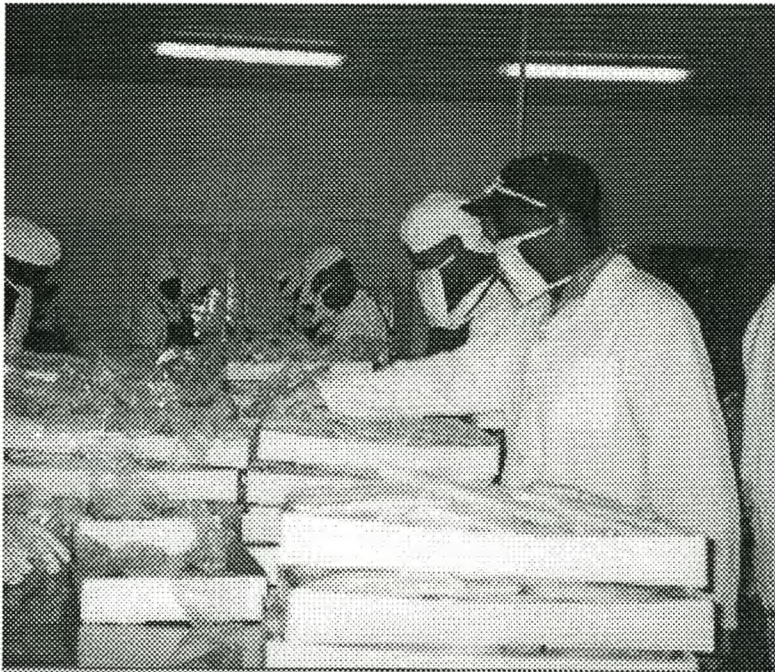


Plate 5.2: Fish Factory Workers at the Packaging Section in one of the Fish Factories in Tanzania.

Source: Mlolwa M., 1999.

5.6.6 Work Habits and Practices

Troller (1983) notes that, in food processing industries, the physical contact between human hands and the food product remain the biggest source of bacterial contamination. Hand

washing in fish factories helps to reduce the microbial load which piles up on the hands as the fish have a lot of slime and fish are brought in ungutted. Although notices were posted to remind workers to wash their hands after every 30 minutes and refrain from other forbidden practices such as smoking and spitting, workers were seen to only wash and sanitize their hands when entering the processing factories. The hand-washing practice was not complied with in all the factories evaluated, which posed high probability of product contamination.

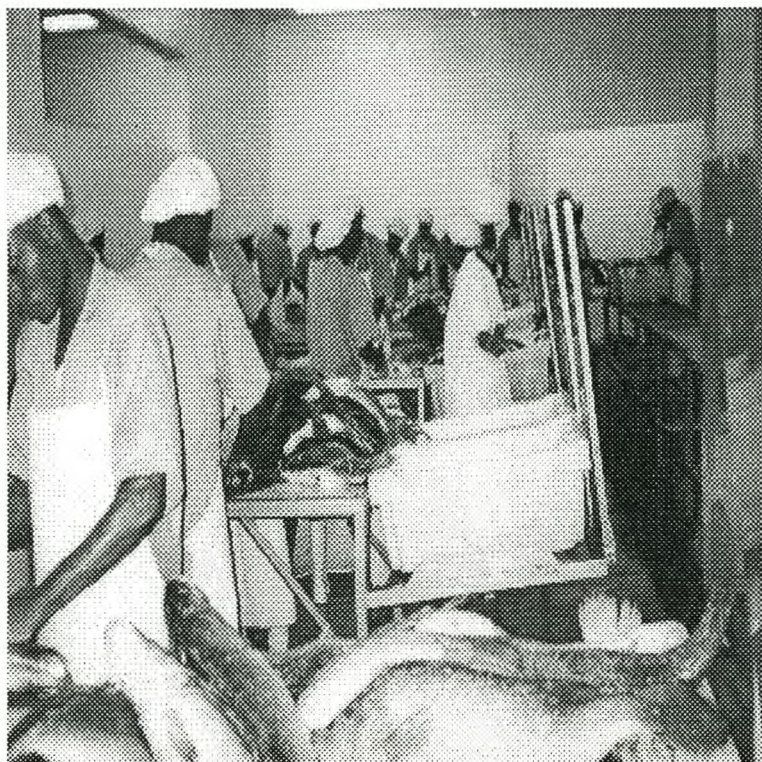


Plate 5.3: Fish Factory Workers at the Filleting Section in Tanzania.

Source: Mlolwa M., 1999.

5.7 INSTITUTIONAL SUPPORT

Several questions were asked in the questionnaire and during interviews to determine whether the literature (discussed in Chapters Two and Three) reflects the level of support that factories in Tanzania get from the government and Fisheries Department correctly. An attempt was made to establish what difficulties, other than those discussed above, affected companies in their production system.

Responses to the question “What should be done to support the industry?” follow in the order of preference:

- Build landing sites with a good infrastructure, i.e. jetties with shade, potable water and toilets

- Build good roads
- Provide training for the fishermen, collectors and suppliers on sanitation, handling, and hygiene
- Provide reliable water and power supply
- Build a fish meal processing plant in Mwanza to absorb all the carcasses and solid waste from the factories
- Impose a closed system to ensure industry sustainability in future

As suggested in Chapter 2, a high probability of deterioration of quality or fish contamination exists where the infrastructure and the facilities for handling fish are poor or non-existent. All seven responders complained about lack of landing sites, potable water and toilets in the islands. This implies that the lack of infrastructure is the most pressing issue. The World Bank (1996) confirmed the need, reporting that the youth have migrated to the landing beaches owing to inadequate employment in Mwanza. Since the facilities at the beaches were lacking, poor sanitation led to health problems and increased incidences of disease.

The road network in Mwanza and many parts of Tanzania was found to be in poor state. Refrigerated trucks that transported frozen fish to Dar es Salaam port from Mwanza had to go to Nairobi in order to use the North Eastern highway through Arusha and Kilimanjaro regions to Dar es Salaam. This was to avoid the Tanzanian central highway that had deteriorated badly and become impassable during the rainy seasons. The central line railway was not used, because it was said to be unreliable and sometimes slow, which increased the distribution cost. The research results therefore confirm the general interpretation provided in Chapter Three, that the transportation system can not be seen to support the fish industry.

The research also revealed that power cuts and fluctuations were commonly experienced in Mwanza. Although all the factories had installed the standby generators, which start immediately when a power shortage occurred to avoid storage temperature fluctuations, they were obliged to incur costs to improve the infrastructure, which the government could have done, at great cost.

In addition to the responses provided to the general question on what improvements respondents considered the most important, some other institutional problems were identified. The first relates to the processing industry, which resorts under the control and supervision of the Fisheries Institute Laboratory in Mwanza and is managed by the central government. This department is responsible for fish quality inspection and assurance services in Lake Victoria (MNRT 1998). The officers are also responsible for laboratory analysis and certification of the exported products. The study revealed that there were only eight extension officers and

trainers in Mwanza. The tight schedule and heavy workload relative to their number raised doubts as to whether staff could do extension work effectively. The support that the industry should be receiving from the government, was therefore not sufficient. This finding is consistent with a previous finding (Anon, 1997) that noted that the natural resource sector was constrained by shortage of staff at the regional level and a lack of infrastructure and up-to-date legislation.

The second concerns taxes. The fish processing companies did receive a tax exemption on the importation of equipment such as nets, engines, and packaging materials as an incentive to build the sector. However, companies paid government taxes and levies as follows:

- Seven shillings per fish to the districts
- 0.3% of the total sales was paid to the municipality as industrial cess,
- 6% Freight on Board (FOB) value of the product as royalty
- 10% FOB as sales tax
- 2% withholding tax on raw material inputs
- 1.2-% local sales stamp duty
- Business, export and annual fishing licenses were paid to the central government

The industry experienced it as a heavy burden. It appears that they experienced these taxes as a lack of support for the industry.

These results lead one to infer that, although the government has promoted exports by creating a business environment through, for example, incentives, it has not improved the basic factors that are crucial for the safety of fish products, and consequently, the level of competitiveness of the industry. A lack of basic things such as a good transport network and water and electricity, that are the responsibility of the government, imposes high overhead costs on the industry, which in turn reduces their competitive position.

5.7.1 The Landing Beach

The two landing beaches evaluated had no jetties and facilities for handling fish in the sanitary way. Handling of fish was the same as described in sections 5.3.1 and 5.5.3. Fish were exposed to direct sunshine during transferring from the boats to the insulated trucks and fish containers, which were later transported to the receiving area at the factories. Being close to the municipal the beaches were congested by other fishermen who brought fish for small-scale processors and retail buyers.

5.8 HEALTH AND SAFETY RECALLS

No irregularity was noted in this item. Packaging materials were coded to show the date, month, year of production and the beach where the raw material came from. Expiring dates and the address of the factory and the buyer were also shown. Records of the incoming raw material, and finished product distribution records were kept for traceability and auditing.

5.9 CONCLUSION

The results of Chapters 3, 4 and 5 are summarised and interpreted in more detail in Chapter 6.

CHAPTER SIX: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

The aim of the study was to examine HACCP and the programmes that are prerequired for the application of HACCP in order to support the safety of a perishable product, in this case Nile perch from Tanzania. If the quality of the product could be improved by guaranteeing its safety, the competitiveness and growth of the fish industry in Tanzania could be achieved. It was assumed that the necessary safety precautions were not being applied rigorously and that correcting this fact would help the Tanzanian fish industry to become competitive in the global market.

6.2 SUPPORTING FACTORS

The literature study confirms that HACCP has received international recognition in the fish industry as a factor to prevent hazards and gain competitiveness in the global fish market. However, conditions in Tanzania were shown in Chapter Three to be insufficient to support the fisheries sector in attempting to gain such a competitive advantage. Although, Tanzania has the comparative advantage of a fishery resource base, a favourable trade policy and foreign technology and management, the macro-factors that include the infrastructure, human resource capital, foreign policy environment and the supporting industries were not supportive. Not only have non-trade barriers been applied in Europe and the US to the agriculture products from developing countries, but protective policy is likely to continue. Owing to the omission of fish in the final round of agreement at Uruguay, where tariffs were significantly reduced for other agricultural products, the fish industry has not had any relief in recent years. The failure of the November 1999 World Trade Organisation Meeting at Seattle to reach any agreement has again shattered hopes of international relief for fishery products.

Improvement can, for the time being, therefore only come from the industry itself and from the government.

6.3 FINDINGS OF THE FIELD STUDY

6.3.1 Areas for Action by the Industry

It was found that, although the Nile perch industry has complied with some of the prerequisite programmes such as the factory design, layout, product flow, temperature control (during

processing), cold storage, safety of water and controlled access, the industry has not complied with other fundamental prerequisite programmes. Since inadequacy in any or part of the programme increases the number of critical control points and reduces product safety, the flaws below, revealed in the filed study, have crippled the integrity of the programme.

While the fish factory premises conformed to the recommended layout and design for fisheries establishment, some of the basic practices and facilities necessary for safety assurance were not sufficient to prevent microbial contamination. The practice of washing hands and the number of sanitary stations were inadequate, which defeats the goal of reducing microbial loads accumulating on hands. Hot water taps and hand dryers were also not adequate. Other deficiencies were a lack of a laboratory for monitoring production, cleaning and sanitation programmes. It was further noted that toilets were fewer than the number recommended, which posed difficulties for maintenance and consequently product safety.

While it appeared that management was aware of HACCP principles on account of pressure from the markets, they were not committed to them. The lack of training and training programmes, a quality policy, representation of members from other departments in the formulation and planning of quality and sanitation programmes, as well as the lack of adherence to the sanitation programmes that did exist, is sufficient indication that management is not committed to or ready for HACCP. The training of employees in good manufacturing practice, sanitation and HACCP principles, for example, is necessary to ensure that employees understand what needs to be done and why. In the implementation of the prerequisite programmes and HACCP, it has been found to be critical.

Despite the fact that water was purified as recommended by Directive 80/778/EEC, that tests from various points were analysed to confirm its safety on a daily basis and The Department of Water confirmed the safety and potability of water used by fish plants, the research revealed that the existing waste water treatment from the fish factories does not adequately purify the water before being discharged. This contributes to lake pollution and confirms the findings of the World Bank (1996) and Kirugaga *et al.* (1996).

Another problem detected is that some companies could not produce enough ice to attain the 1:1 (by weight) ice:fish ratio as recommended by the Fisheries Department as some companies produced more quantities of fish than ice produced. In addition, fish collectors were undermining the icing exercise by cutting down the amount of ice provided for preservation so as to increase the quantity of fish supplied. It was also shown that it might be difficult to enforce a ratio of 1:1 to inhibit microbial spoilage as suppliers indicated that they were forced by the social circumstances to convey more fish than the safety of a product.

Owing to the importance of safety and the standard required by consumers, this area needs urgent attention, as it is one of the areas where product contamination occurs.

Because boxing of fish could not be practised, locally made insulated containers were used. The preservation and handling techniques did therefore not comply with the recommended guidelines. The fact that fish lay on the truck floor increased the probability of product contamination.

Although most factories chose their suppliers depending on the quality and the price offered, price tended to overshadow product quality. In many cases fish was thrown from the boats and trucks during offloading. This indicates that suppliers did not understand the importance of handling and product safety. If product improvement is to be achieved, strong measures will have to be taken to counter this tendency.

In a fish factory temperature control is one of the critical factors that need to be observed. An increase in temperature leads to microbial spoilage and therefore a potential public health. Since the boats that were used for fishing were small and did not have sufficient space to carry ice, product temperature was not controlled from the fishing grounds to the landing sites. In addition, the lack of shade and properly built jetties and the negligence of some suppliers, who indicated that they take more than two hours to ice their fish after landing, have contributed to temperature abuse. Freezer capacity was, however, adequate. This indicates that temperature did not pose any problem regarding product contamination, but that there is an urgent need for measures that would help product preservation at the fishing and landing sites.

The investigation also revealed a gender imbalance in the entire fisheries establishment in which more than 80% of the employees are men. It has also revealed that men have a more negative attitude to cleanliness than women. This is one areas where product contamination is likely to occur and therefore needs urgent consideration. Other factors that were unsatisfactory were work habits, protective gear and manufacturing practices. Production workers have a low level of education, which could be a reason for the lack of awareness and a negative attitude to cleanliness. Although the employees were medically examined before being hired and companies have a routine medical examinations for workers, casual workers were not medically examined. This defeated the purpose of safety assurance from the point of view of personnel health.

6.3.2 Areas for Action by the Government

When asked what kind of support was needed from the government to facilitate the adoption of HACCP in the fish industry, all the respondents ranked jetties with shade, potable water

and toilets as their first priority. This implies that it is the most pressing issue. The list included a need for good roads, reliable power and water supply, a fish meal-processing factory and the enforcement of legislation on fish exploitation to sustain the fishery. In addition, the transportation network, power and water supply were found to be insufficient to support the fish industry. This confirms the findings of Wangwe (1995) that the infrastructure system cannot be seen to support the export industry. The lack of a supporting infrastructure increases the chance of product contamination, imposes high running costs, and thus reduces competitiveness. If factories are obliged to install generators and water purification plants, which the government should provide as a social service, the costs incurred prevent them from becoming seriously competitive.

The only support offered from the government includes the training of the management staff and low tax on the imported capital goods, which companies felt was diluted by the high taxes and levies (see paragraph 5.7) imposed to the industry.

In general, the findings of the research indicate, in the context of the industry, a lack of compliance to the prerequisite programs, a lack of the supporting programs and a lack of commitment by management to HACCP. In the context of the government, they indicate a lack of infrastructure, technological capabilities and human skills. With regard to international support of the Tanzanian Nile perch industry, it was found that trade barriers and protective policies make it increasingly difficult for developing countries to become more competitive.

6.4 RECOMMENDATIONS

Based on the findings, recommendations are twofold. In the first place, the government and supporting institutions of Tanzania are advised to put a special effort into improving the support for the very significant Nile perch industry. In the second place, the industry is encouraged to take responsibility for those improvements that it is capable of bringing about, both with regard to facilities and with regard to personnel.

6.4.1 Government and Supporting Institutions

Although the responsibility of producing safe products lies on the hands of fish processors, support from the government is essential for HACCP implementation and gaining competitiveness. It is therefore recommended that the government should assess the major fish landing stations in Lake Victoria and build the infrastructure and facilities required to ensure that the product is held in a sanitary environment after capture to prevent product

contamination and temperature abuse. This kind of facility has long been provided to the major landing beaches at seashores. The focus should now be on the inland water fishery, beginning with Lake Victoria, which has proved to be a major source of products for export and revenue in the country (Table 1.1).

In addition, the amount of money paid by the companies as levies must be used for the provision of an infrastructure and better services, which are critical not only for gaining competitiveness in the global market, but has been shown to be important for expansion of private sector investment. The government should therefore intervene to overhaul the Mwanza water supply system to match with the safety standards and the increased consumer demand. It should also provide sufficient and stable electric power. To improve competitiveness, the rates should at least match those of neighbouring countries. Good roads are required to avoid delay in delivery of the raw materials, which triggers spoilage of the product. A reliable road network will cut costs of product distribution and improve the position of the industry with regard to competitiveness.

Owing to the importance of ice in preservation, ice production plants should be constructed at the major landing stations to supplement the ice production from the factories. This would increase the quantity of ice produced and encourage its application by the fishermen right after hauling as a result of which sufficient ice can be used for fish preservation. These improvements need to be accompanied by the training of both fishermen and fish collectors. They need to understand why icing is important for preservation and how fish is iced adequately.

HACCP is a new concept in Tanzania. Most factories are not clear as to what exactly is needed. This necessitates that the government work close with the fish industry. The industry can benefit from a generic HACCP plan for the fishery industry developed by competent technical experts from the Fisheries Department in collaboration with the Fisheries Research Institute. The plan will be a guide to the industry in the development of excellent HACCP plans for each factory. Emphasis should be put on the understanding of HACCP principles.

Development of human resources should be looked on as a responsibility of both the industry and the government. To achieve this the number of extension fisheries officials responsible for fish processing should be increased to match the activities that need to be undertaken. The responsible officials and all workers in the industry, including the fishermen, fish collectors and processors, should receive a basic training course on HACCP, good manufacturing practice, sanitation and hygiene. Training must be a continuous activity that accompanies the new innovations and technological developments. To achieve this goal, effective

communication is required, therefore the course material should be translated into the language that is understood by all (Kiswahili). Great care must be taken to ensure that the meaning is not distorted. HACCP can only succeed if all the stakeholders in the fisheries system acknowledge its importance and work towards a common goal.

Because several types of industries as well as untreated domestic waste pollute Lake Victoria, the disposal of untreated wastewater is a national problem. Pollution control requires holistic strategic management by the all industries as well as the neighbouring countries. Meanwhile a study should be undertaken on how the liquid waste in existing factories can be discharged in the most effective and economic process to reduce Lake pollution in the short term. Strong law enforcement on wastewater discharge by all the three states sharing the lake is recommended for immediate implementation, while expert bodies on industrial pollution must approve all future industry designs before a factory is built. Considerable precaution must be taken to ensure that the wastewater is treated adequately before being discharged.

6.4.2 The Nile Perch Companies

Human resource development is an important component of the successful implementation of a HACCP program. Training is therefore required for all levels of employees to cope with the new program, innovation and technological developments. However, training can be effective only if management is committed to and supportive of HACCP implementation. They must therefore commit funds and time for employees to attend training sessions, which should be offered on a continuous basis. Training programmes therefore need to be written for all levels and applied. In future companies should ensure that their employees receive basic training in fish handling, hygiene and HACCP from the recognised fisheries institute before hiring.

Fish handling and preservation practices need to be improved. Companies should discourage the practice of throwing and pushing the fish (as depicted in Plate 5.1) during offloading. This can only be avoided if fish is boxed during transportation.

Factories should also work with suppliers who are willing to cooperate and enter into a long-term agreement. This will build a long-term relationship and joint ownership of the business with each side aiming at the production of a safe product. In a long run the relationship will help to cut down cost, as inspection will not be necessary. Suppliers who cannot cooperate in this matter can serve the local market that has lower hygienic standards. Meanwhile, until the supply of the product becomes consistent, the purchase of fish should be based on the quality of fish supplied. The appointment of a competent quality assurance supervisor would ensure that only the best raw material enters the processing line.

Fishermen and suppliers have been playing an important role in the supply of raw material to the factories. Owing to a high interdependence of the fisheries system, it is important that they all work towards the identified goals. As key players in the exploitation, production and conservation of the system, they should be encouraged to develop a sense of responsibility. The study recommends that frequent workshops with participants from all the subsystems, i.e. the officials, fishermen, collectors, processors and distributors, should be held to strengthen the sense of ownership of the program. Emphasis should be put on the importance of ice and preservation, better handling methods, personnel hygiene, sanitation and HACCP. The role-played by each category on the safety of the product needs to be stressed. Strong measures must be taken to prepare the employees to the new role and responsibility in HACCP program.

It is also recommended that the industry should look for other market opportunities from developing countries. Since no official figures of any description have been published on regional or local trade, this is an area for further research. Association with the world market may be blinding management to potential market opportunities on their doorstep.

6.4.3 Personnel Habits and Facilities

The practice of washing hands is an important prerequisite in fish processing factories. This would work well if the number of hand-washing stations is increased and located in close proximity to the employees' work stations. However, this again has to go along with training of the processing employees. Employees must know the importance of washing their hands frequently and the consequences of not washing hands properly. Installation of a hot water system is recommended for washing hands and cleaning purposes. Hot water is necessary in fish factories as oils and fats tend to soil the equipment and the floor. The number of toilets should be matched to the existing number of personnel. Further, to prevent cross contamination, hand dryers or disposable towels must be provided to ensure that hands are dried especially after visiting the toilets. The installation of automatic doors is also recommended. Compliance to prerequisite programmes regarding protective clothes for workers is recommended. All workers must wear mouth covers and gloves. These must be changed on a daily basis to avoid cross contamination.

Sanitation by itself is a field of expertise. The study hereby recommends that the sanitation programme and the monitoring of records be documented and strengthened. Requirements regarding the frequency of cleaning and sanitation procedure must be adhered to. Sanitation crews must receive training on the importance of cleaning and sanitation. High care areas should be indicated and should receive special attention. Monitoring of the cleaning and

sanitation necessitates maintenance of a laboratory in each factory. Swabs and analysis of bacteria from the raw material, finished products, water tests, should be done daily to ensure that the product is not contaminated with bacteria of public health significance. Although the microbial tests are not emphasised in HACCP, it should be realised that the tests are managed as part of the SSOPs to reduce the number of critical control points, which requires close monitoring.

The health of employees is necessary for the safety of a product. Routine checks must be made to ensure that employees do not suffer from any contagious disease. Medical checkups for employees should be extended to the casual labour used to reinforce the production team. As cholera and typhoid fever are chronic epidemics in Mwanza due contamination of the lake as a sources of water for domestic purposes, workers should be encouraged to be transparent and speak up if they contact any communicable disease. This will decrease the probability of product contamination.

It is believed that compliance with the above recommendations will provide the supporting programmes with integrity and consequently put factories in a better position for the implementation of HACCP. In addition, this might stimulate studies on the application of HACCP to other fishery industries. Finally, the application of HACCP will prevent hazards and ensure product safety and elevate the industry to a competitive position in the global market. However, competitiveness and sustainable trade can only be achieved when HACCP is reinforced by the other determinants mentioned above and supported by all the stakeholders.

6.5 CONCLUSION

Tanzania could benefit from the present demand for white fish by using the opportunity, which might be lost within a few years if taste changes. Despite a comparative advantage of an abundance of fish resources and the Tanzanian government's efforts to ensure sustainability of the fish industry, the competitiveness of the industry is restricted by the lack of compliance to the prerequisite programmes, the infrastructure, supporting industries and skilled human resources. The argument that the application of HACCP and attention to supporting factors that determine competitiveness and success in business is important, even critical. At the very least, food-borne disease needs to be limited. However, complying with regulations that have this intention, does not negate the necessity for rigorous efforts to improve the international conditions of export for Tanzania.

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APPENDICES

APPENDIX 1

SANITARY PRACTICES QUESTIONNAIRE

This questionnaire consists of parts a, b, and c. Data collected from the questionnaire will help evaluate the sanitary and hygienic practices of the Nile Perch industry in Tanzania, as well as help identify possible weaknesses with respect to the implementation and maintenance of food safety standards.

You are requested to place a tick beside the appropriate answer, or to write in the answer when required. For open-ended questions please provide detailed information in the space provided or an extra paper provided.

A. Part (a)

THE COMPANY'S SANITARY & ENVIRONMENTAL FACTORS ASSESSMENT

I. SUPPLY OF RAW MATERIAL

1. Do you operate fishing boats?

If yes, complete 1a to 1e

If no proceed to question (1h)

a) How many boats do you operate?

.....

b) What is the capacity of the boats?

	Tons
Boat 1	
Boat 2	
Boat 3	
Boat 4	
Boat 5	
Boat 6	

c) How many kilograms of ice do they normally carry?

	Tons of ice
Boat 1	
Boat 2	
Boat 3	
Boat 4	
Boat 5	

d) Does your company make its own ice?

Yes

No

If yes:

e) Where does the water which you use to make the ice come from? Provide details

.....

If no:

Please list your ice suppliers:

.....

.....

f) How are the fish packed with ice? Describe in as much detail as possible

.....

.....

g) How many days does the fishing vessel(s) stay in the fishing ground before offload the catch?

Tick where appropriate

less than 5 days []

6 –10 days []

11 –15 days []

16- 27 days []

More than above (specify)

h) If from six (6) days to more days, what procedures are used to make sure the fish remain adequately iced?

i) Do you buy any additional fish from other fishing vessels?

.....

If no proceed to question 11)

j) If yes, what percentage of the total fish used is bought from other fishing vessels?

.....

k) Where do you buy your fish from?

Name the landing beaches.

.....

.....

.....

l) How do you ice the fish after landing on the beach or purchasing from landing beaches?

.....

.....

m) How much time lapses between landing and icing?

.....

n) How much time lapses in transporting iced fish to the factory?

.....

o) What time is fish landed in the beach?

Morning? []

Afternoon? []

Evening? []

Night? []

2) How do you choose fish suppliers?

Depending on the price they offer []

Depending on the quality they deliver []

Depending on price and quality []

3) How many different suppliers do you have?

One []

2-3 []

4-5 []

More than five (please specify)

4) Do you regularly change suppliers?

Yes []

No []

.....

↓

If yes, how many times over the past 6 months
have you changed suppliers?

.....

5) How do your suppliers transport the fish?

Use of boats with insulated containers []

Use of iced containers loaded in pickups []

Both refrigerated van []

Use of insulated trucks [..]

6) Does your company have a written sanitation program?

Yes []

No []

↓

If yes, please make a copy available to the researcher.

a) Does the local authority approve the program?

.....

7) Since the program has been in place have you had any product rejections?

Date	Product	Reason for rejection

8) Who is in charge of the sanitation program?

Name:.....

Position:.....

Qualification:.....

Primary school certificate []

Secondary school certificate []

Diploma holder (course) []

Higher learning institution (course/certificate) []

9) What do you do when the sanitation control procedures are not adhered to?

.....

10) When product contamination occurs, what factor in your opinion, is most often the cause?

Lack of personnel awareness regarding hygienic practices []

Lack of the management commitment to hygiene improvement []

Lack of sanitation program []

Economic constraints []

Market competition []

Others please specify []

11) Do you have a recall program in place?

Yes []

No []

↓
 If yes, please make a copy available to the researcher

12) What do you do if the product is found to be unfit for human consumption after processing has been completed i.e before leaving the factory?

Please explain:

.....

13) What do you do if the product is found to be unfit for human consumption and has been sent back by the retail outlets to the factory?

Please explain:.....

.....

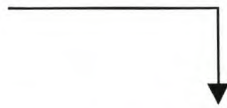
14) What measures do you normally take to ensure that product contamination does not reoccur once a product has been found unfit for human consumption?

.....
.....

15) Have you heard of the directive 493/91/EU?

Yes []

No []



a) How do you understand the directive EEC/491/93 which specifies the health regulations regarding the production and marketing of fish products? Is the directive clear or do you need more information and/or a clearer explanation of the directive?

.....
.....

B. Part (b)

16) Does your company have a policy regarding product quality?

Yes [] (if yes continue to question 16-19)

No [] (If no go to question 20)

17) Is this policy statement available in writing?

Yes []

No []

18) If your company has such a policy, who in the company was responsible for formulating this statement?

.....
.....

19) How is your company's quality policy communicated to the personnel?

.....
.....

20) How frequently is this quality policy statement revised?

.....
.....

21) To what extent is your personnel, marketing and finance departments involved in designing your quality assurance system?

.....
.....

C. Part (c)

22) How frequently do you train your employees on food safety and quality related issues?

- Once per year []
- After every three months []
- After six months []
- Others (specify) []

a) Is a training program available in writing? i.e. in form of a manual? (to be checked by interviewer)

23) Social

a) How many workers do you employ on the line? (please specify)

- Female workers []
- Male workers []

b) What is their level of education?

- Primary []
- Secondary []
- Higher Institution [....]

24) What is the general attitude of the employees towards cleanliness?

.....
.....

25) Economic factors

a) How many tons of fish do you process per day? (specify)

b) What is the capacity of the storage room (Specify)

c) How long does the fish normally stay in the freezer store before export?

- Less than a month []
- 1 –2 months []
- 3 –4 months []
- More than 4 months (specify)

e. At what temperature is the fish frozen?

.....

f. How much time lapses between processing of fish and the freezing of the product?

.....

g. Which market do you supply?

.....

h. How many tons do you supply?

.....

i. Are you generally able to fill retail outlet orders?

Yes []

No []



If not

Why not?

j. What kind of assistance (institutional support in the form of export incentives, training levies etc.) do you get from government?

.....

.....

k. What assistance would you like the government to provide so as to assist to improve the sanitary situation?

.....

.....

26) Environment conservation

a) How do you discharge your waste and effluents?

b) Did you get any expertise on how to discharge the effluents?

.....

.....

THANK YOU FOR YOUR COOPERATION

**APPENDIX 2
ASSESSMENT OF FISH FACTORY**

PLANT LOCATION, PHYSICAL ENVIRONMENT AND INFRASTRUCTURE

Name of factory Type of production

Date for visit Plant location

Access to factory Road/Rail/Airport

Schematic drawing of the processing flow, layout and design (to be drawn)

Photographs (to be taken)

AREAS TO BE EVALUATED	RATING			
	A	B	C	Remarks
BUILDING EXTERIOR				
<ul style="list-style-type: none"> • Building facility not located in close proximity to any environmental contaminants • Roadways properly graded, compacted, dust proofed, and drained • Surroundings adequately drained • Building exterior designed to prevent entry of contaminants and pests 				
BUILDING INTERIOR				
<ul style="list-style-type: none"> • Building and facilities are designed to facilitate hygienic operations by means of a regulated flow in the process from arrival of the material to the finished product 				
<ul style="list-style-type: none"> • General design, layout, flow of goods 				
<ul style="list-style-type: none"> • Separation between clean/unclean processing area 				
<ul style="list-style-type: none"> • Easiness to cleaning, maintenance 				

<ul style="list-style-type: none"> • Lighting should be appropriate such that the intended production or inspection activity can be effectively conducted • Bulbs and fixtures should be protected to prevent contamination of food or breakage 				
<ul style="list-style-type: none"> • Doors should have smooth, non absorbent surfaces and are close fitting and self closing where appropriate 				
<ul style="list-style-type: none"> • Windows should be sealed or equipped with close fitting screens 				
<ul style="list-style-type: none"> • Ventilation should provide sufficient air exchange to prevent unacceptable accumulation of steam, condensation or dust • Ventilation openings are equipped with close fittings screens or filters to prevent the intake of contaminated air. Filters are cleaned as appropriate 				
<ul style="list-style-type: none"> • Walls- are they insect/water proof? • Resistance to corrosion/wear/impervious? • Easy to clean? 				
<ul style="list-style-type: none"> • Color of the wall 				
<ul style="list-style-type: none"> • Is the floor impervious to spillage of product/water/disinfectant? 				
<ul style="list-style-type: none"> • Durable to impact? 				
<ul style="list-style-type: none"> • Resistance to disinfectant/chemicals used 				
<ul style="list-style-type: none"> • Slip resistance? 				
<ul style="list-style-type: none"> • Good appearance? 				
<ul style="list-style-type: none"> • Easy to repair? 				
<ul style="list-style-type: none"> • Slope to drain/prevent formation of puddles? 				
EQUIPMENT				
<ul style="list-style-type: none"> • Sanitary installations and amenities (toilets, hand-washing facilities e.t.a. 				
<ul style="list-style-type: none"> • Laboratory facilities and staff 				

<ul style="list-style-type: none"> • Water supply (quantity, quality hot & cold). 				
<ul style="list-style-type: none"> • Boxes and containers (shape) • Machinery 				
<ul style="list-style-type: none"> • Waste disposal method 				
CHILLING & FREEZING CAPACITY				
<ul style="list-style-type: none"> • Ice supply-availability • Chill room (number, size and capacity) • Is ice made from portable water • Freezer/cold storage (number/size/capacity) 				
RAW MATERIALS				
Quality, handling, control				
PEST CONTROL				
<ul style="list-style-type: none"> • Presence of an effective pest control program has to be in place to monitor, control and appropriate records. • The pest control program should be accepted by the regulatory agency having jurisdiction • Effectiveness of the program is verified by on site inspection of areas for the presence of insect and rodent activity. • Records of all monitoring results, recommendations and action taken are available on request. 				
CONTROLLED ACCESS				
<ul style="list-style-type: none"> • Access of personnel and visitors is controlled to prevent contamination. All necessary precaution is taken to prevent contamination, including the use of foot-baths and hand dips. 				
SANITATION PROGRAM				

<p>Sanitation facilities</p> <ul style="list-style-type: none"> • Washrooms, lunch rooms and change rooms should be separate from and do not lead directly into the processing area. • Hand washing & sanitizing facilities- with a sufficient number of maintained sinks. Should have portable water, soap, and sanitary hand drying supplies/devices. • Sanitizing facilities (e.g. hand dips) are in areas where plant employees are in direct contact with microbiologically sensitive foods. • Notices are posted to wash hands • Organization routine, the sanitation program should be carried out in a manner that does not contaminate food or packaging materials during cleaning or sanitation. • Written cleaning and sanitation procedure <p>Equipment sanitation</p> <p>When the factory is in production, are equipment and facilities cleaned and sanitized at least once a day and more often when necessary?</p> <ul style="list-style-type: none"> • Hand cleaned/ Clean Out of Place (COP) cleaned equipment is disassembled daily for cleaning and inspection, whereas equipment cleaned by an accepted Clean In Place (CIP) system is disassembled for inspection at the frequency prescribed in the CIP program equipment must be free of residue • Any residue and any foreign material • Utensils cleanliness • Effectiveness of the sanitation program is monitored and verified by routine inspection of premises and equipment, and/or microbiological testing. 				
<ul style="list-style-type: none"> ▪ Any residue and foreign material before use 				

<ul style="list-style-type: none"> • Facilities are constructed of corrosion resistant materials capable of being easily cleaned • Equipment cleaning sanitizing facilities is adequately separated from food storage, processing and packaging areas to prevent contamination. 				
TOILET FACILITIES				
<ul style="list-style-type: none"> • Location • Number of toilets • Hand-washing facilities • Availability of suitable hygienic means of drying hands • Taps foot/ankle/hand operated? • Door type i.e. self opening? 				
WASTE DISPOSAL				
<ul style="list-style-type: none"> • Drainage and sewage system are equipped with appropriate traps and vents • Effluent lines do not pass directly over production areas unless they are controlled to prevent contamination • Containers used for waste should be leak proof, and covered • Waste is removed and containers are cleaned and sanitized • Adequacy of liquid waste disposal 				
HEALTHY AND SAFETY RECALLS				
<p>The recall program should outline the procedure the company would implement in the event of a recall. This will ensure that an identified food is removed from the market very rapidly.</p> <ul style="list-style-type: none"> • Product date, code identifying each lot • Finished product distribution records should be maintained for a period longer than the shelf life • Health and safety complaint file must be maintained 				

APPENDIX 3

ASSESSMENT OF PERSONNEL HYGIENE

Name of the factory.....

Number of workers.....

Size of the plant.....

Date of visit.....

Time

Are the following worn?

Item	Yes	No	Describe
Protective clothing			
Mouth cover			
Gloves			
Headgear			
Footwear			

Rating (A) Excellent (B) Good improvement needed (C) An unacceptable situation result to safety threats

The following items, practices are not allowed inside the production plants

	A	B	C
Nail vanishes			
False eye lashes			
Wrist watches & jewel			
Food and drink			
Chewing gums			
Smoking			
Spitting			
Injuries, skin infection			
Dressing water proof			

APPENDIX 4

SCHEMATIC DRAWINGS

