Firm performance in a changing policy environment
the case of TAMECO knife factory, Tanzania

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M.Sc. Thesis Research Report

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Executive summary

The report presents a case study about the Tanzania Mechanical Engineers Co-operative Society Limited (TAMECO). This co-operative was founded in 1972 in Dar es Salaam and still exists today. The core activity of the company is the production of knives. With the help of donor organisations such as the TU/e and HIVOS it managed to increase its production from 8 knives a day in 1975 to 400,000 a year in the beginning of the 1990s. At the moment TAMECO is not producing anymore due to various reasons. The production line is still intact. In the view of restarting production, the company wants to have a study made of the present market situation, the technical feasibility for the future and the firm performance in the past. Eventually this must lead to business proposal.

This report examines the firm performance in the past. The period in which TAMECO was producing is also a period in which the policy environment of Tanzania was changing. In the 1980s Tanzania started to transform the economy from a protectionist economy to a liberal economy. Gradually imports were allowed, price control systems were abandoned and the private sector was promoted. This process is still going on today. The goal of this research is to identify the causes of TAMECO's failure to survive in a new policy setting in the 1990s by determining the firm performance and identifying the impact of the policy environment on the performance indicators of TAMECO.
TAMECO's total firm performance is differentiated into three topics, the technological performance, the productive performance and the financial performance. These are explored and laid out against the policy environment of Tanzania.

The technological performance is determined by the state of technology, which is the product and the production processes, and the technological capabilities, which is the set of knowledge and skills. In the past TAMECO has made some changes in the product and the production processes. The main changes are the purchase of an extra set of grinding machines in 1988 and the purchase of an injection moulding machine in 1989. First the handles were made from wood but with the injection moulding machine the product changed to knives with plastic handles.
In terms of technological capabilities the initial level was low. Most of the workforce, even some of the management, only had primary education. Some efforts were done to increase the level of skills and knowledge through courses and training but this was only for the managers of TAMECO. The rest of the employees gained skills and knowledge through experience and training on the job.

The productive performance is determined by analysing production data of TAMECO. With this data the productivity figures were calculated. These include labour productivity, capital productivity and total factor productivity.
The results show that the labour productivity reached its highest level in the beginning of the 1990s. The capital productivity was highest in the 1980s. The purchase of machines caused the capital productivity to decrease and the labour productivity to increase in the 1990s.
The total factor productivity was at a maximum in 1988. This shows the purchase of the grinding machines had a positive effect and that the purchase of the injection moulding machine had a negative effect in terms of total factor productivity.

All productivity figures show a downwards trend after 1993. At that period the total output of the production started to decrease. The factors for this decrease are determined by analysing data from the bottleneck in the process. The daily production records of the grinding machines are analysed for this matter. The results show that the drop in output was not caused by the efficiency in production. The production per hour was relatively constant at a rate of 40-50% of the optimum and even increasing slightly in the period 1990-1995. In stead, the decrease in production was caused by the decreased utilization of the production line bottleneck. The initial level of utilization of the bottleneck was already quite low at a rate of 35% of the optimum in 1990 and 1991. In 1995 however this level had dropped to only 10%.
Also the factors are analyzed that caused the decrease in overall efficiency. The results show that shortage in raw materials had the biggest impact on the production efficiency from 1993 onwards. In 1995 also electricity problems were a big problem.

The financial performance of TAMECO is based on the balance sheets and income-expenditure accounts. The analysis shows that TAMECO was able to earn small profits in the 1980s. In the beginning of 1990s the operational costs increased. This was mainly due to increased expenditure on interests and loan repayments. At the end of the 1980s TAMECO had applied for loans from commercial banks, CRDB and THB, at commercial rates of 20% and 27% respectively. HIVOS had withdrawn from the project in the beginning of the 1990s but the loan still had to be repaid. Due to this, the expenditure on interest and repayments were quite high in the beginning of the 1990s. In 1993 TAMECO was making losses and got in financial trouble. TAMECO was unable to obtain new sources of finance for the purchase of raw materials. From 1995 the income from sales of knives dropped while costs remained high. This eventually led to the stoppage of production on a large scale.

This also leads to the answer on the main question of this report: What are the main causes of TAMECO's failure to survive in the new policy setting?
As stocks in raw materials were running out and HIVOS had withdrawn as the main financer TAMECO had to look for new sources for finance. This proved to be difficult as the access to finance was limited. Commercial banks were reluctant to supply loans because TAMECO was a co-operative, had not proven itself as a profitable organisation and already had loans outstanding.
The reason that TAMECO was unable to get finance was caused by both internal and external elements. External elements were HIVOS had withdrawn from the project and that co-operatives were not seen as favourable organisations by commercial banks. Also the changed market situation had influence as TAMECO used low price mark-ups in order to compete in the market. Internal elements are that TAMECO had loans from banks at commercial rates that needed to be repaid and that TAMECO had not proven itself as a profitable organisation.

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List of Abbreviations

CICA	Centre for International Cooperation Activities
COASCO	Co-operative Audit and Supervision Corporation
CPI	Consumer Price Index
CRDB	Co-operative Rural Development Bank
CUT	Co-operative Union of Tanzania
DFL	Dutch Florin
EDS	Export Development Strategy
EP	Export Promotion
ERS	Export Rebate Scheme
FDI	Foreign Direct Investment
GRS	General Retention Scheme
HIVOS	Humanistisch Instituut Voor Ontwikkelings Samenwerking
HIPC	Heavily Indebted Poor Countries
HOSCO	Household Supplies Company Limited
IMF	International Monetary Fund
IPC	Investment and Promotion Centre
IS	Import Substitution
ITA	Income Tax Act
MEIDA	Metal Engineering Industries Development Association
NBS	National Bureau of Statistics
NBC	National Development Corporation
NIA	National Investment Act
NIPP	National Investment Promotion Policy
OGL	Open General License
PCA	Public Corporations Act
PSRC	Parastatal Sector Reform Commission
SIDO	Small Industries Development Organization
SIDP	Sustainable Industrial Development Policy
SNV	Stichting Nederlandse Vrijwilligers
SME	Small and Medium sized Enterprises
STC	State Trading Corporation
TAMECO	Tanzania Mechanical Engineers Co-operative Society Limited
THB	Tanzania Housing Bank
TIA	Tanzanian Investment Act
TIC	Tanzania Investment Centre
TOOL	Technische Ontwikkeling Ontwikkelingslanden
TRA	Tanzania Revenue Authority
TSH	Tanzanian Shilling
TU/e	Eindhoven University of Technology
USD	United States Dollar

Acknowledgement

This report presents the thesis of my final project. Here I would like to thank the people that helped me in finalizing this project. First of all the supervisors, Paul Lapperre who initially arranged the project and was the main contact person with TAMECO, Henk Toersen as the technological supervisor and Michiel van Dijk who guided me at the beginning of this project. Special thanks go to Eddy Szirmai who contributed a lot with his ideas and comments. His enthusiasm and support always kept me motivated to finish this project.

The time in Tanzania was a great experience for me. I like to thank the management of TAMECO for giving me this opportunity. They were always open and willing to help me in my project and I have good memories about the time I stayed there.
I like to thank Mr. Remigius Mbawalla for giving me this opportunity. Furthermore I like to thank my "roommate" Mr Robert Mishigati and his wife mama Kornelia and Mr Pascal Matimbwa and his wife mama Mhanza for their kindness and hospitality. They showed me an insight in Tanzanian life helped me if times were difficult. Also thanks to Reitze ten Cate and Michael Damen for their contribution to this project.

Last but not least I would like to thank my parents who always stimulated and supported me in finishing my study.

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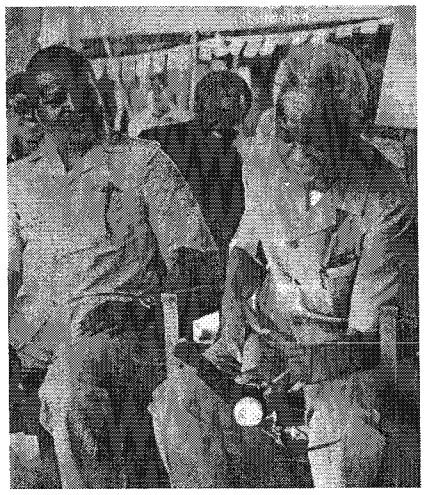
Robert ten Hagen

Chapter 1. Introduction

"Shoka butu", the Swahili words for "blunt axe", words that got meaning on November 4th 1981. During the opening ceremonies of the TAMECO knife factory it was Tanzania's first president, Julius Nyerere, who spoke these words. In the ceremony he had received an axe made by the TAMECO members. In reply he told a story from his youth. When he was a young boy he had learned that "A blunt axe will sharpen itself if one continues to use it". He then referred to TAMECO as being the blunt axe, still inexperienced in making knives, but it could be sharpened by gaining experience in the process of knife production. At the time the story touched the hearts of the TAMECO members, but it is also a story that seems unfortunate today as TAMECO is not producing knives anymore. What has happened since Nyerere's speech and where did it go wrong for TAMECO?

Figure 1.1: Nyerere admiring the axe



What lessons can we learn from TAMECO's experiences, in a period when Tanzania's economy was transformed from the social regime under Nyerere to a liberal regime that it is today? To answer this question the performance of TAMECO is analyzed. It is analyzed how TAMECO responded on the changes in the policy regime. This analysis aims on the technological, productive and financial aspects of TAMECO and how they changed.

The report consists of five chapters followed by a discussion and conclusion. The first chapter consists of a general introduction with the history and characteristics of TAMECO. This chapter also includes the outline of the research and the goals and questions for this research. At the end of this chapter a review of the literature on this topic is presented.
The second, third and fourth chapters form the main body if this report. The research that is done is presented in these chapters. Each chapter consists of a description of the methodology that is used for the data collection and the calculations which is followed by the results and concluding remarks. The topics of these chapters are the technological, productive and financial performance of TAMECO. The fifth chapter presents an overview of the transformation of the economic setting in Tanzania, followed by a discussion of the relation between the policy environment and TAMECO as a company. Chapter six is a discussion on the findings of the different topics combined, eventually leading to the conclusions and recommendations presented in chapter seven. The appendices that support the research are presented at the end of this report.

1.1 Company description

This report presents the case of the Tanzania Mechanical Engineers Co-operative Society Limited, better known as TAMECO. As an introduction to this company first a brief history is presented followed by a description of the organisation structure.

1.1.1 The history of TAMECO

The Tanzania Mechanical Engineers Co-operative Society (TAMECO) was established on November 4th 1972 by a group of workers from the "Dar es Salaam Motor Transport Company" and was registered as a co-operative in May 1973. During the first years TAMECO was active as a motor vehicle repair and maintenance shop. Each member of the cooperative contributed for a share of 2,500 TSH which was used for the construction of a simple building. In that period the TAMECO society grew from 3 to 36 members. In 1975 TAMECO had to stop their garage activities because of problems with in finance and a lack of customers.

Based on advice of the Small Industries Development Organisation (SIDO), TAMECO decided to specialise into knife making. In a traditional smithy process the knives were made from old car springs and scrap iron. It was in 1975 hat TAMECO came into contact with the Dutch volunteer organisation SNV. On TAMECO's request the SNV-expert contacted and the Eindhoven University of Technology (TU/e) in order to find out whether it was possible in mechanize production and increase production capacity to approximately 200.000 knives a year. A project proposal based on the supply of second hand machinery was drafted and some machines were bought. The machines were financed by NOVIB and the TU/e and arrived at TAMECO in November 1977.

Soon after installation of the machines it became clear that the there were serious technical problems in production and that the equipment was unsuitable for making knives in a productive manner. Besides this TAMECO lost its main supplier of scrap metal, a local plough company, and the project stagnated in 1978. An investigation by the TU/e on the matter initiated the third stage in the history of TAMECO. After discussions between the General Manager and TU/e staff, it was decided to try to obtain a modern production line capable of making approximately 250.000 knives per year.

With this in mind the TU/e contacted the Dutch Humanitarian Institute for Development Co-operation (HIVOS). The proposed project consisted of two phases. The first phase was to improve the traditional production method and increase production to 200 knives a day. The second phase consisted of the purchase and implementation of a complete production line with a capacity of 350.000 knives per year (CICA, 1980). HIVOS agreed to finance the project, partly on a grant basis and partly on a loan basis. Machines such as an eccentric press, hardening ovens, grinders and a polisher were bought and shipped to Tanzania and in 1980 the new production line became operational. In November 1981 the production line was officially handed over and Tanzania's first president, Julius Nyerere, attended the opening ceremonies. In the years that followed production was maintained with various ups and downs. HIVOS was serving as the financial agent and CICA (TU/e) served as the technical agent. CICA was also the agent through which the main production inputs, such as steel and grinding wheels, were ordered. In 1988 an extra set of grinding machines was bought to increase the production capacity. In 1989, to give the knives a more modern appearance, an Injection Moulding machine was bought and the wooden handles were replaced by plastic handles.

In the beginning of the 1990s the situation changed for TAMECO. HIVOS was withdrawing from the project as the main financer and the government changed its policy from a socialistic protectionist environment to an open-market and liberal environment. From that moment on knives could be imported freely and the market was penetrated with cheap knives from Asia. This had a major influence on the situation of TAMECO. Production and sales dropped and from 1995 onwards TAMECO was making big losses. This eventually led to the standstill of production. The present situation is that TAMECO still exists and that production line is carefully laid up.

1.1.2 Organization structure

TAMECO is registered as a co-operative. The co-operative structure can be described as a group of persons that engage in activities in order to achieve a certain economical goal. The co-operative is often referred to as a "society" that consists of "members". Persons can become a member by buying a share in this society. The goal of the society is to ensure social well-being for each of its members and profits are usually used for the re-investment in the society.

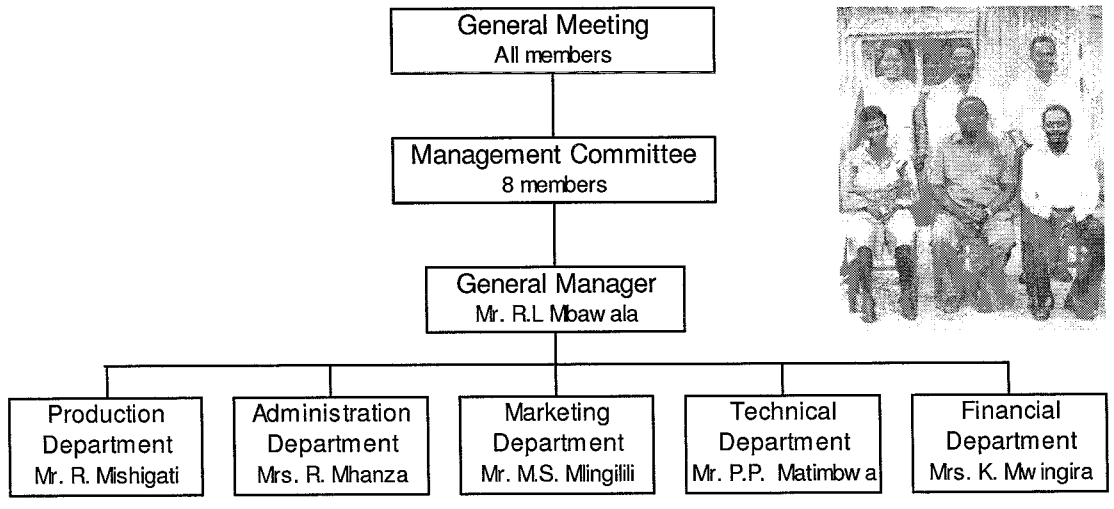
The highest decision making body of co-operatives like TAMECO is the General Meeting. This meeting consists of all the persons that are a member of the society. Every member has the right to give its own opinion in the meeting but in the end the members that own the biggest share in the society have the most influence. As a result of this, decision making can be very time consuming. On top of this, the chance exists that decisions are made from the social perspective rather than from an economic point of view. Not every member has the necessary background or experience to make particular decisions in the right way. The main function of the general meeting is to make decisions about strategy and business topics such as approval of the society's budget and the recruitment of new members.

The management committee is the second highest body in the organisation. At TAMECO this consists of eight members. The members of this committee are the general manager, the heads of the administration and financial department, the marketing manager, the technical manager and three work floor members. The functions of the committee are to stipulate the short-term activities and the implementation of the society's objectives as directed by the general meeting.

The General Manager is the member that is assigned to management of the society's daily activities and making short-term management decisions. The general manager will follow the objectives as stipulated by the management committee. TAMECO's general manager is also one of the founders of the organisation. The general manager heads the five departments that TAMECO is organised in. The departments are the production, administration, marketing, technical and financial department.

The largest department is the production department. This department deals with the production of knives. The employees that work under this department are mostly machine operators. Also the activities that do not really contribute to knife making, such as maize milling and timber sawing are located under this department. Its functions include the making of production plans, solve problems in production and control the amount and quality of produced goods.
The administration department is responsible for the administration of TAMECO. The activities of this department include aspects of human resources such as the recruitment new staff and arranging training for employees. Also simple business tasks are arranged by this department such as copying, printing and purchasing new office stationeries.
The marketing department is responsible for the promotion TAMECO's products. Only one person was employed in this department. The tasks consisted of consisted of the marketing of the product through advertisements in newspapers and promotion through a radio program. Other tasks were to collect money from customers, recover bad debts and finding new channels for distribution.
The function of the technical department was to ensure that all installed machinery is working properly. This department consisted of four trained engineers that, in case of machine breakdowns, had to carry out the repairs. They were also assigned with the task of general maintenance of the machines and keeping the maintenance and repair records up to date.
All financial matters were controlled by the financial department. This includes the transactions such as payment of salaries and services and the purchasing of raw materials and spare parts. Also the yearly budget and balance sheets were prepared by this department. Moreover, this department keeps records of the storages of stocks and finished knives and checks on a monthly basis the inventory level of all items.

Figure 1.2: TAMECO organisation chart and the management

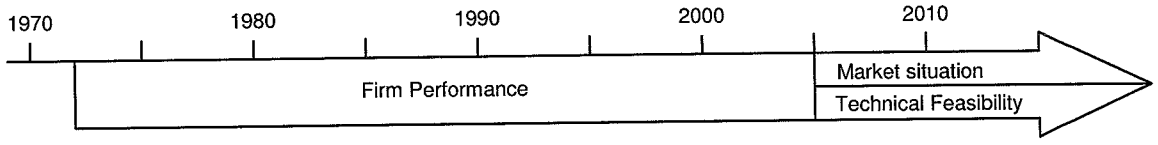


1.2 Project description

As an organization, TAMECO still exists. The production line has been laid up for some years, but should still be serviceable. A visit to the supplier of the production line, Berger in Wuppertal, in February 2005 revealed that spare parts are still available and that the overhauling of the machines is technically possible. The infrastructure of TAMECO, buildings, water supply and electricity supply, is intact. Essential expertise, labor, foremen, is still available. The economic environment has changed and thought is given to the possibility to restart the production of knives. In this line of thought the management of TAMECO wishes to have a comprehensive study made of:

- TAMECO's experiences in the period 1972-2005;
- The feasibility to start knife production again;
  - Current market situation;
  - Technical feasibility.

Figure 1.3: Graphical presentation of the project



The total project consists of three parts, each part to be investigated by different students of the program for Development Studies at Eindhoven University of Technology (TU/e). This report will deal with the first part of the research, the investigation on TAMECO's experiences and performance in relation with the Tanzanian policy setting. The other subjects are investigated by other students and their results are discussed shortly here.

1.2.1 Market situation

The market study was executed by Michael Damen, a student of "Industrial Engineering and Management Sciences". His research included a study on the characteristics of the market, the main competitors and the organisation in the view of the present laws and regulations in Tanzania (Damen, 2006). His findings suggest that TAMECO is still a strong brand in the market as most of the wholesalers and end-users still recognize TAMECO as a knife manufacturer. The main conclusion is that the revival of TAMECO is possible under certain circumstances. The market conditions are favourable for restarting knife production but TAMECO's internal conditions are not yet seen as favourable because funding is needed for overhauling the machines, refurbishing the buildings and the purchase of raw materials.

The present total domestic market is estimated at 4.5 million knives per year which is now fulfilled by the production of local blacksmiths and the imports of knives. The local production is, according to Small Industries Development Organisation (SIDO), estimated at more than 800.000 knives annually. The knives are produced by blacksmith groups who are widely spread throughout the country. The blacksmith knives are made from scrap material in a traditional smithy process. The knives are of relative good quality in terms of strength and durability though they are susceptible to rust. Because the knives are produced mostly by hand the blacksmith produce and sell their knives in relatively small quantities. This process is not very productive and leads to a price that is 1 to 2 times higher than average. Despite the price the knives are popular among the rural population and the blacksmiths are supported by SIDO in terms promotion, training and the supply of working tools.

The foreign manufactured knives are mostly imported by wholesalers in Dar es Salaam. These wholesalers distribute the imported knives to wholesaler and retailers all over Tanzania. To import the knives the wholesalers have to pay a customs duty of approximately 10%. The amount of imports in kilograms is presented in Table 1.1. The 'Non-fixed blade' knives represent the imports of knife blades and knife handles separately and probably are assembled within Tanzania. The TAMECO knife is

comparable with the knives with fixed blade. From these imports 60% of the knives are originally manufactured in China, 15% in the United Arab Emirates and the rest is from South-Africa, India and in 2005 also from Kenya. The trend is that the amount of imported knives is gradually rising.

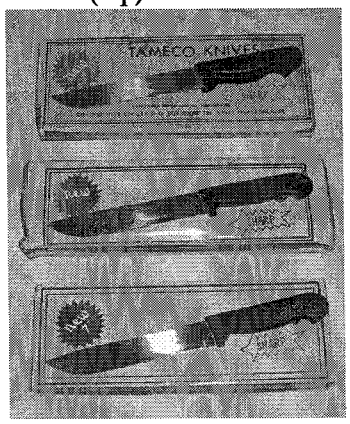
Table 1.1: Import of knives per product group in kg

type of knives	1997	1998	1999	2000	2001	2002	2003	2004	2005[a]
Assorted	22,392	563	3,251	11,191	18,233	14,153	11,776	8,238	10,732
Table knives	5,814	4,967	36,780	40,584	105,739	133,986	87,617	169,584	106,048
Fixed blade	39,528	30,310	38,535	42,718	44,234	25,899	66,914	45,268	32,941
Non-fixed blade	33,531	3,977	10,188	20,094	14,020	9,706	28,895	17,352	24,753
TOTAL	101,265	39,817	88,754	114,587	182,226	183,744	195,202	240,442	174,474

Notes: a = January – September 2005
Source: Damen (2006) from Tanzania Revenue Authorities.

The imported knives are relatively cheap but also of rather poor quality. Some types of knives are imitations of the knife that TAMECO used to sell, see figure 1.4. The imitations have a similar appearance and are packed in similar boxes. These knives are sold by the wholesalers as genuine TAMECO knives and the wholesale price varies from 375 to 470 TSH, where the TAMECO knife used to be sold for 655 TSH to wholesalers 10 years ago.

Figure 1.4: TAMECO knife (top) and imitations



Source: Damen (2006)

The conditions are seen as favourable for TAMECO to re-enter the market. A decade ago TAMECO used to sell most of their products to wholesalers in Dar es Salaam. At present the TAMECO knife is still recognized by the wholesalers as a knife that was of good quality. They also indicate that they are willing to buy the TAMECO knife if it would return in the market. However remarks were given about the price, which was relatively high, and the supply of TAMECO knives which was inconsistent and unreliable.

The study of Damen (2006) also included a survey on the end-users of knives. The survey was conducted in co-operation with the National Bureau of Statistics (NBS) and consisted of a sample of 180 urban households from Dar es Salaam and 184 households situated in the rural Pwani region. 33% of the respondents indicated that they knew TAMECO as a knife manufacturer. The average amount of knives per household was 1.88 and was positively correlated with the income and the size of the household. The knives were mostly used for housekeeping purposes.
The survey also included question of customer desires. The product characteristic that was rated as most important was corrosion resistance. Other factors that were rated as important were availability, stiffness of the blade and price. 85% of the respondents preferred plastic handles over wooden handles. The price customers are willing to pay for a good stainless steel knife varies. End-users are willing to pay 815 TSH per knife whereas wholesalers in Dar es Salaam are willing to pay 500 TSH per knife.

1.2.2 Technical Feasibility

The research on technical feasibility was executed by Reitze ten Cate, a student of "Mechanical Engineering". In this study two options for a new start-up of the production line were investigated. The first option was to overhaul and re-install the old machinery, the second option was to purchase and install a new production line. The research included aspect such as technical requirements, maintenance schemes and the economic and technical lifespan of the machinery. When the student arrived in Dar es Salaam it became clear that most of the machines were in a relative good state. This changed the scope of the research from a more theoretic one to a more practical one with questions such as deciding which parts of the machines needed repair or replacement. Because of the changed scope, among other reasons, the technical feasibility was not further investigated.

1.2.3 Firm performance

This report will describe the first part of the project. This part is an investigation of TAMECO's performance in the period 1972-2005 set out against the background of Tanzania's economic policy. Special interest in this research will be how the company reacted to the changing policy environment in Tanzania. In order to achieve this, archive material of TAMECO is accessed, interviews are taken and research reports are analysed. Also a study on the economic policy of the Tanzanian government is executed.

This research will limit itself to the knife production part of TAMECO only. In reality the TAMECO Corporation exists of more than knife production. During its lifetime the corporation was active in car repair, maize milling and, at a later stage, technical education. These activities can be seen as sources of income for the corporation and the profits may be used for improving the knife production department, but they will not be taken into account in this analysis.

1.3 Research goal

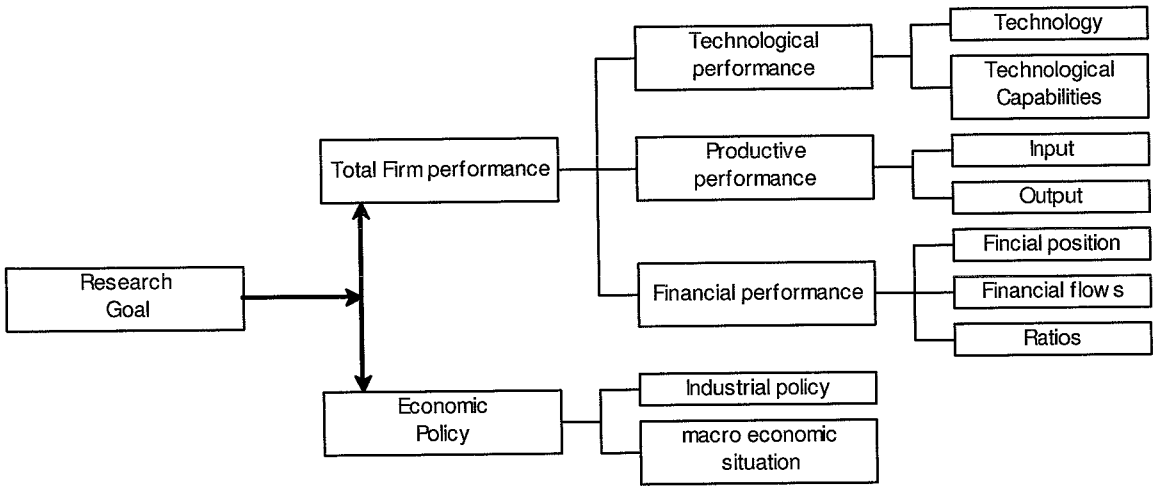
With the description of the project in mind, the research goal of this part of the project can be formulated as follows;

The research goal is to identify the causes of TAMECO's failure to survive in a new policy setting by determining the firm performance and identifying the impact of the policy environment on the performance indicators of TAMECO.

1.4 Research model

The research goal is achieved by relating the performance of the firm with the economic policy of the country. The total firm performance is found by investigating the financial performance, the productive performance and the technological performance of the firm. The financial performance is analyzed by comparing the income and expenditure of the firm, the productive performance by comparing the input with the output of the firm, and the technological performance by research on the technology and the technological capabilities that were present in the firm. The economic policy will be investigated by determining the industrial strategy and the macro-economic situation.

Figure 1.5: Research model



1.5 Research questions

The main research question of this report is based on the research goal and is;

What are the main causes of TAMECO's failure to survive in the new policy setting?

The sub-questions are derived from the research model and are;

- What is the productive performance of TAMECO?
- What is the financial performance of TAMECO?
- What is the technological performance of TAMECO?
- What relation can be identified between the total firm performance and the economic policy?
- What lessons can we learn for the future of TAMECO?

1.6 Literature review

In this paragraph some of the literature on the relation between firm performance and government policy is reviewed. First the theories on the relation of firm performance and economic policy are presented as well as some of the empirical evidence. The second paragraph explains the concept of technological capabilities and discusses some of the empirical evidence. The third part presents some factors for success in firms in Africa. It ends with concluding remarks about the literature

1.6.1 Theories on trade liberalization

In this paragraph some theories on trade liberalization are discussed. The justification for liberalization comes from the belief that excessive state intervention is a distortion into the functioning of an economy. Furthermore state intervention does not promote competitive behaviour based on market rationality, it discourages specialization based on comparative advantage and generally results in wasteful and inefficient ways of allocating scarce resources (Bagachwa, 1992). The goal of trade liberalization is to establish an enabling environment for making decisions on market rationality.

A wide range of literature is available on the theoretical approaches towards economic policy and firm performance. A common distinction that is made is between the neoclassical approaches and the evolutionary approaches. Lall and Latsch (1999) discuss the main theories on the role of technology and import liberalization.
The authors first discuss the neoclassical approach. Among the neoclassical development economists there seems to be the consensus is that free trade optimizes global resource allocation. An increase in competition leads to better industrial efficiency. This allows specialization in the field were there is a comparative advantage. Countries that follow liberal trade policies grow faster than those without trade.
A neoclassical theory that discusses openness in economic development is the New Trade Theory. New Trade Theory is a combination of game theory and economies of scale. The idea is that import protection is good when it is used as a strategic instrument of export promotion. Protection enables industries to exploit economies of scale and become efficient enough to export on the world. A critique on New Trade Theory are potential the conflicts between national and global welfare as they are not applicable to developing countries.

The micro level processes by which firms become efficient are assumed to be costless and automatic and are therefore not treated in the neoclassical theories. For a more in-depth look into the micro level processes one has to turn towards the evolutionary theory (Verspagen, 2004). The emphasis of the evolutionary approaches is based on international differences in technological capabilities and the dynamics of comparative advantage. The informational structure of the world economy is complex. A more evolutionary approach to trade indicates a move from the general level to a more micro level analysis such as firm level processes of learning and capability acquisition.

Besides differentiating between neoclassical and evolutionary theories one can also make another distinction. Tybout (2000) makes a distinction between the static arguments and the dynamic arguments why trade protection might affect the performance of domestic firms in Developing Countries.
The static arguments describe the effects of trade policy on the competitive pressure that faces the firms. If the market is protected, domestic firms have a higher market power than without protection. The enhanced market power may be exploited by increasing the price mark-ups by which the firms may earn greater profits. Another effect of protection is that it increases the market size for domestic producers. The domestic firms are likely to respond by expanding, and perhaps exploiting economies of scale. Another argument is that when employee effort is a choice variable, trade policy can affect the amount of "managerial slack" or "X-inefficiency". In other words, protection leads to managers to relax and become less efficient.
These static arguments of trade policy all indicate that a protective environment will probably have negative effects on the productivity of domestic firms. If the domestic firms make higher profits it may allow relatively inefficient firms to survive. Or in other words, when profits are higher this may relax the firms to increase productivity.
The dynamic arguments relate to issues of trade policy and the response of firms over a longer period of time. According to Tybout (2000) different outcomes are possible depending on the modelling assumptions and the particular policy experiment. One issue is whether trade protection will induce technologically backward producers to invest in catching up. Catch up models describe a transition from outdated technologies to new technologies but they do not link trade policies to ongoing productivity growth. To link productivity growth with trade policy dynamic models are used. The outcome of these models is that protection and productivity growth depends partly upon the way which knowledge diffuses.
Trade protection may improve productivity growth if it promotes the technological activities that generate the highest learning rates and most valuable spill over. On the other hand, protection may slow down productivity growth by constricting channels of knowledge transfer. This is the case when domestic producers acquire their knowledge through exposure to foreign clients, imports of highly technological products, or knowledgeable competitors.

Most theories are in favour of trade liberalization. According to neoclassical trade theories openness leads to countries that specialize in fields with a comparative advantage. The static arguments suggest that protection may lead to relaxation of managers and eventually leads to inefficient production. Dynamic arguments suggest that openness enables the diffusion of knowledge which is important for backward countries to catch up to world productive leaders.

1.6.2 Empirical evidence on liberalization

This notion that liberalization enhances productivity growth seems to be backed up by empirical evidence. The articles of Tybout (2000) and Jayanthakumaran (2004) give an overview of the existing empirical evidence.

Tybout (2000) gives a good outline of the existing empirical evidence on policy and firm performance. Evidence from empirical data tends to find that liberalization is associated with rising average efficiency levels. Similarly protected industries tend to find more dispersion in productivity. The interpretation of these results is that foreign competition drives inefficient domestic producers either to produce more efficient by adopting best practice technologies or to shut down.
The empirical findings also suggest that internal scale effects are not the main reason for higher efficiency. In most cases the improved efficiency was probably largely due to intra-plant improvements that are unrelated to internal or external scale economies.

The article of Jayanthakumaran (2004) finds that the empirical evidence suggests that in the short term, liberalization has a positive impact on productivity growth. Long-term productivity growth is ambiguous as there is a vast range of changes in both technical conditions and prices internationally.
Overall it seems that in the south-east Asian countries the liberalization of the market led to economical growth. Countries like South-Korea started to catch-up to the level of Western European

countries. What is interesting is the question why the wave of liberalization in Africa did not lead to a catch up of those countries on a global scale? On this topic the author notes that;

"The "least developed" country-based evidence indicates that trade liberalization is a necessary but not a sufficient condition for rapid TFP growth. These countries need to address deficiencies such as shortages of human capital, physical infrastructure and institutions to strengthen the case for trade liberalization."

This brings us to another topic in the economic literature. Trade liberalization is not the only issue that needs to be addressed when countries want to catch up to economically developed countries. The other factors that are important have to do with the diffusion of knowledge and the amount of Technological Capabilities.

1.6.3 Technological Capabilities

The technological capabilities are important for countries to catch up with the advanced economies. According to Abramovitz (1986) the simple catch up hypothesis asserts that the counties being backward in level of productivity carry a potential for rapid advance. If the technological and productivity gap is larger there is a stronger potential for growth in productivity.
Catch-up is self limiting. When following countries catch up the opportunity of making large leaps by replacing old with best-practice technology is reduced. Abramovitz gives some constraints for countries to catch up. In reality there are only a few countries that successfully narrow the productivity gap. The potential depends on factors like the properties of technology on the one hand and the size of the market and natural resources on the other. Specifically scale intensive production might be a problem for follower countries with a small domestic market.
A factor that has special attention in his article refers to the social characteristics of a country. This is what the author calls "social capabilities". Social capability is very broadly defined by Abramovitz, capturing technical competence, which refers specifically to the capacity to acquire, use and diffuses technology (e.g. educational level and share of population with training in technical subjects) but also include infrastructure (power transport and communication) and the political, commercial, industrial and financial institutions of a country. The trouble with absorbing social capability into the catch up hypothesis is that the concept is very broad and it is difficult to measure.

A better defined concept of which partly reflects social capabilities is the concept of technological capabilities. This concept is used the study of Bell *et al.* (1982). This article describes a case study of a manufacturing firm in a country with infant industry protection[1]. The authors use the concepts of "learning" and "technological change" to detect the possible influence of the policy regime on the behaviour of the firm. In a case-study on a factory in Vietnam they found that the protectionist development strategy that was followed by the governments seems to have contributed to the long term technical stagnation the firm. Also it contributed to the firm's failure to invest in those technological capabilities that are needed to raise efficiency and productivity.
This also comes forward in the article of Bell *et al.* (1984). The article is a survey of the existing literature on infant industries. The authors find little evidence for productivity growth in infant industries. The central point in the article is the suggestion that infant industries cannot mature or become competitive unless they accumulate the capability necessary for continuous technological change.
Jonker *et al.* (2004) focus on the relationships between technological effort, technological capability and economic performance. The main argument put forward in literature is that technology can be imported but technological capabilities cannot. There is no relation between technological effort and technological capabilities. The technological capabilities can only be acquired through a learning process. They also find that an improvement of technological capabilities at machine level contributes to the economic performance of these machines.

[1] Infant industry protection: with protection, technical change will take place in infant industry such that the gap between the initially inefficient level of production and best practice will be narrowed to the extent that internationally competitive production will take place.

These findings imply that technological capabilities are very important for technological change and improving production efficiency in countries and firms.

Both trade liberalization and technological capabilities are important if countries want to increase efficiency and productivity. But does this also count for firms in Africa? In the next paragraph some literature on firms in Africa is discussed.

1.6.4 Productivity and African firms

A first issue regarding African firms is whether the markets function in a similar way as in Developed Countries. In the past government policy and performance have been blamed for an environment where markets do not function efficiently. Tybout (2000) findings suggest that when comparing Developing Countries with Developed Countries there is no reason to expect less competition. Firm turnover is equally as important and the dispersion of productivity is similar. A difference that was found was that the scope for realizing scale economies was limited.

Given this observation, the question arises which firms have a better chance to survive in the market. A study by Frazer (2005) tries to analyze firm exit in Ghana by using data on productivity. Ghana was one of the first countries to engage in an Economic Recovery Program (ERP) and liberalize the economy. The main finding of his study is that firms that are less productive are more likely to go out of business. Furthermore capital intensive firms are more likely to exit as well as state-owned enterprises. On the other hand, the firms that are more likely to survive are larger, older and exporting firms.

In a similar study, Van Biesebroeck (2005) investigates the relation between firm size and productivity levels. He uses data set of manufacturing firms of nine sub-Saharan African countries. His findings suggest that in Africa the larger and most productive firms display the highest growth rates and contribute disproportionately to aggregate growth. This leads to divergence between firms at the top and bottom of the distribution. Small firms rarely reach the top in terms of size and productivity distribution. The larges firms achieve higher productivity levels and are more likely to survive. His arguments for this are that the labor market relocates the workers towards the more productive firms. Also large firms have easier access to formal credit. This indicates a positive correlation with productivity and access to credit for large firms.

The study of Mengistae and Teal (1998) tries to assess the effects of trade liberalization on the performance of exporting firms in the manufacturing sector in Africa. Their findings suggest that exporting firms have a higher productivity. It is not clear whether firms are large and efficient because they export, or whether increased size and efficiency is necessary to enable them to export. The findings are that firm level efficiency plays a major role in enabling firms to export. Public sector controls of firms in Zambia and Ethiopia have ensured that they perform well below average in exporting.

A study on the level of technological capabilities in Tanzania was done by Deraniyagala and Semboja (1999). They examine the extent to which manufacturing firms responded technologically to the trade liberalization. They also examine whether the performance of firms in the post liberalization period can be explained in terms of their relative technological efforts and capabilities.
Their findings suggest that in Tanzania the technological response to liberalization is not very encouraging. The initial capabilities were poor and their reaction to liberalization has on a whole been passive or negative. Firms that have displayed better economic performance are those whose initial capabilities where higher. The firms with the highest technological dynamism were the young firms with educated entrepreneurs that provided systematic workforce training.

Moshi (2001) describes two case studies in Tanzania that responded positively to the liberalization. After liberalization the two firms had a higher output, better utilization of capacity, higher productivity, improved product quality and increased competitiveness. However the full potential

benefits of liberalization has been inhibited. An interesting remark that should be given is that the two firms were owned by foreign companies.

These studies show that firms with a high productivity have a better chance of survival. These are mostly larger and exporting firms that have easy access to finance. On the other hand firms that are more likely to exit are state owned and capital intensive firms that produce for the domestic market.

1.6.5 Concluding remarks

The theories and empirical evidence suggest that trade liberalization has a positive effect on economic growth. Trade liberalization allows countries to allocate their resources towards sectors with a comparative advantage and enables the diffusion of knowledge. On the other hand protectionism relaxes firms and leads to inefficient producers.

In most sub-Saharan countries however, opening up did not lead to sustained growth in the manufacturing sector. Most firms were unable to increase the productivity to the level that was needed for competing in the liberalized market. A possible assertion put forward in literature is that the manufacturing sector in Africa failed to grow because of the lack of technological capabilities.

Successful firms in Africa are mostly large firms that export and have easy access to finance. TAMECO does not match this description as it was a state owned company, producing for the domestic market and using capital intensive production methods. According to the literature these are just the factors that are applicable for firms that are likely to exit.

Chapter 2. Technological performance

In this chapter the technological performance of TAMECO is examined. This includes a description of the product, the production process and the changes in these. Also the technological capabilities are investigated by determining the knowledge and skill level of TAMECO.

2.1 Methodology

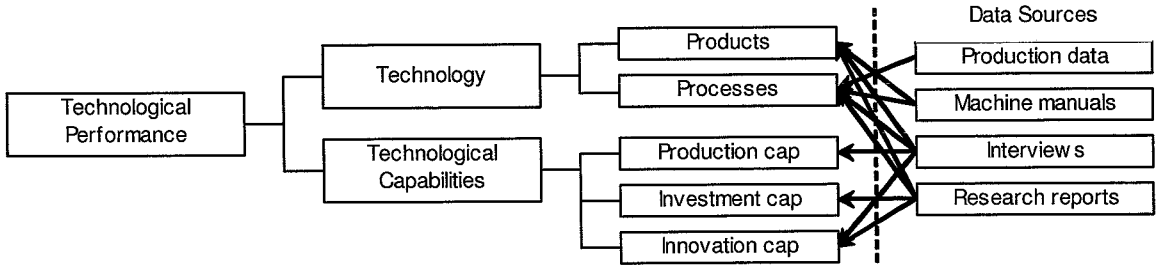
The technological performance is a concept that is closely related with the economic performance or productivity. In the literature there are various definitions of technology. Also concepts such as technological change, technological capabilities, embodied and disembodied technology are used and often overlap and get mixed up (Gonsen, 1998).

According to Van Dijk (2005) technology refers to two different concepts, the embodied technology and the disembodied technology. The embodied technology refers to the physical processes that transform inputs into outputs and the disembodied technology refers to the skills and knowledge that are required to carry out these transformations. Technological change can be seen as changes in the embodied as well as the disembodied technology. Other authors define technology as only the physical products and processes that are used to transform inputs into outputs.

For the disembodied elements they use a separate concept, the concept of technological capabilities. They define technological capabilities as the ability to make effective use of the technology. The level of skills and knowledge are important for this ability (Bell *et al.*, 1982; Basant and Chandra, 2002; Lall and Latsch, 1999). In the literature about technological capabilities three elements are often used. These are the production capabilities, the investment capabilities and the innovation capabilities (Van Dijk, 2005).
The production capabilities refer the skill and knowledge that is needed to transform inputs into outputs. This includes aspects such as production management, engineering, quality control, stock control, repairs and maintenance.
The investment capabilities refer to skills and knowledge necessary to expand capacity and establishing new production facilities. This includes manpower training, feasibility studies and execution of projects in terms of management and procurement.
The innovation capabilities can be defined as the skills and knowledge necessary to develop new products and processes. This mainly consists of research and development.

In this research the following definition will be used. Technological performance can be seen as the amount of technological change and is separated in the technology and the technological capabilities.
Technology refers to the physical products that are the outcome of the production process or processes that are used by the firm to transform the inputs into outputs, such as the machines and tools that are used to fabricate the product.
Technological Capabilities refer to the ability to make effective use of the technology. This consists of the production capabilities, the investment capabilities and the innovation capabilities.

Figure 2.1: Technological performance



The data is gathered from sources within TAMECO. Interviews were taken with the technical manager and the production manager. Furthermore the available literature was investigated which includes research reports, machine manuals and production data.

2.2 Product

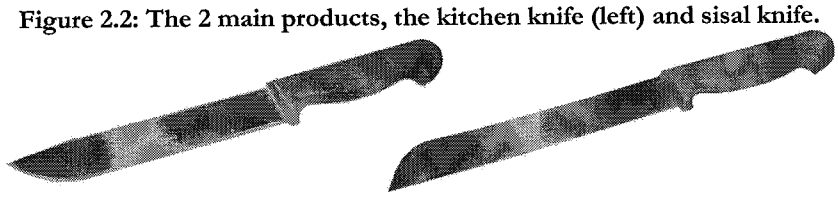
The main product TAMECO used to produce was the 7 inch kitchen knife or multipurpose knife. The kitchen knife was produced at an average of around 400.000 pieces per year in the beginning of the 1990s, contributing almost 97% of the total production. TAMECO also produced a variety of other cutting products such as sisal knives, flaying knives, rubber tapping knives, bush knives, meat inspection knives and tea pruning tools. Of these, the only ones that were produced on a regular basis were the sisal knives at an amount of approximately 10.000 pieces per year. The other types of cutlery were only produced in small amounts and on a demand basis.

Table 2.1: Production of multi purpose knives, 1992-2000

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Multipurpose knives 7"	406,342	272,440	198,674	113,054	83,742	93,759	103,776	76,896	39,536
Sisal knives	11,825	10,136	6,064	10,266	1,440	-	1,578	738	1,669
Other types of knives	1,041	1,571	457	57	0	-	0	0	105
total	**419,208**	**284,147**	**205,195**	**123,377**	**85,182**	**-**	**105,354**	**77,634**	**41,310**
Multipurpose (%)	96.93	95.88	96.82	91.63	98.31	-	98.50	99.05	95.71

Source: Stores ledgers, various years

Figure 2.2: The 2 main products, the kitchen knife (left) and sisal knife.



During the TAMECO lifespan there were some changes in the appearance and materials of the product. One was the change form wooden handles to plastic handles. An injection moulding machine was purchased in 1989. The other was the change from carbon steel blades to stainless steel blades. Both changes are discussed here.

2.2.1 Changes from wooden handles to plastic handles

In 1989 the handle material changed from wooden handles to plastic handles. The wooden handles were at first made by hand in an artisan way. In 1980, with the new production line installed, TAMECO was also supplied with a complete set of wood working machines to produce wooden handles more effectively.
During the period from 1980-1987 this process was working smoothly without large problems. The handles were produced in the wood workshop which was producing at full capacity employing 23 persons. In the mid 1987 however TAMECO recognized there were some drawbacks considering this material. The handles were produced with Garvelia wood, a type of wood with a brown/yellowish colour and a soft and long fibre structure. Because of this structure 30% of the handles were damaged in the milling process and could not be used as knife handles. In the mid-1980s the price of wood was also increasing rapidly and woodcutting was leading to deforestation which became a great concern for the government.

These factors forced the management to look for new options for handle making. With the help of HIVOS a Dutch consultant was send to TAMECO in March 1988 to investigate and write a report about the matter[2]. The report describes two options to improve the handle fabrication and both are

[2] No author or publishing date could not be found.

compared with the original process. One was the purchase of a rotating milling machine[3], which could make a wooden handle in one piece. The second option was the purchase of a pressure moulding machine[4] to produce polypropylene handles. With this machine poly-propylene grains could be moulded into handles and at the same time be attached to the blades. These two options were compared with the original method in terms of costs, production process and market considerations.

The cost calculation included input materials, labour costs, electricity, repair and maintenance and depreciation of the machine. The calculations showed that both methods would have an additional cost advantage due to the fact that the handle side of the steel blade could be shortened and material could be saved, see Figure 2.4. This additional cost advantage was calculated. The outcome was that both the rotating milling machine and the pressure moulding machine would produce the knife blades at lower costs. As for the initial investments (purchase, transport and instalment), the rotating milling machine was estimated at DFL 186.400, - and the pressure moulding machine at DFL 205.700,-.

Figure 2.3: Old and new blade shape

The production process of the two options was also investigated. With the rotating milling machine a piece of wood could be mounted and then the machine would automatically execute the milling operations. Still it would require the same production steps as the original method and at least 19 skilled employees would be required to execute the work. Also both processes required various input materials as saw blades, emery cloth glue and rivets. This process is difficult to control from both quantity and quality point of view.
The pressure moulding process also had some drawbacks. The machine has a complicated electric regulation system and the process must be clean and accurate. TAMECO at the time did not have any experience with such sophisticated machines. The advantage was that the number of steps in the process could be reduced. With this machine only 5 employees were required and the process would become easier to manage.
In terms of production capacity both options were calculated and based on an 8 hour shift with 200 working days a year. For the rotating milling 4 handles per minute could be manufactured meaning a capacity of 384.000 pieces a year. For the pressure moulding machine it would take approximately 70 seconds to produce 4 handles, the production capacity was calculated at 326.400 pieces a year. Production could easily be increased by running more shifts.
With regard to the market situation TAMECO at the time was still dependant on one large customer (HOSCO) as far as prices and quantities. At the end of the 1980s the market situation changed. The market was liberalized and with the introduction of the Open General License in 1988 customers had the opportunity to buy foreign knives. TAMECO wanted to become a self-reliant company and was also looking for opportunities to get customers and the option to export knives to Rwanda-Burundi and Uganda. In order for these plans to work the quality of the knife had to improve.
A small consumer test was executed to see what types of knives were preferred by the consumers. In this test women were given the opportunity to choose from four different types of knives. The choices ranged a German knife with a wooden handle and a German knife with a polypropylene handle, a TAMECO knife with wooden handle and a TAMECO knife with a polypropylene handle. It turned out that 70% preferred the German knife with the polypropylene handle and the other 30% choose the German knife with the wooden handle and. None of the women preferred a knife made by TAMECO but it has to be noted that price did not play a role in this test. The considerations for the choice of the polypropylene handle were durability, strength, colour and decency. The considerations to choose the wooden handle were shape, colour and a preference for timber.
With these observations in mind the report concluded that the option of the pressure moulding machine was the most attractive. The process of producing wooden handles, which consisted of at least 13 steps and was labour-intensive and therefore difficult to control, could be abandoned. The

[3] This machine could be supplied by Verboom b.v. at Renswoude
[4] A second-hand machine could be supplied by Philips

polypropylene handles would improve the quality and looks of the knives and the production process would be easier to control and manage. Regarding the financial situation it was recognized that TAMECO's loan situation was tight but the investments could be earned back quickly. According to Op het Veld (1987) the return on investment could be there within one year of purchase.

2.2.2 Change from Carbon steel blades to Stainless steel blades

Another change was in the material used for the blades. The blades were always produced from carbon steel. In the beginning steel plates were used with a thickness of 2mm but in the mid-1980s this changed to plates with a thickness of 1.6mm to save material. A big problem regarding the use of carbon steel as a material for the blades is rust. Since the beginning of knife production customers complained about the blades being rusty even before use. In 1987 this matter was looked into. Some of the staff-members were sent to manufacturers in Holland and Germany in order to solve this problem. Some measures were taken at the time.

- The grinding of the blades was at lower speeds in to improve the surface structure.
- The stacking of blades into the polishing machine was changed leading to better results.
- The blades were carefully cleaned, oiled and wrapped before packing

These measures resulted in a better product and customers were satisfied with the improved quality.

In the beginning of the 1990's TAMECO had serious plans to start production of stainless steel knives. In 1993 a number of Dutch students of the TU/e were sent to TAMECO to conduct research on the feasibility of the production of stainless steel knives.
First the market opportunities were investigated by Looijen and Sonke (1993). Their findings suggested that most of the users were satisfied with the carbon steel knives but that there was also a demand for stainless steel knives. At that time there were few domestic competitors in Tanzania and the major threat on the market was from imported knives from China, India and Korea.
The assumption was made that only the high income groups wanted stainless steel knives and that these knives had a higher durability and lifetime. The market size was estimated at 440.000 stainless steel knives and 3.760.000 carbon steel kitchen knives. TAMECO at the time produced approximately 400.000 knives a year. The authors recommended TAMECO to diversify the product range with production of stainless steel knives besides the carbon steel knives.
Another study was done by Radstock (1993). The focus of his investigation was whether stainless steel (in this case X45 CrMoV) was suitable for knife production and what changes in heat treatment were needed. The heat treatment for Carbon steel consisted of 5 minutes of hardening at 930°C (some report note 1050) and quenching in oil followed by tempering at 370°C for 10 minutes. In case of stainless steel the heat treatment changed to hardening at 1050°C for 8 minutes and quenching in oil followed directly by tempering at 200°C for 20 minutes. It was concluded that with the current equipment of TAMECO it was possible to produce stainless steel knives.
Both reports also suggest choosing for a different shape of the blade for the stainless steel knives and the carbon steel knives. In that case the stainless steel blades would not get mixed up in the production process. Also the customers then could easily recognise the differences between the knives. It would help to explain the price difference.
A third report was written by Schaapherder (1994) who investigated new market opportunities and executed a feasibility study on the topic. In his study a project was proposed in which TAMECO could increase its production capacity to 1.2 million knives a year and increase product differentiation by starting production of stainless steel knives. In his project some of the machines needed replacement and a new pressure moulding machine had to be acquired. The conclusion of his study was that this project was only feasible under certain conditions

- An Investment Promotion Centre (IPC) certificate had to be obtained.
- The number of shifts had to be increased to 3 shifts a day.

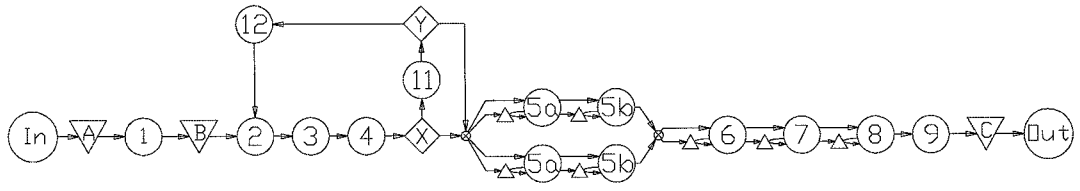
The author also recognized that TAMECO at the time was facing large liquidity problems and had a lot of problems getting foreign exchange. Because of the liquidity problems TAMECO had to postpone the plans of producing stainless steel knives. In 1999 TAMECO did have the opportunity to buy an amount of stainless steel from a steel company in Dar es Salaam that got bankrupt. After the procurement they were able to produce an amount 100.000 stainless steel kitchen knives.

2.3 Production process

During the history of TAMECO the process of producing knives has evolved. At first the knives were produced by hand in a traditional smithy process. The knives were produced from scrap materials, mostly old car springs and leaves. These were cut to size and forged by hand into the form of a knife blade. These were cut and grinded into the right shape and then polished. After this the wooden handles were made and attached to the blade. The production at the time was about 80 pieces a day (Bossché, 1982).

With the help of HIVOS and the TU/e a new production process was designed and implemented between 1979 and 1981. In 1980 a new production line came into order. This production line made it possible to increase production to approximately 250.000 a year. The bottleneck in production proved to be the grinding of the blades. In order to increase production a new set of grinders was acquired in 1988, doubling the production capacity. Another change in the production line was the process of making handles. Before 1988 handles were made from wood, a process that contained many different steps and therefore was difficult to control. In 1989 an injection moulding machine was acquired and handles were made from polypropylene from then on. This change reduced the number of process steps for handle making from 6 to just 1. The production line has stayed unchanged since then and is still present today although it is not running anymore. The process steps of the production line will be explained here. For further detail about the process steps see Appendix C.

Figure 2.4: Flowchart production process, 1989-present



Process step
Storage/Buffer
Test/Inspection
Outbound buffer
Nodal point

In	Delivery of raw materials	6	Polishing blades
A	Storage of raw materials	7	Additional sharpening
1	Pressing blades	8	Moulding handle
B	Storage of blades	9	Packing knives
2	Hardening blades	C	Storage of finished knives
3	Quenching blades	Out	Knives sold to customers
4	Tempering blades		
X	Testing blades	11	Straightening blades
5a	Left hand grinding	Y	Retesting
5b	Right hand grinding	12	Annealing blades

The process starts when the raw materials are delivered at TAMECO. When the raw materials arrive they are at first stored in the storage building. If production of a knife begins the metal sheets are transported from the storage building to the knife workshop, see Appendix C.
An eccentric press is used to press the blades. Metal sheets are used as input materials. There are two dyes available for the pressing of the blade, one dye with one hole and the other dye with two holes for handle attachment. With just one hole the plastic handle would easily come loose from the blade so in that case an extra hole is drilled to increase quality and durability of the knife.
The pressing of the blades is a process step with a high throughput and therefore large quantities of blades are pressed at once. A production buffer is created after the pressing in order to store the blades.

The second phase in the production process consists of the heat treatment. In the heat treatment several steps are taken. First the blades are hardened in a furnace at a temperature of 930°C[5] for 5 minutes. After the hardening the blades are quenched. Low carbon steel is quenched in water while

[5] In most reports 1050°C is stated but according to Radstock (1993) the hardening temperature was 930°C. This was because of a difference between the setting temperature and the actual temperature

high carbon steel is quenched in the oil bath. After the heat treatment the blades are very hard and brittle and they break easily. To reduce the inner tension and increase the strength of the material the blades are tempered in the tempering furnace. The tempering is at a temperature of 370°C for 10 minutes. Thereafter the blades are tested to see if the blades are straight enough and if the heat treatment has had the desired result. 10% of the blades fail the test and need to be straightened manually by using an anvil and a hammer. Thereafter the blades are retested. The test consists of bending the blades. 0.5% of the blades fails the test and goes back to the hardening oven for annealing 800°C for 2 minutes, thereafter the steps of the heat treatment are repeated. The separate steps in heat treatment are done successively, without buffers and delay, in order to improve consistency in the results.

The next step in the production process consists of the left hand grinding (5a) and right hand grinding (5b). These steps are also the bottleneck of the production process. Buffers are built in to relieve the bottleneck and to make sure production can continue even in case of machine breakdowns. Outbound buffers are placed between the process steps and have a size of approximately three days of production. As the production target is set at 1500 products a day, the outbound buffer has a size of 4500 blades. TAMECO owns a total 4 grinding machines forming 2 sets. One set consisting of a left hand grinder, and a right hand grinder. The blades are grinded through a copy-grinding process. The first set was installed in 1980 and a second set of grinding machines was installed in 1988. The new grinding machines were acquired in order to increase production capacity in the bottleneck of the production line. With the purchase of the new set of grinders the production capacity doubled.

After the grinding the blades were polished. The polishing machine is capable to process multiple blades in one session. TAMECO has designed a bracket so approximately 16 knives can be processed at once. When the blades are polished some additional sharpening, shaping and polishing is done. This can be seen as an extra step in the production process and it is required because the end result of the grinding and polishing does not deliver sharp blades. The additional sharpening is done manually with the use simple grinding stones or polishing stones. Because of manual routine that is required, the sharpening is done by experienced employees only.

Now the blades are ready for attaching the handle. After 1989 the injection moulding machine was used which could process 4 blades at once. The handle was made from Polypropylene and is available in different colours. Also a machine was acquired which could be used to recycle the polypropylene waste material from the handle moulding. With the moulding machine the various steps in handle making were reduced to just one step and only 2 operators were needed.
With the handles attached onto the blade to end product was ready to be packed. The knives were packed in boxes of 12 pieces and cartons of 12 boxes, making a total of 144 per carton. The cartons were then transported to the storage area were it was stocked. The knives were now ready to be sold and waiting for customers.

In 1988 an injection moulding machine was acquired and handles, from then on, were made from polypropylene. This change simplified the production process. Both processes are explained here shortly. Before 1988 the handles were made from wood. The handles were produced in the wood workshop which was producing at full capacity employing 23 persons. The process of attaching the wooden handles consisted of at least 6 steps and was therefore difficult to control. The separate steps are presented here shortly.

1. First the wood was sawed into planks in order to get a smooth surface.
2. The planks were then sawed into small strips of which one handle could be made.
3. These strips were milled into the shape of the handle and were sawed into halve.
4. Three holes were drilled in the handle halves.
5. The handles were then mounted on the blade; aluminium wire was used to rivet the handle onto the blade and glue was used for extra strength.
6. The knives were finished by grinding the handles with an emery disc and oiling the handle and blade.

It was estimated that during the process 30% of the handle halves were damaged during the milling of the handles and could not be used therefore. This was mainly caused by the type of wood that was used which had relatively soft and with long fibres and was therefore sensitive for damage during the process. Also the wooden planks were stored in the open air without protection from sun or rain, leaving the planks in a bad condition, bended, twisted and with cracks.

2.3.1 Bottleneck in the production process

Each machine in the production line is limited its physical capabilities. One of these is the speed at which the machine is able to produce. The bottleneck in the production line is where the speed of production is lowest. In this paragraph the bottleneck will be determined for the production line after 1989 based on the production records.

In order to determine the bottleneck, a sample is taken from daily production records for each of the process steps in the production line. Records were available for the eccentric press, the hardening and tempering furnace, the grinding machines, the polishing machine and the injection moulding machine. For some of the process steps, such as additional sharpening and packing, no data was available. These steps are not expected to be a bottleneck in the production process because they are done manually and on simple machines and they are therefore left out of the analysis.
The records that were available are used for taking samples, these were taken from days that no problems were recorded in order to reduce external influences and get a clear picture of the optimal production speeds. The period in which production was recorded was from 1990-1995.
From each year 36 samples were taken randomly making a total of 216 samples over the period. For the eccentric press and the polishing machine the production records for some years could not be retrieved.
With these records the production per hour could be calculated and the bottleneck is determined, see Table 2.2. Also the average time of a shift is calculated and the average input of labor units, workers in a shift.

Table 2.2: Bottleneck in the production line

Production line records (1990-1995)	sample size (shifts)	AVERAGE			BOTTLENECK		Value[a] (million TSH)	Share of total (%)
		labor units per shift	shift time (hours)	Prod. per hour	sets	production per hour		
Excentre press	89	3.66	4.84	1685.6	1	1685.6	6.5	8.0
Hardening furnace	216	2.77	3.89	603.8	1	603.8	2	2.4
Tempering furnace	216	2.95	4.39	510.3	1	510.3	1.1	1.3
Grinding machines	216	1.65	6.99	109.2	2	218.4	34.0	41.6
Polishing machine	193	1.85	6.02	323.3	1	323.3	7.5	9.2
Moulding machine	216	1.43	5.94	226.2	1	226.2	30.6	37.5

Notes: [a] Replacement value in 1994 based on Schaapherder (1994)
Sources: Daily production records: Eccentric press, Hardening furnace, Tempering furnace, Grinding machines, Polishing machine, Injection moulding machine (1990-1995)

As the table shows the average production per hour is the lowest at the grinding machines at a level of 218.4 products per hour. Also the production speed at the injection moulding machine is relatively low at a rate of 226.2 per hour. The replacement values show that not only in productive terms but also in financial terms the grinding machines and injection moulding machine form the bottleneck in the production process. These machines form the core machinery in the production line. For more detail on the separate machines, or separate years see the tables presented in Appendix B.

2.3.2 Production Inputs

The production inputs for knife making are discussed in this paragraph. The production inputs are the inputs in raw materials and parts that were needed for the production of the kitchen knife. The production inputs can be divided into direct production inputs and indirect production inputs. The direct production inputs are the raw materials that are visible in the end product. The indirect

production inputs are the materials or parts that were used in the production process but that are not directly visible in the end-product.
The process of acquiring the production inputs was as follows. In order to get the production inputs TAMECO used to order all their raw materials and production supplies through the Eindhoven University of Technology. The orders would be placed at CICA, Centre for International Cooperation Activities, which served as an intermediary agent for foreign exchange provision programs of HIVOS and the Royal Netherlands Embassy in Dar es Salaam.
The production inputs were supplied by companies in the Netherlands and Germany. The shipments were done at most once a year. The shipment consisted of a container stacked with all kinds of goods such as raw materials and spare-parts that were used in the production process. A drawback of this was that there was a long lead time for the production inputs. The time between the moment of order and delivery of the goods at TAMECO could take up to one year.

The direct production inputs in the TAMECO carbon steel knife are steel to make the blade and the material to produce the handle of the knife. Bundles of steel sheets, type CK75, DIN17.222, were imported from Holland. The sheets were cut to size before delivery. The steel sheets had a length was 2000 mm and a thickness of 1.6 mm. The width of the sheets ranged from respectively 225, 323½ and 325 mm. The supplier was "Metaalcompagnie Brabant B.V." located at Valkenswaard, The Netherlands. One metal sheet was enough to produce 64 knives. The amounts that were delivered ranged from 10 to 65 tons of steel. With one ton of steel can 8,550 knives can be produced (Schaapherder, 1993).

The polypropylene that was used to make the handles was also imported. The polypropylene was Novolen 1100L transparent or black 99990. By mixing the polypropylene with pigment different colours could be made. The pigment was mixed in a 50:1 ratio and TAMECO used to produce handles in the colours green, red, brown and black. 1 kg of polypropylene was enough to produce 24 knives.

Before the purchase of the pressure moulding machine in 1990 the handles were made from timber. The most common type of wood that was used was Garvelia wood which was bought locally. In some occasions a different kind of wood was bought, Mkangazi, but this was of inferior quality and therefore not used a lot. The amount of timber was measured in cubic foot; 1 cubic foot of timber was enough to produce 108 handles.
With the production of the wooden handles also iron or aluminium wire was needed to attach the handles onto the blade. The handle and blade both had three holes through which aluminium wire was riveted for the attachment. The aluminium wire was both locally and 1 kilogram of aluminium wire was enough to produce 327 knives. For a stronger fixation the handles were glued onto the blades. The glue was mostly acquired locally but also sometimes imported. 1 litre of glue was used to produces 504 knives.

The indirect production inputs consisted of a variety of materials and parts that were used in the production process. The most important ones are discussed here. When the blade is pressed in the right shape a heat treatment must be done which consists of hardening and tempering. After the hardening the blade is quenched in an oil bath. The hardening oil that is used in the bath is quendilah no. 32 oil. The oil available in drums of approximately 200 litres and is purchased locally. The oil in the bath is replaced after the production of 24,960 knives.

Table 2.3: Production inputs

Production inputs	unit	knives per unit [a, b]	knives per unit*	price per unit (TSH) [b]
Direct production inputs for 7" knives with plastic handles[b]				
carbon steel	kg	8.55	9.3	670.53
polypropylene	kg	24	23.6	472.40
Direct production inputs for 7" knives with wooden handles[a]				
carbon steel	kg	4,95	na	na
rivets	kg	327	na	na
garvelia timber	cf	108	na	na
glue	ltr	504	na	na
Indirect production inputs[b]				
grinding stones	pcs	24,672	13,837	14,000.00
hardening oil	ltr	125	369	459.60
grinding wheel	pcs	960	1,174	4,518.05
polishing paste	bars 2,5 kg	292	395	4,634.00
polishing buffers	pair	24,962	622	876.34
emery discs	pcs	48	3,463	3,422.22
boxes L/S	pcs	144	107	174.67
boxes S/S	pcs	12	12.3	732.11
rust preventive	kg	960	656	2470.72

Notes: * based on own calculations, [a] budget 1985, [b] budget 1994, na = not applicable
Source: TAMECO budget

The grinding machines needed magnesite bonding grinding wheels. These had to be replaced after approximately 960 blades. The wheels were ordered in the sizes 350/360 x 125 x 270 mm. For the grinding process also a rust preventive agent was needed. This agent came in the form of powder mixed with water and was sprayed on the grinding wheels for cooling, reduce friction and the transport of metal particles. Both inputs for the grinding process were imported from Holland

For the polishing of the knife blades the following inputs were used. First there were polishing buffers to prevent the left hand and right hand rollers from colliding. The polishing buffers were made by TAMECO using emery discs and glue. 1 pair of polishing buffers was enough for the production of 24,960 knives. For the polishing process also polishing paste was needed. The paste came in the form of bars of 2 kg or 2.5 kg to polish the blades. The bars were purchased locally and with one bar of 2.5 kg 292 knives could be produced.

Knives are sharpened manually. Grinding stones are needed for the sharpening of the knife. A grinding stone had to be replaced after 24,960 knives. Besides these material inputs listed in Table 2.3 also some other inputs were used. These are oils for hydraulic and lubrication purposes, hacksaw and planer blades for the wood workshop, drill bits, leather gloves, cello tape, safety glasses, welding gas, circle saws, emery cloth, tools and spare parts. Two other important indirect inputs are electricity and water. Electricity is used for machines and water is used for cooling.

After assembly the knives were put in small boxes with a capacity of 12 pieces. In case of large orders these boxes were put in cartons with 12 boxes. Before packing the knives were rubbed into oil to prevent it from early corrosion.

2.4 Technological Capabilities

The level of technological capabilities is reflected in the knowledge and skill level of TAMECO. There are three elements in the technological capabilities. The production capabilities refer the skill and knowledge that is needed to transform inputs into outputs. This includes aspects such as production management, engineering, quality control, stock control, repairs and maintenance.
The investment capabilities refer to skills and knowledge necessary to expand capacity and establishing new production facilities. This includes manpower training, feasibility studies and execution of projects in terms of management and procurement.
The innovation capabilities can be defined as the skills and knowledge necessary to develop new products and processes. This mainly consists of research and development.
The initial level of Technological capabilities is determined by the education level of the members. Technological capabilities can be acquired through a learning process. For a company as TAMECO technological capabilities can also be acquired through the input human capital.

The initial skills and knowledge level of TAMECO was quite low. The person with the highest of education was the General Manager. He was trained as an engineer in the former Soviet Union for three years. After joining TAMECO he participated in various management courses, often in Europe. Most other members were not really educated besides primary education and some basic courses. The members of the management and some of the technical department received training courses. Skills on knowledge was mainly gained only through experience "learning by doing" and through training "on the job".

The production capabilities were initially low. Before 1985 no collective production targets or production records were maintained. The production targets at the time were set at an individual basis not collectively. From 1985 onwards some improvements were made. Production records were kept more frequently with daily, weekly and monthly production records.
In the period 1990-1995 production records were kept for each day and machine. From 1996 onwards this was not normal practice anymore because of erratic production.

The maintenance and repairs of the machines in the production line is carried out by the Technical Department. A record system of maintenance and repairs was introduced in 1983. The system consisted of a preventive maintenance scheme and a repair system.
The preventive maintenance scheme represented the activities on a time schedule. For all machines the maintenance activities were written down on a weekly, monthly and quarterly basis. These activities were planned in a yearly planning list. Each time an activity had taken place this had to be reported in the maintenance report. However according to the reports of Op het Veld (1985, 1989) the maintenance reports were inconsistent and it is unsure that the maintenance was really executed.
"The maintenance system was nicely designed but not maintained. TAMECO has little information about the history of the machines and there is no control over the technical maintenance of the machines"

In case of machine repairs there were two forms that had to be filled in, a work-order and a machine card. When a machine breakdown occurred these forms had to be filled in with the amount time spent on the repair and the materials and spare parts used in the repair. The machine cards would show the history of repairs on each of the machines. In practice the machine cards and work-orders were not systematically kept and in some cases were inconsistent and in some cases did not match with each other.

Because of the inconsistency in the record system it is difficult to make statements about repairs and maintenance. It seems that preventive maintenance was not done in a proper way. Except for simple activities like greasing and lubricating the maintenance was not done due to lack of spare parts or capital. Parts were only replaced after a machine broke down and not for preventive maintenance purposes. The result was that when a machine breakdown occurred and parts needed to be replaced, no spare parts were present or available for TAMECO and the machine had to be repaired in a provisional way.

The investment capabilities were initially also low. There bookkeeping system before 1985 was not fully optimized and could be improved. In that period no systematic use was made of budgeting and costs control. Also no proper cash control was maintained and the account codes were haphazardly arranged (Op het Veld, 1985). Basic financial administration methods such as debtors and creditors accounts and monthly progress reports on costs were not properly maintained. With training and guidance through HIVOS some things were improved though. In 1987 the budget was increasingly being used as a management tool and bookkeeping was improved. Still there was room for improvement as the budget was based on values in stead of consumption of physical quantities.
In that period also the market situation changed. The initial level of marketing knowledge was low. Through training of the marketing manager, partly abroad, some results were achieved. New distribution channels were maintained and promotion improved.

In terms of training the General Manager was send most training courses. After joining TAMECO he participated in various management courses, often in Europe. The other managers also received training courses. The marketing manager received a course of 1 year in the Soviet Union in 1989. The administration and financial manager received a training course in Holland for two weeks. Also the technical and production manager received a course in Germany for two weeks on quality control. Such training courses were only available for the management of TAMECO. Besides these training courses abroad the staff also received training courses locally. In 1986 the financial manager received a training course from a local consultant in order to improve bookkeeping and budget control. The production personnel mainly received training on the job and learned skills in a learning by doing process.
The technical manager had finished a two years training course at the High technology centre in Mwenge. Also two persons of the technical department attended a one week technical maintenance course in 1984 at SICATA (a branch of SIDO for training and consultancy). This was a practical course with emphasis on the importance of machine lubrication, machine cards for history, annual maintenance plan, manual for machinists.
Another person followed a two week workshop maintenance course. This course touched upon all aspects of proper workshop management like safety aspects, quality control and machine maintenance, as well as drawing up an action plan (Op het Veldt, 1985).

2.5 Concluding remarks

During the time TAMECO was active in knife production some improvements were made on a technological front. The quality of the product had improved through changes in the handle materials from wood to polypropylene. Also the production process became more technologically sophisticated with the purchase of an extra set of grinding machines and the injection moulding machine.

The technological capabilities also improved in the 1980s. Starting out at an initially low level the capabilities were gained through experience, on the job training and local training courses for the managers.
The in terms of technology one can say that improvements were made. In terms of the international setting the performance seems moderate. Improvements were made on most levels but still there is a lot of room for progress.

Chapter 3. Productive performance

This chapter describes the productive performance of TAMECO. The chapter consists of two subjects that are closely related to each other. First the productivity figures are calculated. The second subject is the calculation of efficiency and utilization levels of the production line. At the end of the chapter a discussion and some concluding remarks are given.

3.1 Methodology

Economic or productive performance is usually measured by determining the productivity of a country, sector or firm. At macro level, a production function can be used to explain the basic pattern of economic growth and performance. The production function links output with the factors of production (Land, Labour, Capital and level of technology). The traditional form of the production function is that the output (O) depends on the primary inputs, which are the amount of Labour (L) and the amount of Capital (K), and the intermediate products, such as materials and energy (Schreyer and Pilat, 2001). An example of a common used production function is he Cobb-Douglas production function which can be written as:

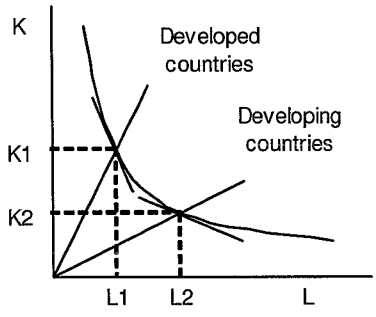
$$O_t = T_t * K_t^{\alpha} * L_t^{\beta}$$

With O = the real output, T = total productivity, K = capital input, L= Labor input, α =elasticity of output in respect to capital input if labor is constant, β = elasticity of output in respect to Labor input if capital is constant, t = point in time

If output is a function of labor and capital, then an increase in output can be achieved in three ways:

- An increase in the labor stock
- An increase in the capital stock
- An increase in total productivity

Figure 3.1: Choice of Technique



The productivity term is influenced by factors such as economies of scale, advances in knowledge and skills, better organization and improvements in other factors of production. Companies have the choice in what ratio labor and capital is used in the process. This choice of technique can be determined by the availability of the labor input or capital input. Often the assertion is made that in developing countries labor is cheap and easily available and capital is scarce and expensive. Therefore it can be argued that in developing countries production should be labor intensive

Productivity is a fairly straightforward indicator linking the inputs of the production process with the outputs. In practice several issues arise while determining productivity. First of all one has to determine what indicator of productivity is useful to calculate. There are three indicators that are commonly used to calculate the productivity, which are derived from the production function, the Total Factor Productivity (TFP), the labor productivity, and the capital productivity.
TFP resembles the productivity combining all the factors in the production process and is often regarded as a measure for the level of technology. Labor productivity resembles the value that the labor force of a firm adds to the final product. Capital productivity measures the value that the capital goods, such as machines and tools, add to the product. These are related as labor productivity can be increased by adding more capital into the production process. On the other hand capital productivity might be positively influenced by adding more labor into the production process. All the three productivity measures, labor productivity, capital productivity and total factor productivity are calculated in this report

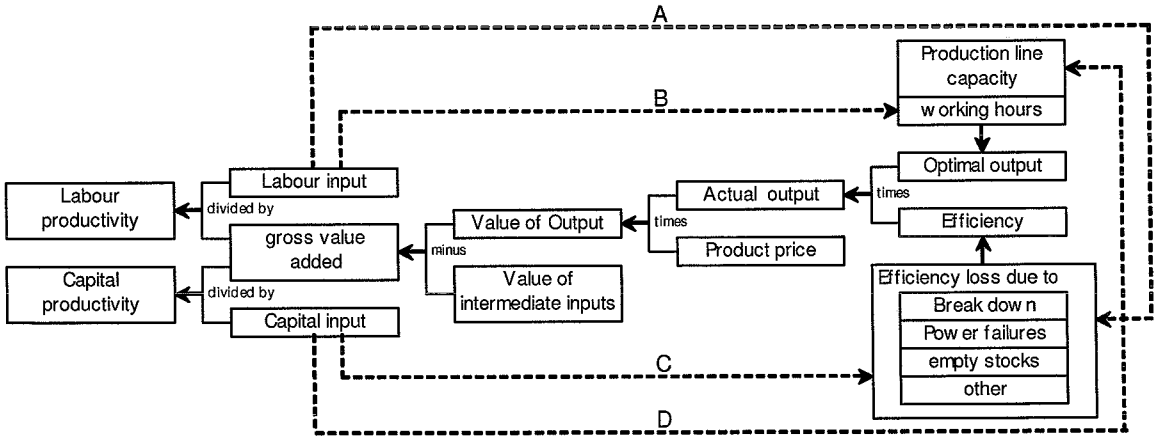
There are two ways to determine the productivity. First is the gross output approach, which measures productivity in linking primary inputs and intermediate inputs with the gross output. Second is the value added approach that links the primary and intermediate input with the value of outputs. The value added approach is often used when comparing differences between countries.
Another methodological issue is whether to calculate the productivity constant prices or current prices (Schreyer and Pilat, 2001). In the case of TAMECO it will be useful to determine the productivity in constant prices so that differences between the years become visible.

Value added productivity can be calculated by multiplying the physical output by the price at which the product is sold. The physical output is affected by many determinants such as the number of machines, machine capacity, work intensity, time loss due to machine breakdown and maintenance work. The determinants could also influence each other, for example, maintenance of machines will cost working hours and has a negative influence on labor productivity, but it will probably reduce the machine breakdowns and therefore improve the efficiency. The net result of maintenance work could be positive depending on the efficiency improvement.

The methodology to calculate productivity is similar to the previous work of Ten Brinke (1995) and Minderhoud (2002), see Figure 3.2. The Gross value added is determined by subtracting the value of the intermediate inputs from the value of production. Labor productivity is defined as the gross value added per employee. The labor input is based on the headcount of employees. The capital input is determined by the value of the machines that are used in the production process.

Both measures can be aggregated into efficiency levels in the production process. With the actual output known and the optimal output that can be calculated, efficiency and utilization levels can be determined. Efficiency and utilization are determined by factors such as machine breakdowns, electricity problem, and etcetera. By calculating the influence of the factors one can get a clear picture on how these affect the overall productive performance. In the case of TAMECO important factors like machine break downs, empty stocks and power failures that case production to halt are important. The following figure represents the relation between the inputs.

Figure 3.2: Productivity measures



The dotted lines represent the relation between the input of labour or capital and the actual output of the production line. If more labour is added into the production process this will improve the efficiency (A). Think of problems such absenteeism or sickness which could be taken care of or machine breakdowns that could be repaired more quickly. Also the optimal output (B) can be improved if more shifts are done.
The capital input also influences the optimal output and efficiency. If more capital is added to the production line (D) such as adding grinding machines the production capacity will increase. Also efficiency losses could be reduced. The problem of electricity or power failures could be solved by the purchase of a power generator.

The third measure of productivity is Total Factor Productivity. This can be calculated with the data in the following way. First indexes of the labour input and the capital input are calculated. With these indexes the growth rates of labour and capital can be determined. The growth rate of Total Factor Productivity can be calculated and the index can be determined by using the following formula (Maddison, 1987).

$$\dot{A} = \dot{O} - \alpha\dot{L} - (\alpha - 1)\dot{K}$$

With A= growth of total factor productivity, O= growth of output, L= growth of labor input, K = growth of capital input, and α = the wage share in value added.

3.2 Productivity

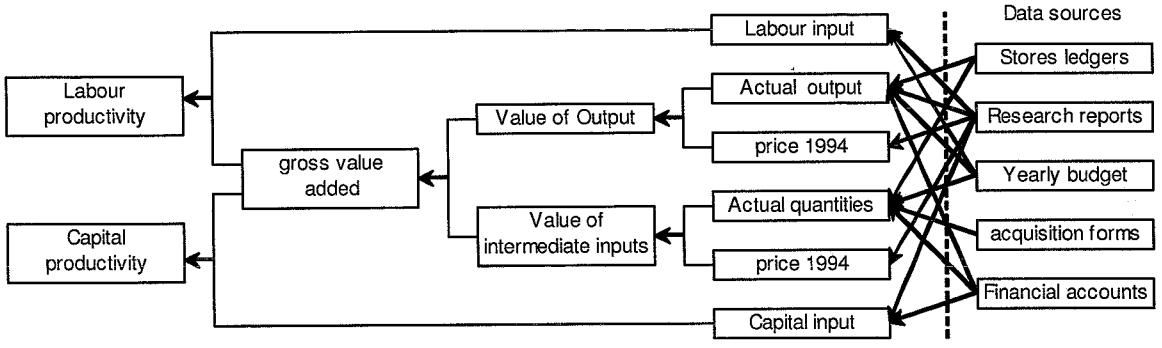
In this paragraph the results of the productivity calculations are presented. First the data acquisition is explained. Thereafter the results of the calculations are presented. This includes the labor productivity, the capital productivity and the total factor productivity for the period 1985-2000.

3.2.1 Data acquisition

The data was gathered by using material from the archives. During the research it became clear that the archives were not very structured and it was difficult to retrieve the data. In this part of the research multiple sources are used in order to get a complete picture. The data for calculating the labour productivity is on a yearly basis. The labour productivity is calculated in 1994 constant prices so that trend in years can be analysed.

The value of output is calculated from the actual output and production price. The actual output was found in several research reports and was gathered from stores ledgers. On the stores ledgers the total of produced knives was recorded. Before 1981 the production output could be calculated by dividing the income of sales with the selling price. The production output is on a yearly basis and represents only the production of multipurpose knives. Other types of knives only contribute for a small part in total production as can be seen in Table 2.1 and are therefore left out of the analysis.

Figure 3.3: Data sources for determining productivity



The value of output is determined by the actual output and the price. As the productivity will be calculated in constant prices only for one year the price rate is used. The base year that was taken for this calculation was 1994. The price of a multipurpose knife in that year was 575 TSH (Schaapherder, 1994).

Intermediate inputs are the inputs needed for production of a knife. The direct inputs are the raw materials such as carbon steel sheets and polypropylene for the handles. Besides the direct inputs also indirect inputs are needed in the production process. These are inputs like grinding stones, hardening oil, polishing paste, drill bits and electricity.
For the calculation of labour productivity the value of these intermediate inputs must be calculated. One way of calculating the value in constant prices is to use data on physical quantities. These can be multiplied by the value of the inputs in one year (1994) to get the data in constant prices.

The data for the production inputs was gathered from three sources. These were the yearly budget forms, the stores ledgers and the material requisition forms. The forms independently show the amounts of physical quantities of the production inputs used. The main reason for using three data sources in stead of just one is that for most years only one data source was available and for some years even none. If more than one data source was present this could be used to cross-check the data and to see if the data is viable.
The yearly budget forms are the most straightforward data source. Each year the administration department had to make a yearly budget calculation for the coming year. A basis for this calculation was the amount of material inputs that were actually used that year. The annual budget shows how much of each production input was used in the previous year.
The second data source was the stores ledger. These were forms that were kept in the stores of TAMECO. A stores ledger was maintained for each individual material/product. Each time an amount of this material was transferred from production to stores this would be noted on the stores ledger. The amounts that were transferred to production are taken as the amounts used in the production process.
The third data source was the material requisition forms. These forms were kept by the production department and represented the data for each time materials were transferred from the storage to the production department. All three sources present the physical quantities and should, in theory, show equal amounts. In practice however some quantities did not match the different data sources. In those cases the data that that seemed most reliable to the researcher was selected.
For some years no data was available. In those years the quantities were calculated by dividing the total production with the quantity of an input that was needed to produce one knife.

Table 3.1: Data sources of physical quantities used in the production process

Data sources	Years available
Yearly budget	1985, 1988, 1990, 1991, 1993, 1994, 1995, 1998
Stores ledger	1984, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000
Material requisition form	1996, 1997, 1999
No data available	Before 1984, 1986, 1987, 1989

The value of the intermediate inputs is calculated in current prices with 1994 as a base year. A complete overview of the production inputs in physical quantities is presented in Appendix D.
The intermediate inputs do not represent all the inputs in the production process. Some items like emery cloth, circle saws, dust masks are left out of the analysis. Also for the energy consumption, electricity use and water it was difficult to retrieve the actual quantities and are left out of the analysis.

3.2.2 Labor productivity

The labor productivity is calculated by dividing the gross value added by the input of Labor. The input of Labor is based on headcount. The Labor input can be determined by the counting the input of working hours. Unfortunately in the case of TAMECO this data was not available. Therefore in this research the method of headcount is used and the hours worked are calculated on this basis. Not only the people active in production are taken into account but also the technical department and the office personnel. The office personnel include the general manager, the marketing manager, the administration department and the financial department. The data was found in various research reports and annual budgets. Only for a few years the data was available. For the missing years the numbers are calculated through extrapolation of the data that was available.

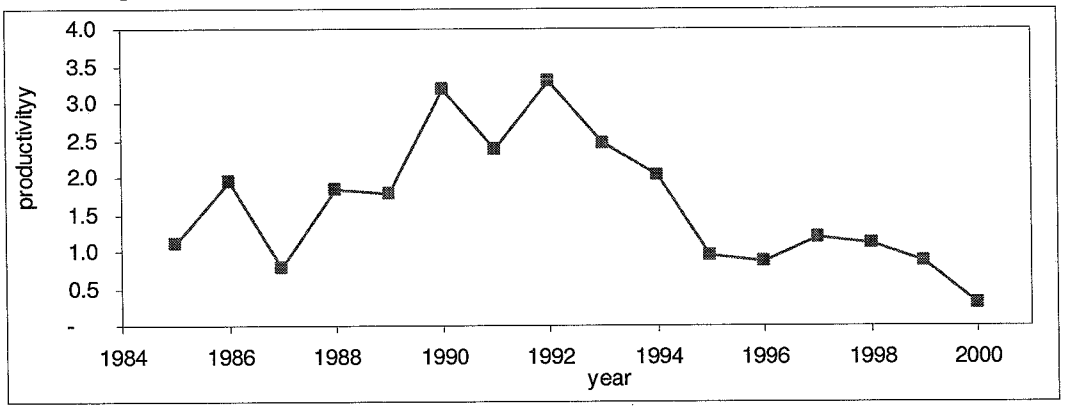
Table 3.2: Annual labour input in persons employed

Year	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000
Production	55[a]	50*	42*	51[b]	32[a]	28[a]	34*	29	26	20[d]	22	23	25	25	24	24
Technical	4[a]	3	3	3[b]	2[a]	3[a]	3	3	3	3[d]	3	3	3[e]	3	3	3
Office	18[a]	19	19	19[b]	23[a]	24[a]	23	22	21	20[d]	19	17	14[e]	14	14	14
Total	**77[a]**	**72**	**64**	**73[b]**	**57[a]**	**55[a]**	**60**	**54**	**50[c]**	**43[d]**	**44**	**43**	**42[e]**	**42**	**41**	**41[f]**

Notes: * = calculated from financial data

Sources: a = budget, b = Op het Veld (1990), c = Looijen and Sonke (1993), d = Schaapherder (1994), e = Zijl and Lassche (1997), f = based on Nkya (2002),

Figure 3.4: Value added Labour productivity in millions of constant 1994 TSH



The figure shows that the labour productivity increased from 1989 onwards. This increase is probably caused by the input of extra capital. By the acquiring of an extra set of grinding machines and an injection moulding machine less labour input was needed and a higher output was possible. The labour productivity peaks in 1990 and 1992. After 1992 the labour productivity starts to decrease and drops in 1995.

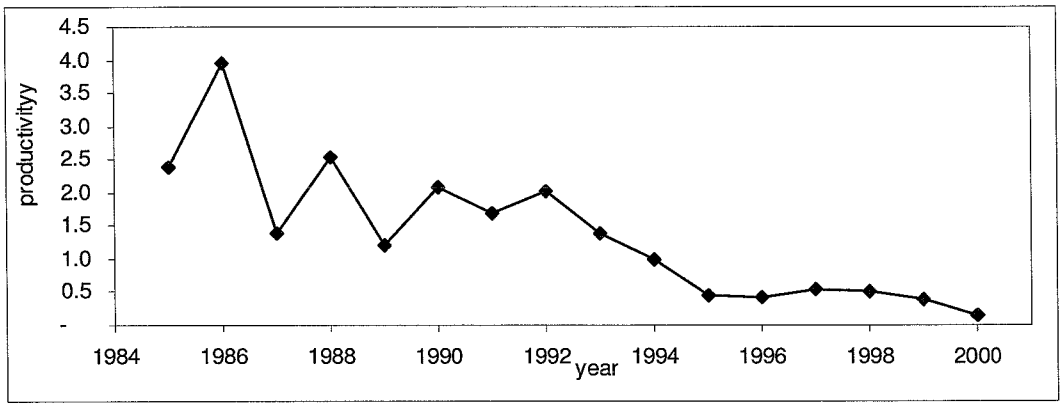
3.2.3 Capital Productivity

The capital productivity is calculated by dividing the gross value added by the input of capital in the production process. According to the literature there are various methods for determining the capital input. In economical literature often the Perpetual Inventory Method (PIM) is used. In this method the investments in capital are added each year and capital goods that have reached the end of its service life are discarded. Another method is the Core Machinery Approach which is aimed at the technological characteristics of the core machines in a production process (Szirmai *et al.*, 2002). The method that is used in this report is a fairly straightforward one and is based on the replacement value of the capital goods. The capital input is determined by the machine park of TAMECO. As a measure of this capital input the replacement value of each machine is determined. The value of the machines is based on Schaapherder (1994)

Figure 3.5: Replacement value of the machine park

machines in production line	Year of installation	Replacement value in 1992	Year	capital input	Capital index
Eccentric press	< 1985	6,500,000	1985	35,710,000	40.4
Drilling machine	1991	2,250,000	1986	35,710,000	40.4
Hardening furnace	< 1985	2,000,000	1987	35,710,000	40.4
Cooling oil tank	< 1985	160,000	1988	52,710,000	59.6
Tempering furnace	< 1985	1,100,000	1989	83,710,000	94.6
Grinding machines (set 1)	< 1985	17,000,000	1990	83,710,000	94.6
Grinding machines (set 2)	1988	17,000,000	1991	83,710,000	94.6
Polishing machine	< 1985	7,500,000	1992	88,460,000	100.0
Hand grinder	< 1985	650,000	1993	88,460,000	100.0
Hand grinder	< 1985	400,000	1994	88,460,000	100.0
surface grinding machine	1991	2,500,000	1995	88,460,000	100.0
Polisher	< 1985	400,000	1996	88,460,000	100.0
Plastic moulding machine	1989	30,600,000	1997	88,460,000	100.0
Plastic milling machine	1989	400,000	1998	88,460,000	100.0
			1999	88,460,000	100.0
			2000	88,460,000	100.0

Figure 3.6: Value added capital productivity in 1994 constant TSH

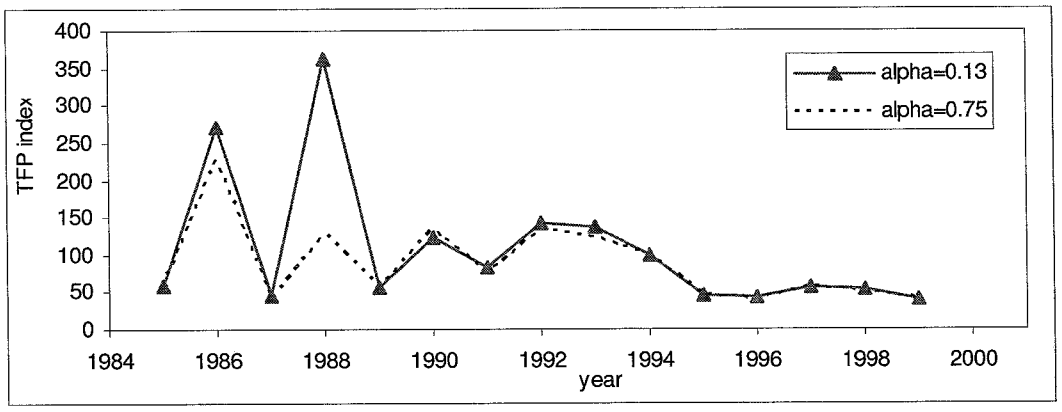


The capital productivity shows slightly a different picture than the labor productivity. The capital productivity is highest in 1986 indicating that in that year capital was used in the most productive manner. In 1987-1989 the productivity is low. In 1988 and 1989 the there was an increased capital input in the production process with the purchase of a set of grinding machines and the injection moulding machine. Even in terms of capital productivity this led to an increase but the level of 1986 was never achieved.

3.2.4 Total Factor Productivity

The Total Factor Productivity is calculated in index numbers. The elasticity (α) is calculated as the wage share in value added. In 1994 this value is 0.13. This value is lower than expected so the results might be unreliable, for example Maddison (1987) uses and alpha of 0.75. Despite this fact the results are discussed here to give an indication. The trends of the Total Factor Productivity show that in 1986 the productivity was high. The purchase of the new grinding machines reduced the bottleneck and caused the highest TFP index. After 1990 the productivity index is decreased and never reaches the level of 1988 again. This might be caused by the fact that the injection moulding machine was bought and labor was substituted for capital input.

Figure 3.7: Total Factor Productivity index



The findings of the productivity show that labour productivity was higher in the 1990s and that capital productivity was higher in the 1980s. This is caused by the purchase of machinery and the end of the 1980s. Was this substitution between labour and capital a correct management decision? The difference in choice of technique is reflected in the Total Factor Productivity index. It shows that in the productivity was actually higher in the 1980s than in the 1990s. The choice for the extra set of grinding machines was good in terms of Total Factor Productivity in 1988. The choice for the injection moulding in 1989 was not good in this perspective as the Total Factor Productivity never reached the level of 1986 again. It must be reminded however that this increased the quality and appearance of the product which is not reflected here. Overall it can be seen that after 1992 the productivity declined. The causes for this are explained in the next paragraph.

3.3 Production Efficiency

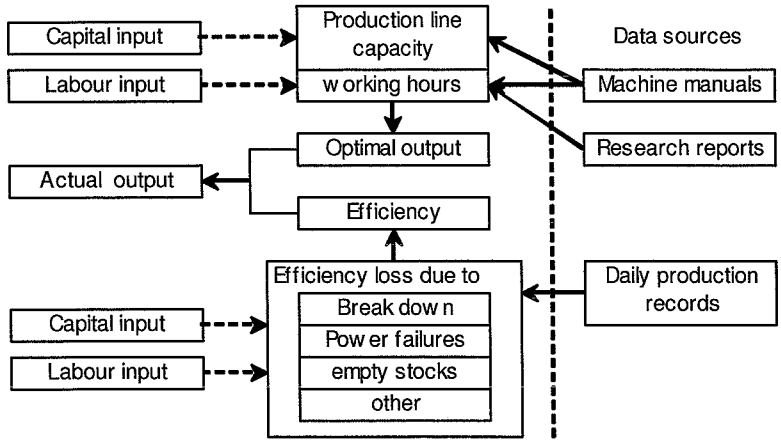
The production efficiency is determined by using data from the bottleneck in production. First the optimal production output is determined which is also the optimal production output for the entire production line. Thereafter the overall efficiency rates and utilization rates are determined. The production days are categorized according to the problem category. With this data the impact of each problem is calculated. The period for which the production efficiency was calculated was 1990-1995.

3.3.1 Data acquisition

The general idea in the following analysis is that each time there is a problem in the bottleneck this will influence the output of the total production line. As was explained in paragraph 2.3.1, the bottleneck in the production process is the grinding of the blades. The production line capacity is physically constrained by the production speeds in the bottleneck.

The optimal output is calculated using data from machine manuals and research reports. With the optimal output and the actual output known the efficiency rates can be determined. The daily production records of TAMECO were used for determining the efficiency rates. The daily production records were maintained on a daily basis and consisted of notes on production. The notes consisted of the names of the persons that were working in a shift on that day, the amount of time they had worked, the amount of production and rejects and a note if a there were any problems in production that shift.

Figure 3.8: Data sources for determining production efficiency



Each production day is categorized following the notes of that day. On most production days more than one shift was recorded, with a maximum of four shifts. For this analysis the following rule is maintained, if in at least one shifts a problem was noted than the entire day was categorized into that category. The following categories are determined from the production data.

Table 3.3: Categories of the production days

Category	Description
normal	Production was normal, no problems were recorded in any of the shifts
no knives	There were no knife blades available for grinding, caused by empty buffers or shortage of raw materials
electricity	There was downtime caused by power failure or electricity problems
breakdown	A machine broke down and time was needed for repair. A machine breakdown that often occurred was when the grinding stone came to close to the product resulting in rejects.
maintenance	When the machine was not used for production but for maintenance.
absent	In case someone got sick or a shift had to be cancelled because the employee was absent.
multiple	Days that more than one problem was recorded during a day or a shift. Think of the days where both an electricity problem and a machine breakdown occurred.
holiday	Days that were marked as a National holiday, sometimes production continued on those days
Meeting	In the organization structure of TAMECO the general meeting is the highest decision making body. Every once in a while a meeting is organized. On those days mostly no production was recorded
Sunday	Most Sundays production continued but the achieved production and working hours was lower than during the rest of the week. For this reason Sundays are treated as a different category. The problems that occurred in production on a Sunday are not taken into account.
Unknown	These are days without production and no clear reason for this, days that were missing from the records completely, or days were a problem occurred but the handwriting was unclear.

With these records the efficiency and utilization of the production is calculated. A difficulty in the production records that the actual impact is not recorded. When a problem in production was recorded it was not clear how big the impact was. The notes did not say how long the problem occurred or what the influence was on the production efficiency.

Here an example to illustrate this issue; a shift was recorded with 5 hours working time, 200 products, and an electricity problem. In this case it could well be that out of 5 hours there were 3 hours of downtime. This similar day could then also be noted as: 2 hours working time, 200 products, and an electricity problem. According to the production records both ways of noting was used.

Numbers on efficiency or utilization are still needed to make statements about the impact of these problems. To resolve this issue the calculations were not based on shifts or working hours but on complete days. The days are compared with days of optimal production and in that way the impact on utilization and efficiency can be calculated. The impact on utilization and efficiency is determined on a yearly basis.

The optimal output is calculated by using the maximum production efficiency and the maximum utilization of the production line. The following formulas are used to calculate the efficiency and utilization numbers.

$$Q_{actual} = Q_{optimal} * E_{total}$$

with Q_{actual} = Actual output, $Q_{optimal}$ = Optimal output and E_{total} = Total production efficiency

$$Q_{optimal} = 365 * PL * PS_{max} * MR_{max}$$

with $Q_{optimal}$ = Optimal output, PL = Number of production lines, PS_{max} = Maximum production speed per machine hour (η=1) and MR_{max} = Maximum machine utilization per day (μ=1)

$$E_{total} = \sum\left(E_x * \frac{n_x}{365}\right)$$

with E_{total} = Production efficiency, n= Day count per category and x = Category

$$E_x = \eta_x * \mu_x \text{ and } E_{total} = \eta_{total} * \mu_{total}$$

with E = Production efficiency, η = Efficiency per production hour, μ = Utilization rate and x = category production days

$$I_{total} = 1 - E_{total}$$

with I_{total} = Impact (Efficiency loss), E_{total}= total production efficiency

$$I_x = (1 - E_x) * \frac{n_x}{365}$$

with I = Impact (Efficiency loss), E = production efficiency, n = Day count per category and x = Category

The overall output is influenced by problems that occur during production. The impact of the problems in production can be acquired by calculating the efficiency and utilization rates. To get these also the optimal rate of production should be calculated. The maximum output of a production line is determined by the maximum output in the bottleneck. The general idea in the following analysis is that each time there is a problem in the bottleneck this will influence the output of the total production line. As was explained in paragraph 2.3.1, the bottleneck in the production process is the grinding of the blades. The daily production records of the grinding machine are analyzed to determine the impact of certain problems. The assumption is that if such a problem is recorded in this process step then this will influence the entire production line capacity of TAMECO.

The production records that could be recovered were in the period 1990-1995. Before 1990 no daily production records were maintained. After 1995 the production became too inconsistent and production was not recorded anymore. The efficiency and utilization could only be calculated for these years only.

3.3.2 Optimal production output

The optimal efficiency or production per hour can be based on different kind of numbers. When comparing the production in an international setting the best way is to take the technical frontier as a basis. However for this case it is more useful to take the investigated production line as a reference. The bottleneck in this production line is the grinding of the blades.

The optimal efficiency is determined by using data from the machine manuals. According to the machine manuals a grinding machine should be capable of producing 240 pieces per hour. This number is compared with the actual production records to see if it is a valid number. According to the actual production records only 6 occasions were recorded where the production per hour exceeded 200 pieces per hour with a recorded maximum of 223.7 products an hour. 240 pieces per hour therefore seems like a fair number to set as a maximum. When a production of 240 pieces per hour is achieved the efficiency rate will be 1 (η=1).

The utilization is a figure that indicates the amount of time a machine is used for production. In theory a machine can be used at a maximum of 24 hours a day but in practice it is not possible to achieve this because factors such as of national holidays or general maintenance work. Pack (1987) for instance calculated the maximum amount of hours a textile spinning machine can run in a year. His number is based on 300 working days and 24 hours a day making a total of 7200 hours a year.
In the case of TAMECO however almost every day is used for production. To resolve this issue the maximum amount of hours is calculated over 365 days. According to own assumptions and calculations the maximum utilization is set at 18 hours of day for 365 days, making a total 6570 hours a year. The calculation is based on the fact that Tanzania has 15 official national holidays per year. 24 days per year are reserved for maintenance works. On the remaining 326 days 1 hour a day is reserved for cleaning of the machines, 2 hours a day are reserved for adjustments to the machines during the production process such as replacing the grinding wheels[6] and mixing coolant fluid. One hour a day is reserved for small maintenance work such as lubrication of the machine. This makes the maximum runtime in hours a day at 20 hours for 326 days, or if calculated over 365 days the maximum amount is 17.8 hours a day. For the calculation the number is rounded to 18 hours a day for 365 days. The 18 hours is based on 1 set of grinding machines.
In the period 1990-1995 the records of TAMECO show 26 occasions were the running time of the 2 sets of machines exceeded 30 hours. The maximum hours of running time in the period 1990-1995 was recorded at 34.2 hours for two sets, or 16.1 for 1 set of grinding machines. Therefore 18 hours a day seems like a valid number to take as the maximum amount of running time. When this number is reached the utilization will be 1 (μ=1).

With the maximum efficiency and utilization known the optimal output ($Q_{optimal}$) can be calculated. The optimal output on a yearly basis is 3,153,600 knives for two sets of grinding machines. On a daily basis this is a production of 8640 knives.

3.3.3 Production efficiency

The results of the analysis are presented in Table 3.4. The table shows the figures on utilization and efficiency for the entire year, including days in which some of the problems occurred.
What is interesting to see is that during this period yearly production levels declined. The cause of this can be found in the efficiency rates. The table shows that the efficiency per hour remained equal the same level and even slightly improved in 1994 and 1995. The utilization level of the machines on the other hand dropped dramatically. Causes of this drop can be found in the days with problem analysis in production. A complete overview of the data is presented in Appendix E.

Table 3.4: Total Efficiency and utilization

	Yearly total (2 sets)		Daily average for 1 set of grinding machines				Efficiency rates		
Year	days	production	production	rejects	hours	prod/hr	η	μ	E-total
1990	365	437465	599.27	3.63	6.05	99.13	0.413	0.336	0.139
1991	365	474244	649.65	3.38	6.80	95.56	0.398	0.378	0.150
1992	366	411865	562.66	3.10	5.61	100.25	0.418	0.312	0.130
1993	365	214931	294.43	1.52	2.89	101.94	0.425	0.160	0.068
1994	365	202840	277.86	0.33	2.30	120.87	0.504	0.128	0.064
1995	365	165039	226.08	1.07	1.88	120.28	0.501	0.104	0.052

Source: Daily production records grinding machines 1990-1995

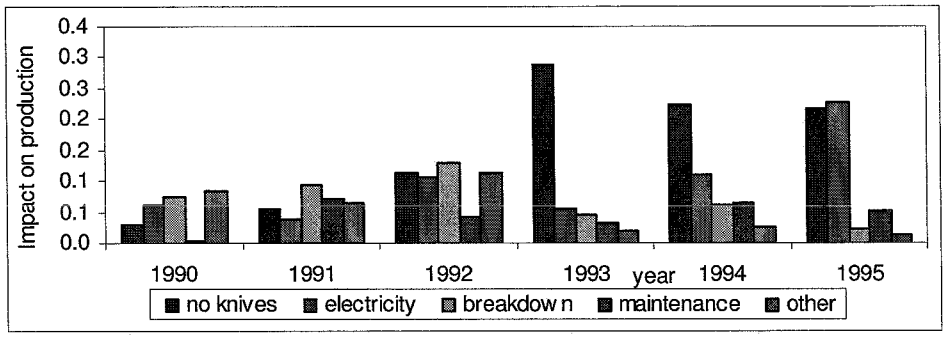
The efficiency and utilization rates are known but it is also interesting to calculate the impact (I) of a problem category on the yearly production output. The impact can be calculated by determining the loss in efficiency (1-η) and (under)utilization (1-μ). By calculating the losses in Production efficiency on a yearly basis the impact of each problem will become clear. The aggregated value of is the total production efficiency loss over that year.

[6] The grinding wheels need to be replaced every 960 products

The impact of problems is presented in

Figure 3.9. The table shows that the problems that had the largest impact on production are electricity, machine breakdown and "no knives". Other factors such as holidays, absenteeism or meetings only contribute for small amounts (under 10%) and are placed under "other"

Figure 3.9: Loss in production efficiency



Notes: Other includes absent, multiple, meeting, holiday.

During 1990-1992 machine breakdowns had the largest impact on production. In 1993 the situation changed. The category that had the largest impact on knife production was "no knives" indicating there were not enough blades available for production. In 1993 106 days were recorded that there was a shortage of knife blades. Shortages in the supply of raw materials were leading to a standstill in production. In 1995 also problems with electricity had a large impact on production causing a loss of 23 % in production efficiency.

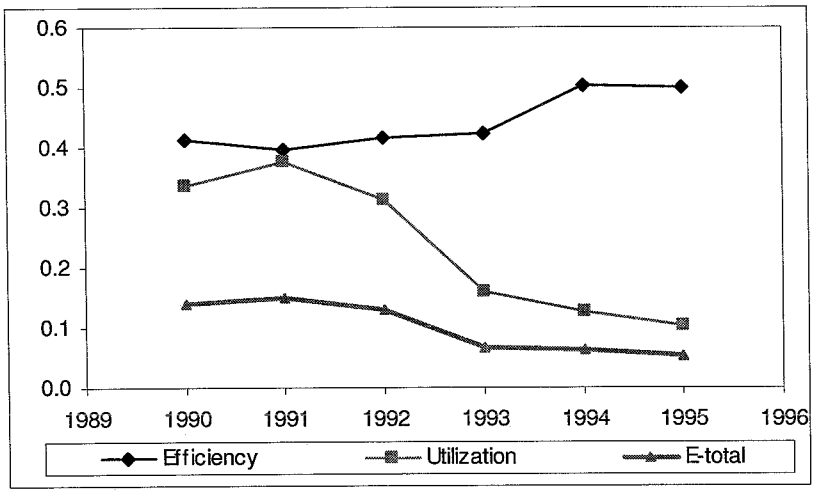
3.4 Concluding remarks

In this chapter the productive performance of TAMECO is analyzed. In terms of labour productivity the period 1990-1992 the highest productivity was seen. In this period the highest production output per employee was seen. In terms of capital productivity a different picture was seen. The highest level of capital productivity was seen in 1986 when the capital productivity was almost 2 times higher then in the beginning of the nineties.

The deeper meaning of this observation is that in 1988 and 1989 new machines were acquired. This contributed to the increased labour productivity. The trade-off was that the capital productivity declined. The choice of technique changed from labour intensive production to a more capital intensive production process. In terms of Total Factor productivity this was the wrong choice. Nevertheless the overall output of production line was higher, the process was easier to control and the quality of the product was higher.

The beginning of the 1990s showed the highest output figures but in 1993 these started to decline. To determine the causes for this the daily production records of the grinding machines, the bottleneck in the production line, is analyzed.
This data shows a similar path with a decrease in the total production efficiency (E-total) in 1993. The data also shows that the efficiency of production (η) remained at around 45% of the optimal level and even increased in from 1993 onwards. The utilization (μ) on the other hand is decreasing after 1993. This indicates that the machine stoppage times increased. The conclusion is that the productive performance of TAMECO declined because of lower utilization of the machines.

Figure 3.10: Efficiency figures of the grinding machine



With the data on production efficiency also the influence of the aggregate factors was analyzed. This data shows that the factor that had the highest impact on production was "no knives" indicating that production decreased mainly because of a shortage in raw materials. In 1994 and 1995 also electricity problems influenced the production output.

In view of Figure 3.2 the optimal output and the efficiency rates are influenced by the labour input and capital input. The optimal output is mainly influenced by the input of capital. The more machines in the bottleneck the higher the production output will be.
Some of the problems that occurred in production might also be solved in this way. Absenteeism for instance can be solved by adding more labour into the production process. The main problem that caused the decreased production "no knives" however can not be solved by adding more labor or capital. This problem probably originated in the management sphere or financial situation. In 1994 and 1995 electricity problems also had an impact on the production output of TAMECO.

Chapter 4. Financial performance

In this chapter the financial performance of TAMECO is examined. This includes an analysis of the balance sheets and the income and expenditure accounts of TAMECO. This data is also used to calculate some of the key ratios that are mostly used by financial analysts. These ratios include the liquidity, financial leverage and profitability.

4.1 Methodology

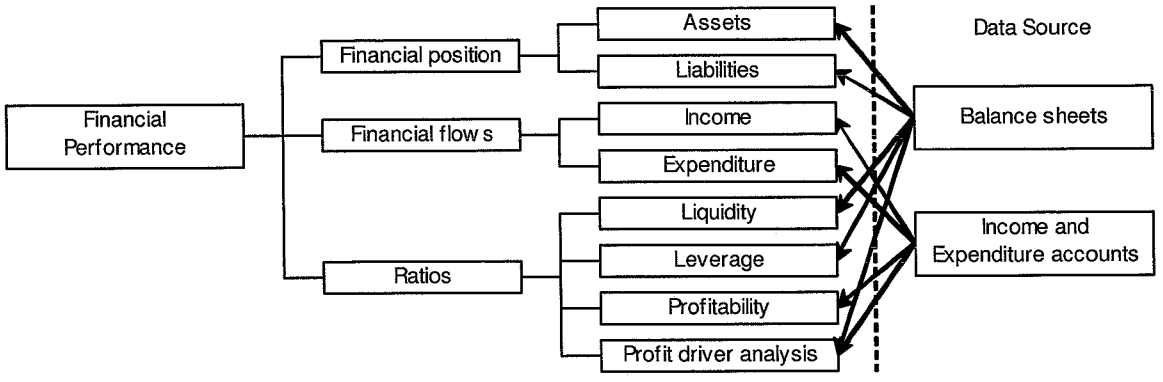
To assess the financial performance of a company one has to understand the financial accounts that are usually used. For most companies this is the same, consisting of a balance sheet and an income and expenditure account. The factors and ratios used to determine the financial performance are extracted from Libby *et al.* (2001) and Palat (2005).

There is a difference between the balance sheets and the income and expenditure tables. In the balance sheet the values of the assets and liabilities such as machines, stocks and loans are given. The income and expenditure account represents the cash flows of a company such as revenues and payments. Therefore the balance sheet shows a different picture of the financial situation of a company than the income and expenditure account.

With the data from the balance sheets and income and expenditure accounts several ratios can be calculated. These ratios are mostly used by financial analysts and they serve as a tool to get a clear view of the financial situation of the company. Well known ratios are the liquidity, leverage, and profit ratios. The profit driver analysis is also a useful calculation. This analysis provides logical relationship between several ratios and provides insights into the strategy of a company.

The financial performance of TAMECO is based upon three indicators. First is the 'Financial position' of the company which can be retrieved by analyzing in the assets and liabilities of the firm. These values can be found in the balance sheets of the company. The Financial position for each year is a static value as it is figure that is based upon a fixed moment. In time, however, trends can be visible on how these change.
The second indicator is the 'Financial flows' of the company. This is the money that flows in and out of the company. The data is found in the income and expenditure accounts of the company.
The third indicator is based upon 'Ratios'. The ratios give a picture of the financial situation of the company and can be calculated by using data from both the balance sheets and income and expenditure accounts. The overall financial performance can now be determined by analyzing the figures and comparing the trends in these.

Figure 4.1: Financial performance



4.1.1 Data acquisition

The data that is used for this analysis is based on the balance sheets and income expenditure accounts of TAMECO. These financial accounts are produced every year by the company and published under the supervision of Co-Operative Audit and Supervision Corporation (COASCO). The findings and ideas of the auditing company are presented in the audit report. According these reports the accounts give a fair view of the financial position of TAMECO. The data that could be retrieved was from the period 1977 – 2003. However some data is missing. Prior to 1977 no data could be found. From the years 1979 and 1980 no balance sheet was present. From the year 1977 no income expenditure account was available.

The data is put in an excel spreadsheet and adjusted for analysis. The way the company presents the data in the year reports has changed or evolved over time. The spreadsheet is therefore adjusted in such a way so that the data can be presented in a consistent manner and that the trends can be analyzed. The data from the balance sheets is kept, as far as was possible, similar to the original balance sheet. The data in the income and expenditure accounts is somewhat different. In the original accounts expenses were first labelled as administrative expenses and after 1989 divided into four categories (administrative, business, personnel, and office & general expenses).
Some items or types of expenses moved between categories during the period. To give a consistent picture of the expenses, the items were categorized for the whole period into five new categories (personnel, business & administrative, office & general, bank & finance and production, transport & other expenses). The balance sheets are presented in Appendix G and the income and expenditure accounts in Appendix H.

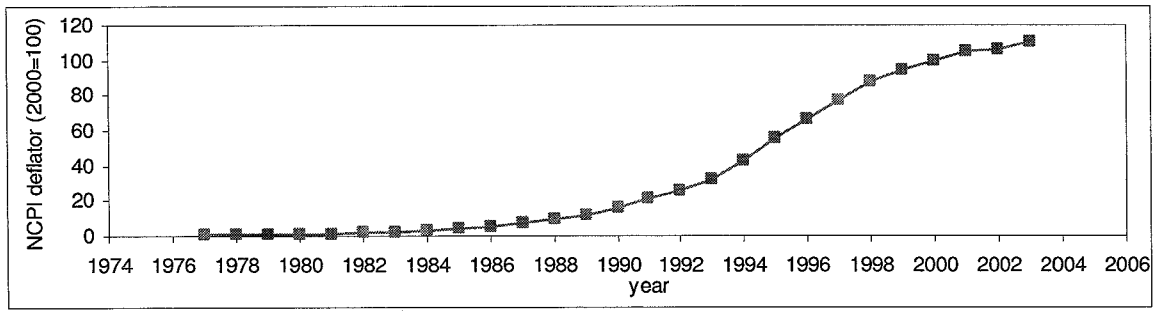
4.1.2 Inflation

The values in the balance sheet and income expenditure account are in constant or current prices. Especially in developing countries that have high inflation rates it is difficult to analyze data for long time series. In order to compare the time-series data for TAMECO a deflator is used

The Consumer Price Index is used as the deflator. Inflation rates cause the prices to change in a country. Especially in developing countries these inflation rates can be quite high. The Consumer Price Index represents these changes in prices. By using this deflator as a basis the growth of the company becomes presented in constant prices.

For each year the data is calculated in constant prices. The Consumer Price Index is based on IMF values with 2000 as the base year. The calculated values of the balance sheet and income expenditure account are in 2000 constant prices.

Figure 4.2: Net Consumer Price Index (2000=100), 1977-2003



Source: IFS Statistics database

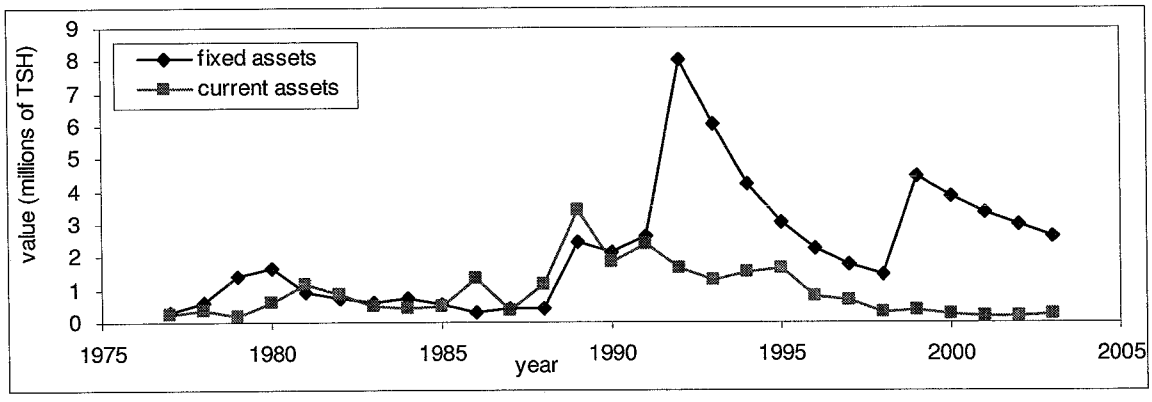
4.2 Financial position

The financial position of TAMECO is determined by analyzing the balance sheets and consists of the assets and the liabilities of a company. The assets, that what a company owns, can be subdivided in fixed assets, current assets and the money in cash and the direct accessible bank accounts. The fixed assets are possessions with a term longer than one year and the current assets are possessions with a term shorter than one year.
With regard to the liabilities, that what a company owes, a distinction can be made between the shareholder funds or company reserves, the loan funds or the current liabilities. The balance sheet can provide useful data on the actual financial situation of the company. Some key indicators or ratios can be calculated form the balance sheet. The ratios can provide good information on the financial trends of the company and its strengths and weaknesses. Three well known and commonly used indicators are the profitability, the liquidity and the leverage and these will be presented later.

4.2.1 Assets

The assets are consist of the property of the company, that which the company owns. The assets can be divided into fixed assets, investments and current assets. In Figure 4.3 the fixed assets and current assets are shown. The fixed assets, consisting of machinery, buildings, motor vehicles and furniture and other equipments, are depreciated every year. The figure shows that the fixed assets are the main portion in the total assets. In 1990 there was an increase in the fixed assets as new machines were acquired, among others a plastic moulding machine. In 1992 and in 1999 the fixed assets were revaluated. The fixed assets are depreciated every year according the straight line method, which means that every year an equal sum is depreciated. Before 1994 buildings were not depreciated.

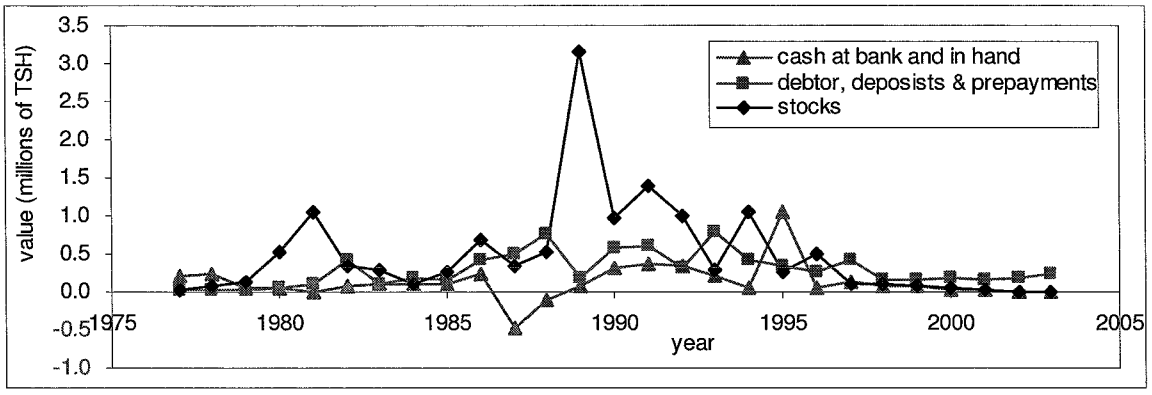
Figure 4.3: Total assets in constant 2000 prices



The investments are not shown in the figure because their value was too low in relative terms. In this case the term "investments" is used as an accountancy term. For TAMECO the investments consist of shares that are bought from institutions or unions that support cooperatives. It is arranged by law in Tanzania that every cooperative has to own shares of the unions. The investments are only a marginal part of the total assets.

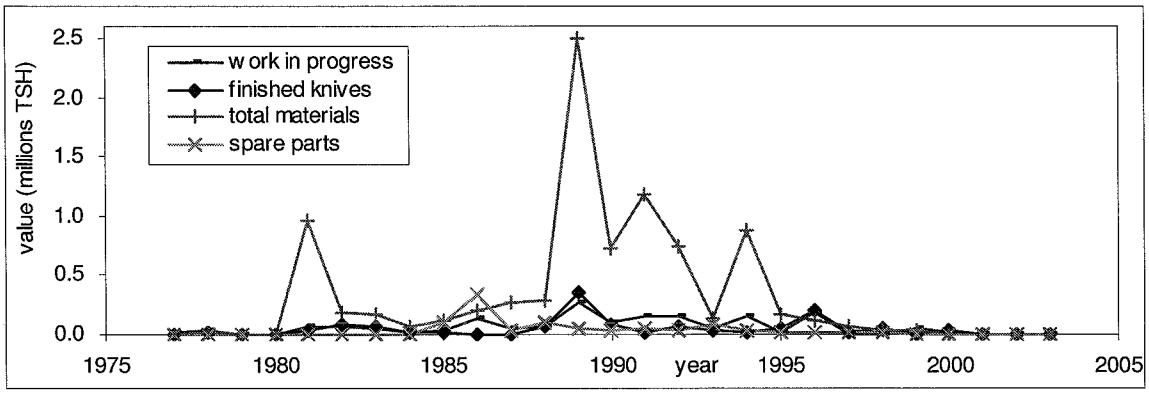
The current assets are the assets that are used to in the company's daily business like cash or assets that can be converted into cash within a year. The current assets consist of (claims of) debtors, deposits and prepayments, stocks, and cash on the bank accounts and in hand. The composition of the current assets of TAMECO is presented in Figure 4.4.
The current assets of TAMECO mainly consist of the stocks of the company which makes up the largest share. The debtors and prepayments curve, existing of staff and business debtors, shows a fairly regular pattern. Cash at bank and in hand are the most liquid of the company and are used to pay the bills of the company. The value of cash at bank account or in hand is negative in 1987 and 1988.

Figure 4.4: Current assets in constant 2000 prices



The stocks make up for a great share of the current assets. The stocks itself consist of raw materials, spare parts, works in progress and the finished products. The stocks of TAMECO show the raw materials (carbon steel, production means, construction and buffing materials) are the main input of the total stocks. The ups and downs in this line are mainly caused by the acquisition of raw materials as Figure 4.5 shows. For finished products the line only show peaks in 1989 and 1996 which can indicate difficulty of selling the products. However the stock of finished products remains low.

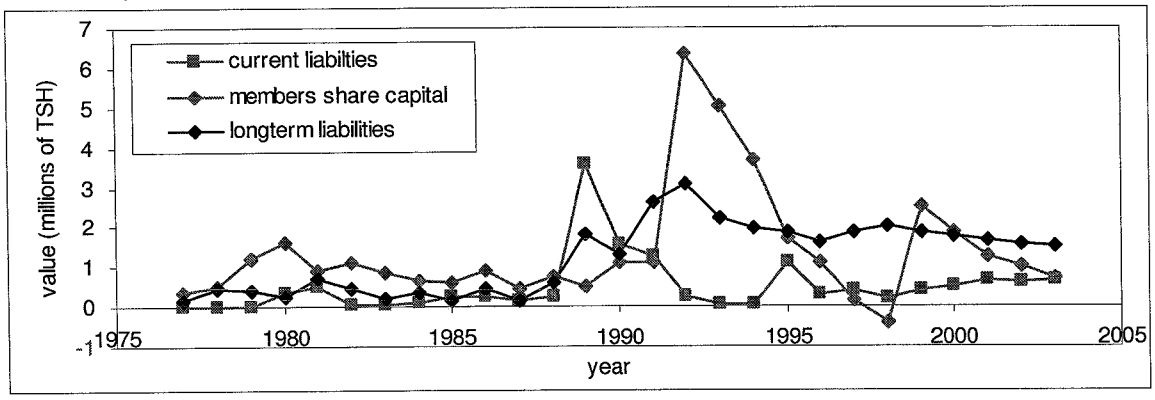
Figure 4.5: Stocks in constant 2000 prices



4.2.2 Liabilities and members share capital

The liabilities are the amounts due, or that which the company owes. The liabilities can be divided into current liabilities and long-term liabilities. The members share capital is the amount of capital that company owes to its members or shareholders. The total of the liabilities and the members share capital is equal to the total of the assets. In Figure 4.6 the decomposition of the liabilities is shown.

Figure 4.6: Liabilities and members share capital of TAMECO in constant 2000 prices

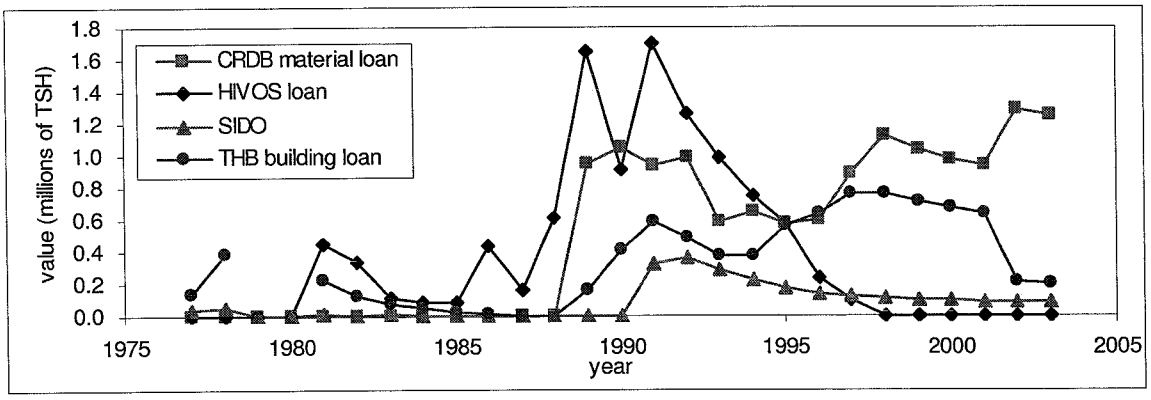


The members share capital is increased in 1992 and 1999 when the fixed assets are revaluated; the increased value is added to capital reserve and later share capital. The revaluation of 1999 is shown under members share capital as revaluation surplus. In 1999 the share capital was also enlarged an amount of the depreciation that was written back to the members share capital[7]. The members share capital decreases after 1992 because of the way TAMECO used to depreciate the assets.

The current liabilities mainly consist of creditors and accruals. Creditor and accruals resemble the amount (bills) that the company has to pay within a year. In the case of TAMECO the peak in 1989 is caused by a bank overdraft and a CRDB material loan that in later years is placed under long-term liabilities. There is no increase in the current assets which indicates that it the company is capable of paying the short term bills.

The long-term liabilities are loans and that are used to increase the total capital of the company and finance the acquisition of machine and materials. Until 1988 the main loan was the HIVOS loan. In 1989 TAMECO was able to get a loan from CRDB (Cooperative Rural Development Bank) for financing raw materials[8]. Also the loan from THB (Tanzanian Housing Bank) for financing the buildings was enlarged in order to build the office building. The loan from HIVOS was gradually repaid after 1992 while the other two loans remained visible at a high value on the balance sheet.

Figure 4.7: Loans in constant 2000 prices



[7] improved revenue reserve - accumulated surplus brought forward, see 'prior year adjustment' on the income and expenditure account.

[8] In 1989 visible under 'creditros and accruals'

4.3 Financial flows

This chapter describes the findings that come from analyzing the income and expenditure accounts of TAMECO in the period 1977 – 2003. The data of the incomes and expenditures are deflated with a Constant prices index and 2000 as a base year. The original income and expenditure accounts are presented in Appendix L.

4.3.1 Income and costs

The main activity of TAMECO is knife production. The financial records show that income from the other activities such as maize milling or timber sawing can be marginalized. The knife production activity was the main source of income of the company and also the largest part of the incurred costs were due to the knife production.

Figure 4.8: income from knife sales and costs of knife manufacturing in constant 2000 prices

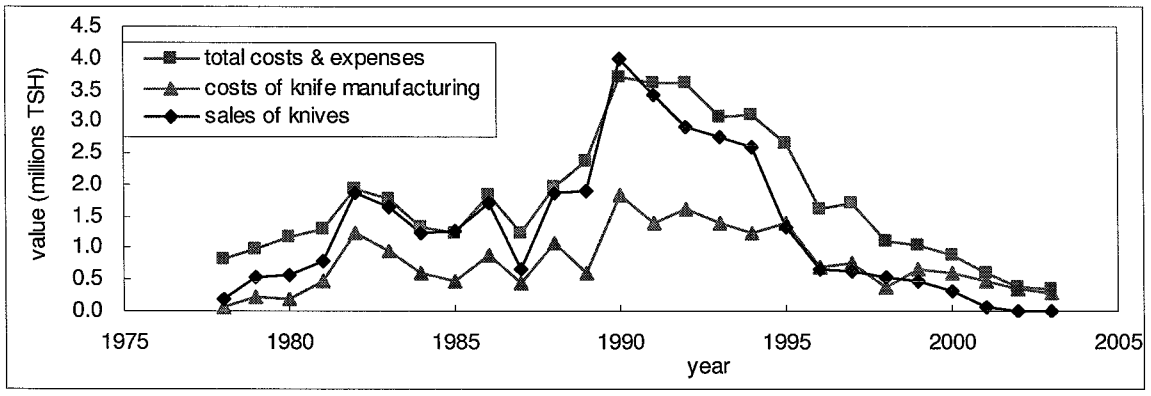
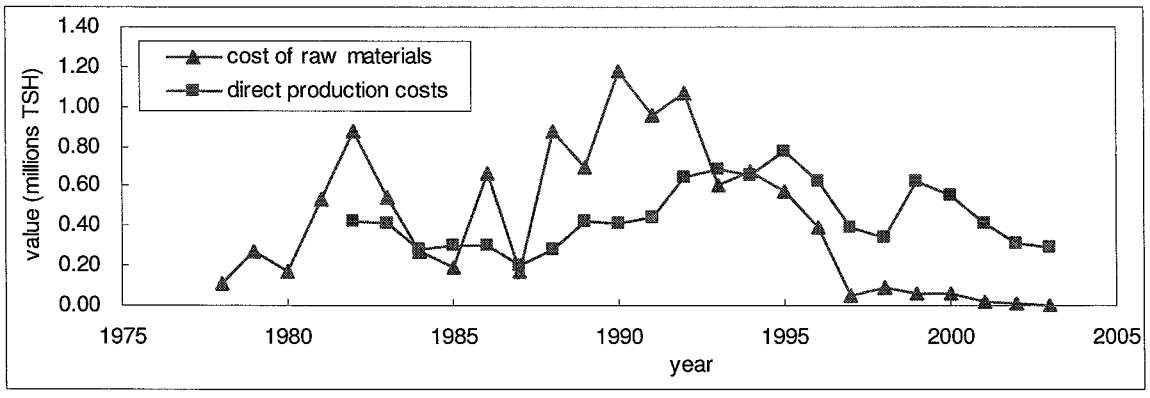


Figure 4.8 shows the income from sales of knifes and the costs of knife manufacturing. The income from sales peaks in 1990 after which it declines again. The costs remain relatively constant after 1990. While the costs remains at a high level. From 2000 and onwards the production is reduced and at the moment no production takes place anymore. The figure also shows the total costs and expenses. This includes both the costs of knife manufacturing and the operational expenses or overhead. The figure shows that only in 1990 TAMECO the income from sales of knives was higher than the total costs.

4.3.2 Knife production

The costs and income of that are directly accountable to the production of knives are presented here. The operational or overhead costs are not included in this section.

Figure 4.9: knife production in constant 2000 prices



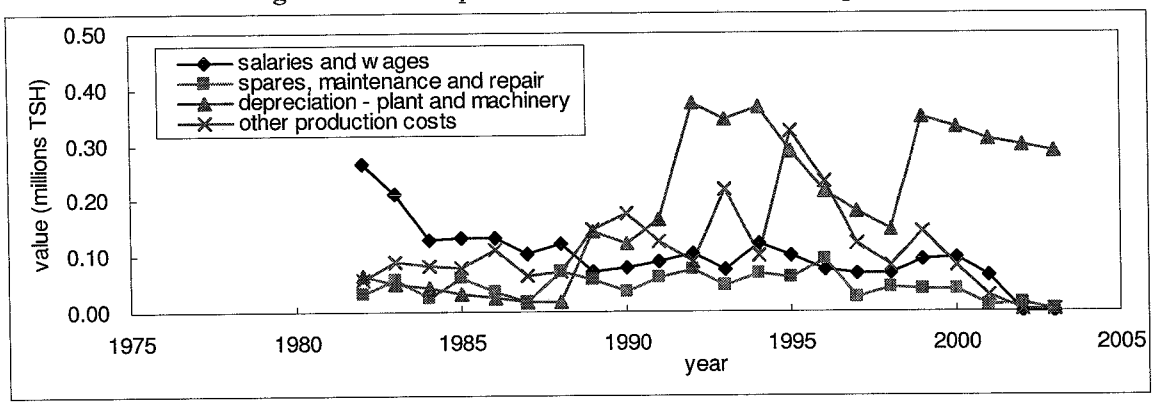
The raw materials are the production means for producing knives such as steel and polypropylene. The direct production costs are expenses on salaries, maintenance and repair, depreciation of

machinery, etc. The figure shows that the costs of raw materials gradually decline after 1990 while the production costs rise. After 1994 the sales degrade and, even without overhead or operational expenses, the costs of knife producing are higher than the income form sales of knives.

Figure 4.10 shows how the direct production costs are structured. The costs of production can be divided into 'salaries and wages', 'spares maintenance and repair', 'depreciation of plant and machinery' and 'other production costs' such as production means (grinding stones, lubricants), technical research, engineering costs, etc.

In the 1980s the main production costs were on salaries and wages. In the 1990s the costs on salaries and wages remain at a similar level but other types of costs increase. There is an increase in 'other production costs' after 1987 with peaks in 1993 and 1995, which are mainly due to increased spending on electricity and water bills. Also the costs on depreciation of plant and machinery rise. In 1989 they rise because of the acquiring of new machinery and in 1992 and 1999 because of revaluation of the assets. After 1995 costs were cut down. The only costs that remain are from depreciation.

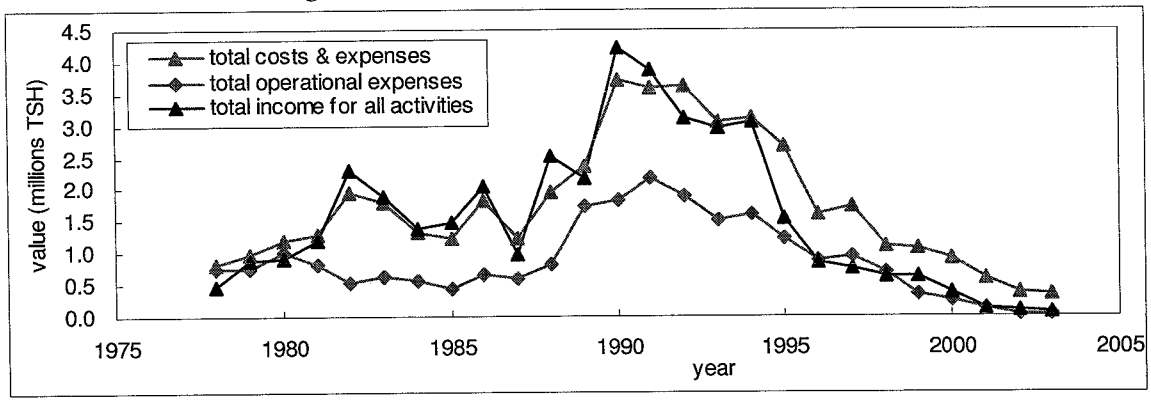
Figure 4.10: direct production costs in constant 2000 prices



4.3.3 Operational expenses

Tithe costs that are directly accountable to production of knives are not the only costs that are involved in running a company. Also the overhead costs or operational costs should be considered. Figure 4.11 presents the total incomes and total costs. These costs are for all activities of TAMECO including maize milling and timber sawing. A share of the total costs can be is attributed to operational expenses

Figure 4.11: income and costs in constant 2000 prices

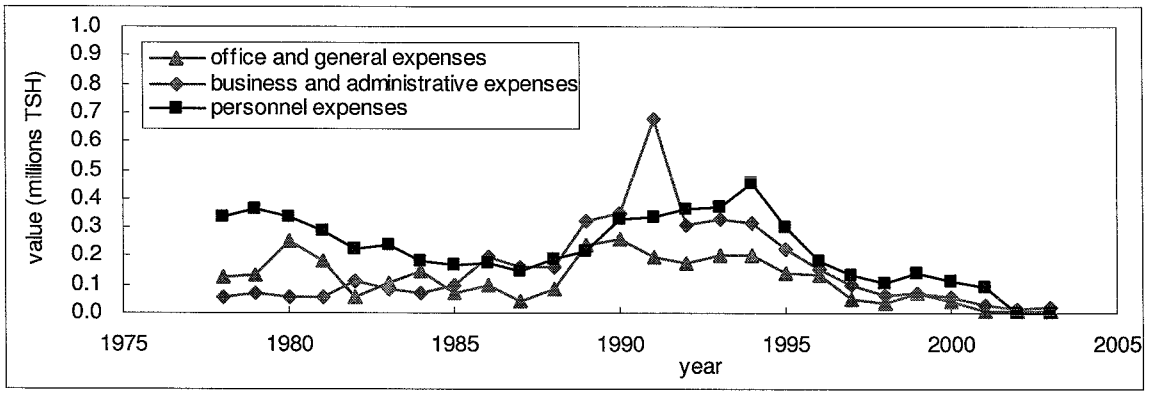


The 'total income' and 'total costs & expenses' curves are at a similar level in the 1980s. Until 1994 it remains similar with some years of (marginally) small losses and other years with small profits. After 1994 the total income declines while the costs remain high. This causes big losses for TAMECO during that period. The costs from core activities remain at a high level. This caused by the fact that

the machines are still being depreciated. The operational costs remain high until 1997 before they are cut down. Only after 1997 the operational costs decline.

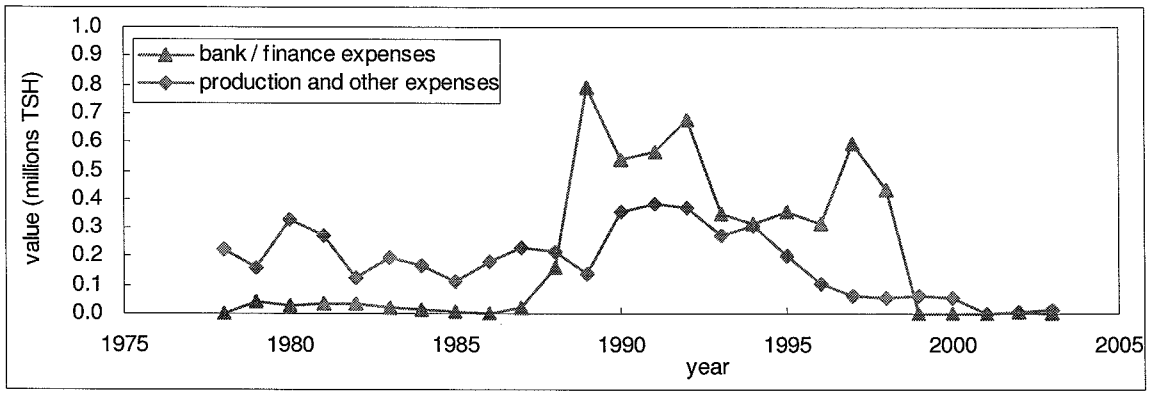
The operational costs can be divided into five categories; Office and general expenses (1) business and administrative expenses (2), personnel expenses (3), bank and finance expenses (4), and production and other expenses (5).

Figure 4.12: Operational costs in constant 2000 prices (1)



Office and general expenses consists of costs like office repairs, cleaning and sanitation, water and electricity, land rent and depreciation of buildings, etc. After 1988 the costs of depreciation on office buildings and furniture and equipments increase. After 1995 the expenses decline mainly because a cutting down sanitary and cleaning expenses.
The business and administrative expenses consist of expenses on printing, stationeries, meeting expenses, insurance, marketing and promotion, taxes and duties, etc. The graph shows a peak in 1991 but that is due to consultancy expenses that were covered by a grant of HIVOS. Besides that the expenses rise after 1988 but are reduced after 1994.
Personnel expenses are costs like wages, training, pension payments and other costs regarding the labor force. The personnel expenses start to increase after 1987 because of a gradual increase in expenses on wages and salary and expenses on housing allowance/levy. After 1994 those costs are reduced and the expenses on personnel decline.

Figure 4.13: Operational costs in constant 2000 prices (2)



The bank and finance expenses consist of bank charges and payments of interests on the loans. The graph shows that until 1987 almost no interest was paid. After 1987 however the expenses on interest payments increase rapidly and these becomes even larger than the other expenses. In that period TAMECO was granted loans from CRDB bank and THB bank at high commercial interest rates. Also efforts were done to repay the loan from HIVOS.
In 1999 TAMECO stopped paying interest, despite this the loans still appear on the balance sheet. In 2005 the loan o CRDB was fully repaid. Production and other expenses consist of expenses on spare parts, oil and lubricants, fuel and transportation and other expenses (stolen stocks, etc). These expenses show a light increase in 1990 but are decreased after 1994.

4.4 Ratio analysis

In this paragraph ratios are calculated that can be used as an indicator for the financial position of the company. Because the balance sheet only represents the value at a given moment in time they are averaged over two years, which is a common measure by financial analysts and also allows us to calculate ratios that use values form the balance sheet as well as values from the income expenditure account. The ratios are based upon the original data balance sheets and the income-expenditure accounts

4.4.1 Liquidity

The liquidity measures whether a company has enough cash to meet its operational requirements. If a company cannot do so, it may be forced to sell its assets at a loss and, in some cases, be forced into liquidation.

The most common measure is the current ratio which is computed by dividing the current assets by the current liabilities. This indicator represents the force of the company to retain a balance between the expenditures and the revenues, the ability to suffice its payment obligations.

Another well known indicator is the quick ratio or acid test which measures if the company has adequate cash or cash equivalents to meet its current obligations without having to resort in selling assets such as stocks.

This ratio is calculated by dividing cash and easily saleable investments and debtors by the current liabilities.

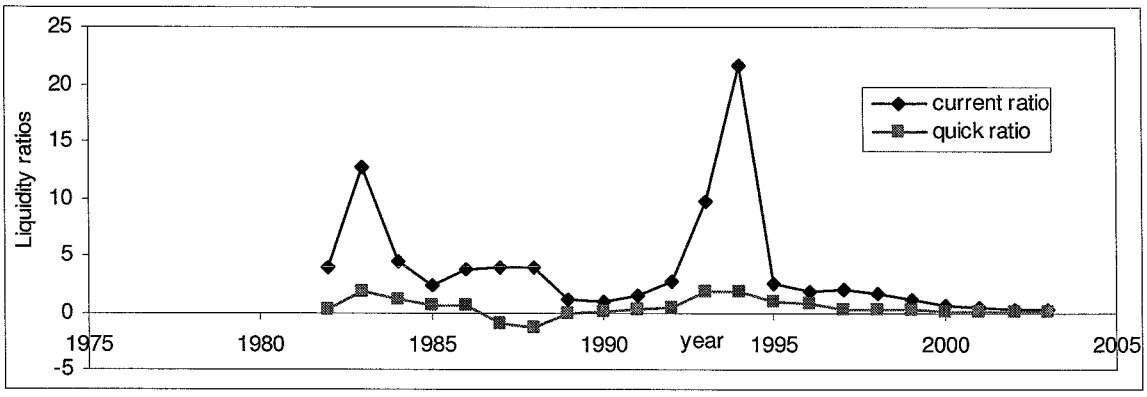
$$current\ ratio = \frac{current\ assets}{current\ liabilities}$$

$$quick\ ratio = \frac{cash\ \&\ cash\ equivalents}{current\ liabilities}$$

When a company begins to experience financial difficulties, it will meet its financial obligations more slowly, as a result the current liabilities begin to built up and rise faster than the current assets. It could result in the company facing financial trouble and being unable to meet its obligations. However liquidity ratios vary from company to company. A low ratio does not necessarily have to be bad. For example, companies that have high stock turnovers and sell for cash can have more liabilities than assets. It is not possible to generalize on an ideal ratio.

A high liquidity is not necessarily good. It may be due to an increase in stocks which the company was unable to sell, to inefficiency in the control of assets, debtor collection may be weak, or the company may have too much cash that is unable to be invested due to lack of opportunities. Liquidity ratios can be used as window-dressing. Companies have been known to sell stocks at lower prices in order to show greater liquidity. It is therefore important to see the trends.

Figure 4.14: Liquidity ratios



The current ratio shows to peaks, first in 1983, and later in 1994. These peaks are not caused by increasing stocks but by reduced creditors. After 2000 the current ratio is below 1 which indicates that the current liabilities are larger than the current assets, and the company is not able to meet its obligations.
The quick ratio show peaks in the same years (1983, 1994) because of the low amount of creditors and accruals in those years. In 1988 the value of quick ratio is negative. The company at that time had a negative balance at the accounts of the bank. After 1995 the quick ratio is declines and is below 1. The ratio in a way predicted the later liquidity problems.

4.4.2 Leverage

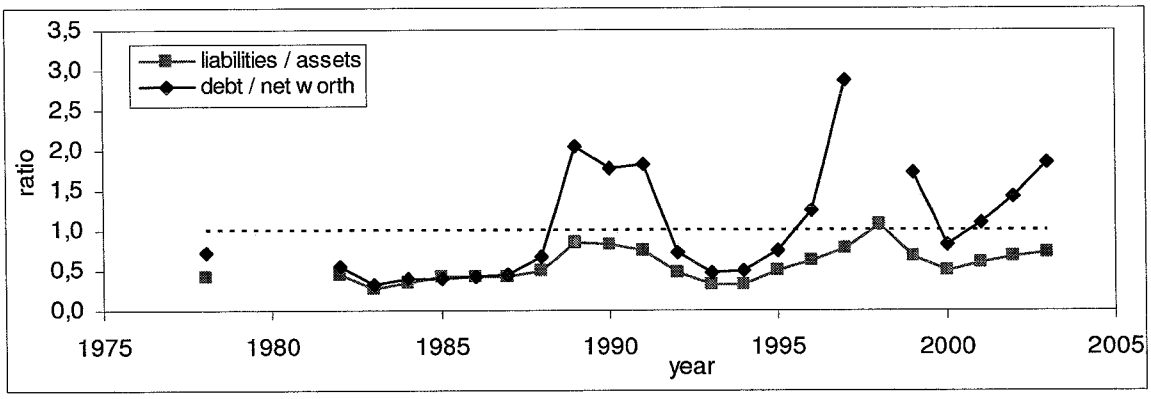
Companies use funds to purchase assets. In order to raise funds companies can raise their own share capital or borrow money from banks and institutions. The ratio of finance that is raised between share capital funds and borrowed funds is called leverage and is important for the companies profitability and growth. Companies that are highly leveraged (or geared) are those that are have a large amount of funds from loans and borrowed funds. Those companies are able to make high profits (returns on share capital) in good years, but in years with low sales income the reverse may occur and the company may come in trouble because of interest payments on the loans.

The liabilities to assets ratio is an indicator of leverage and indicates the extent the company is financed by creditors from outside (current and long-term liabilities). The ratio indicates the percentage of assets that can be sold to meet the commitments. The debt / net worth ratio is another indicator for determining the leverage of a company. The ratio is an indicator for the extent the company is financed by borrowed funds.

$$liabilities\ to\ assets\ ratio = \frac{total\ liabilities}{total\ assets}$$

$$debt\ /\ net\ worth\ ratio = \frac{longterm\ liabilities}{members\ share\ capital}$$

Figure 4.15: Leverage indicators



The liabilities to assets ratio indicates that in the years 1989-1991 almost 80% of the fixed assets book value need to be sold to meet the liabilities. After the revaluation of the assets and the increased book value this amount is reduced again.

The debt/net worth ratio indicates that in the years 1989 – 1991 the loans of the company are higher than the members share capital. After 1991 the assets of the company are revaluated and the revaluation surplus is added to the members share capital. The same counts for the period 1996 – 1999. The year 1998 is left out because in that year the members share capital is below zero. In 1999 the assets are revaluated and the share capital is positive again.

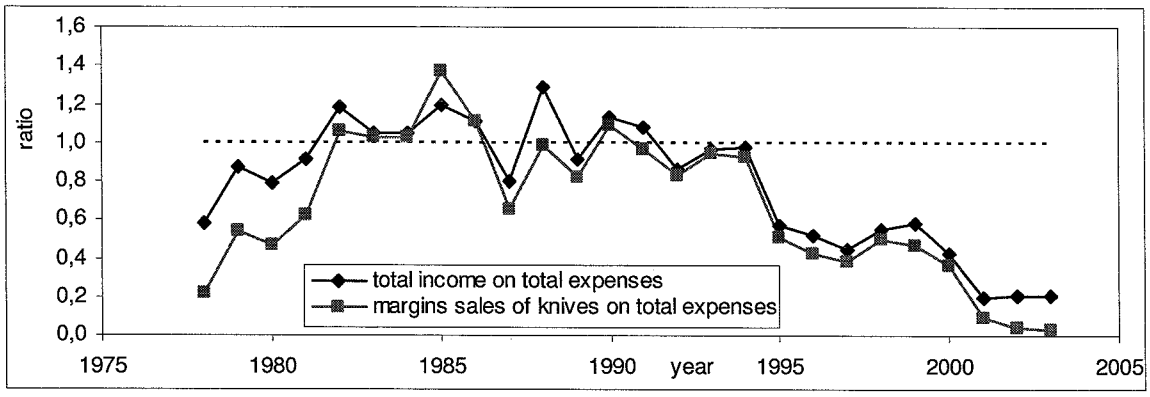
4.4.3 Profitability

The profitability ratio is of primary importance in determining the overall success of a company. It is a necessary condition for survival and there are several indicators that can be used to measure profitability. The ratios focus on measuring the adequacy of income by comparing it with one or more factors that are measured in the financial statement. The profitability reflects the quality of the products, the competence of the management and the efficiency of the company. Margins reflect the returns the company makes on sales. By calculating the margins one can find out whether the increases in expenses on, for example, raw materials are calculated into the product price or whether they are absorbed by the company.

$$gross\ margin = \frac{sales}{cost\ of\ goods\ sold}$$

The margins here are calculated in two ways. The first is the margin of the total income (including other activities such as maize milling) on the total expenses (core activities plus operational costs). The second is the margin of the sales of knives on the expenses of knife production plus the operational expenses (expenses on other activities are not included)

Figure 4.16: Margins



The graph shows that the margins of the total income in the 1980s were mostly above 1 indicating that in those years the income was higher then the costs. However the ratio is never high (only in 1988 above 1.2) indicating that the margins on sales were fairly low. After 1991 the margins are below 1 and never recover and after 1995 the margins drop substantially.
Considering knife production the graph show a similar path. The income from knives sales only exceeds the costs in the period 1982-1986 showing a peak in 1985. After 1990 the margins decline and after 1994 they drop. In general the margins are very low, even in the years where TAMECO was able to make a profit.

4.4.4 Profit driver analysis

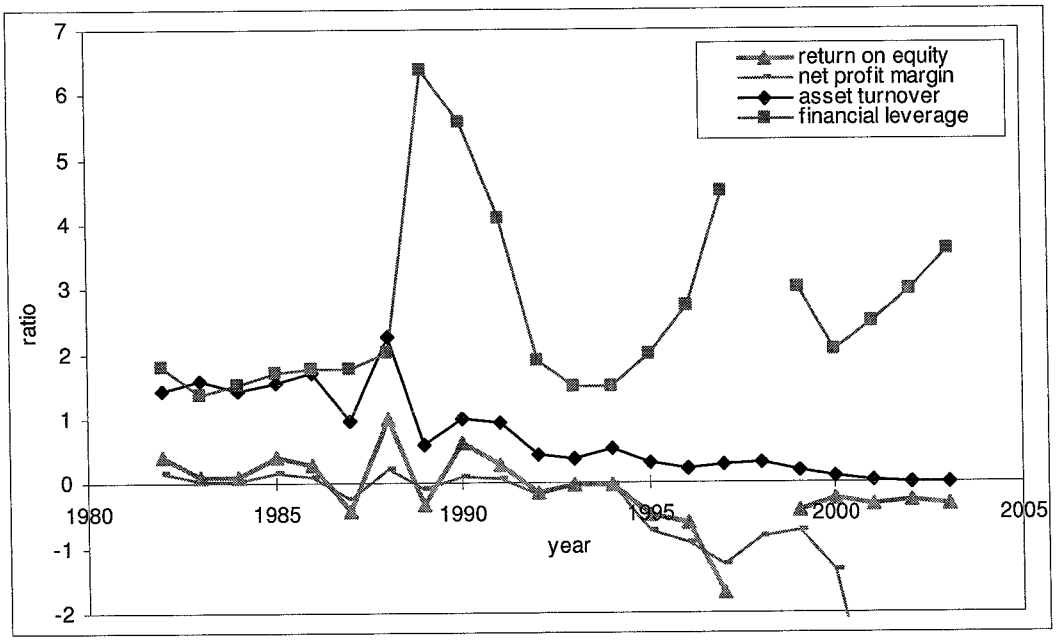
The profit driver analysis, also known as Dupont analysis, shows a logical relationship between several ratios and provides useful insights into the strategy of the business. According to Libby et al. (2001) there are two fundamental strategies a company can have. The first is product differentiation, a company offers products that are unique in some manner (high quality or special features) which allows them to charge higher prices and earn more profit. The second strategy is cash advantage. Companies try to operate more efficiently than their rivals. This allows companies to offer lower prices.
A goal for any business is to earn high returns for the owners of the company, or in case of TAMECO, the members of the society. The indicator for this is a profitability ratio called return on equity. Return on equity relates the income with the investments that were made by the shareholders.

With the profit driver analysis data of both the balance sheets and the income and expenditure accounts is used. A balance sheet is the situation at the end of each year. In order to link these with the income and expenditure data the average of the opening and end balance is taken.

$$\textit{Return on Equity} = \textit{Net Profit Margin} \times \textit{Asset Turnover} \times \textit{Financial Leverage}$$

$$\frac{\textit{Net Income}}{\textit{Average Owners' Equity}} = \frac{\textit{Net Income}}{\textit{Net Sales}} \times \frac{\textit{Net Sales}}{\textit{Average Total Assets}} \times \frac{\textit{Average Total Assets}}{\textit{Average Owners' Equity}}$$

Figure 4.17: Profit driver analysis



When the profit driver analysis is conducted for TAMECO it can be seen that in until 1988 the curves show a similar path. After 1989 the asset turnover declines gradually. This indicates that more assets have to be used to generate the same income from sales, or in other words, the sales income declines or the assets productivity declines.
The financial leverage shows peaks in 1989 and later in 1995 indicating that at those the outstanding loans where increased and/or the stockholders equity decreased. When the shareholders equity is increased by revaluating the assets in 1992, the level reduces again. The same pattern is visible from 1995 onwards.
The net profit margins measures how much from each sold TSH is profit. This margin fluctuates around zero in 1994 but drops in 1995 indicating a decrease of sales volume and/or a decrease of sales price and/or an increase in expenses.

4.5 Concluding remarks

In the 1980s TAMECO's financial performance was fairly good. In most of the year profits were earned but the margins were relatively low. In the beginning of the 1990s the financial position of TAMECO worsened and the profits became losses. Also in that period the costs and expenses increased, especially the costs and operational costs and expenses. The major share of operational costs was due to the increased amount of interest payments. Bank loans were acquired from THB and CRDB bank at high interest rates and a loan of HIVOS needed to be repaid. The higher expenses did not, at first, lead to big losses. Until 1994 only the margins were only slightly below 1, indicating only small losses. But in 1995 the income from sales of knives dropped resulting in high losses and a worsening financial position.

The decrease in sales income is caused by the fact that the production was stopped because of shortages in raw material supply. TAMECO at the time needed finance to purchase the raw materials. In the past Dutch aid organisations such as HIVOS used to help TAMECO in getting finance through loans and foreign exchange programs but in the beginning of the 1990s they were withdrawing from the company. The loan of HIVOS still needed to be repaid. Also TAMECO already had outstanding loans from CRDB and THB at commercial rates. This combined with the fact that TAMECO was making losses at the time the factors made it very difficult for TAMECO to get finance. Commercial banks were reluctant to offer a loan.

Another reason for the worsening financial position that can be related back further was the low margins in cost-price calculations. According to cost price calculations TAMECO used a price mark-

up of 5% in 1989 with a production target of 312,000 knives (Mwingira, 1987, 1989). TAMECO desired to have a price mark-up of 25% but in order to make the price more attractive to customer the 5% mark-up was used. This mark-up is quite low for a commercial organization and can only be profitable high sales turnovers are expected and the production process is consistent.

Besides this Tanzania had a high inflation rate at a time and the cost-price calculation was outdated quickly. Furthermore costs and expenses were also high because of fringe benefits. In the 1980s TAMECO had adopted a housing scheme for workers that have been in the organization for more than 10 year. They were entitled to build a house on the expenses of TAMECO. All these factors combined eventually led to losses and a worsening financial position.

Chapter 5. Economic Policy

In this chapter the economic policy of Tanzania is analyzed and presented. The methodology for this investigation is based on the article of Van Engelen *et al.* (2001). In the article the industrial policy of Tanzania in the period 1961-1995 is analyzed. The analysis is based on empirical data and results in the identification of different periods of consistent policy. As the article only describes the policy periods until 1995 an extra analysis must be made for the period after 1995. This analysis will be integrated with the findings of the article and will be presented at the end of this chapter.

The structure of this chapter is as follows. First the methodology of analysis is presented. This is followed by an examination of the different periods of coherent policy, serving as a short recap of the findings of Van Engelen *et al.* (2001). After this the period after 1995 is investigated using the same methodology and the findings are added with the results from the article. The chapter finishes with a discussion on the government policy and TAMECO.

5.1 Methodology

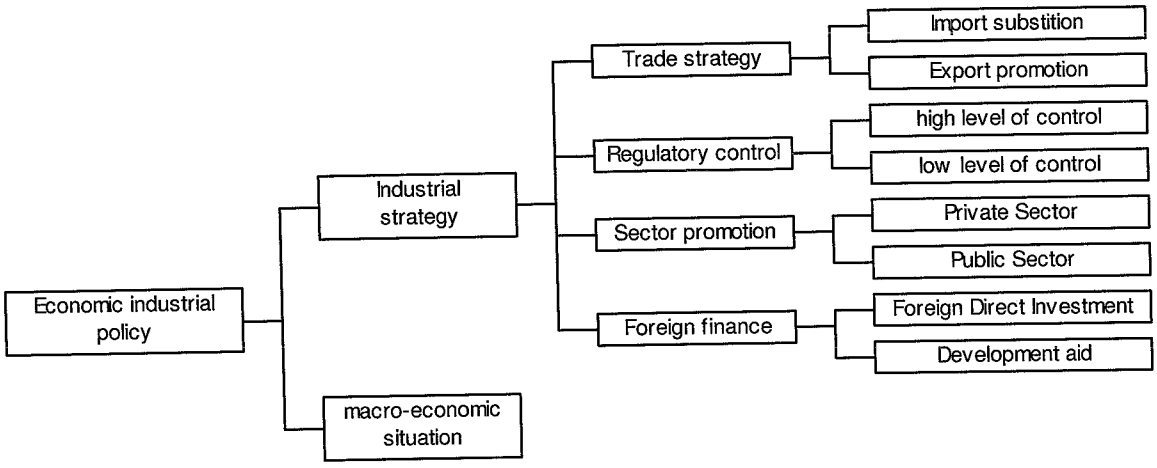
The economic policy is a very broad concept and in itself involves various broad aspects such as the trade strategy and the degree of regulatory control. In the case of Tanzania the policy has changed over time. There are two ways of identifying changes in the policy. The first is to look at objectives, plans and the strategies presented the Development plans of Tanzania. The second approach is to empirically monitor the actual use of policy instruments over time.
It is important to realize that these two approaches may lead to different results. There can be a difference between the design of the policy plans and the actual usage of policy instruments. Especially in developing countries this might be the case. Van Engelen *et al.* (2001) discuss three possible reasons for this. First development plans are sometimes used for gaining local and international support. Therefore they can be seen more as propaganda documents rather than real plans that really are to be implemented (Todaro, 1997). Secondly, when the political and economic situation is unstable, which is not unthinkable in developing countries, the government might be forced to implement short-term policies rather than the long term development plans (Killick, 1976). The third reason is given by Gulhati (1990) suggests that in Africa the policy instruments in the development plans are often changed in the end, or not used at all.

In order to get good indication about the policy that is executed by a government, the second approach is preferable because it measures the actual usage of policy instruments. This is also the methodology that is used by Van Engelen *et al.* (2001). In the research, four general aspects of policy are investigated. These aspects are based on the article of Weiss (1988) and are to investigate the strategy of industrial policy in developing countries.
First aspect is the industrial trade strategy. The government can use instruments for import substitution, protecting domestic producers (such as import quotas, licenses exchange rate appreciation), or for export promotion, stimulating local firms to export (with tax concessions, export credits, export processing zones).
The second aspect is the degree of direct regulatory control. The regulatory control can be in the areas of international trade, the monetary sector, labor, ownership, and prices and international trade. Regulatory control ranges from a low (liberal) to a moderate and high degree of direct regulatory control.
The third aspect that is investigated is the roles the government attributes to the private or the public sector. If the public sector is promoted there is public enterprise investment, firms are nationalized and there is a preferential allocation of resources. If the private sector is promoted than there will be investment incentives, privatization of firms, et cetera.
The final aspect is the nature of foreign finance. The inflow of foreign finance may come in the form of foreign direct investment (FDI) or in the form of development aid. For example, the government can stimulate FDI by giving tax incentives or other privileges to foreign investors such as the right of monopoly.

By analyzing these four aspects one can get a general idea of the economic policy. This method is also useful to identify changes or shifts in policy. Whenever there is a radical change in at least two of the four dimensions, then a new policy period will begin. For example, if the trade strategy shifts from import substitution to export promotion and the degree of regulatory control changes from high to medium then this will mark the beginning of a new policy period, even if the other two stay dimensions stay unchanged.

Besides the analysis of the four policy dimension, Van Engelen *et al.* (2001) also investigate the macro-economic situation of the Tanzania. The macro-economic situation is added as an extra dimension before determining the final policy periods. The framework of the analysis is presented in figure 1.1.

Figure 5.1: Dimensions of Economic Policy



Before presenting the results of the own research first the periods of industrial strategy and the macro-economic of Tanzania in the period 1973-1995 are described. The following paragraphs serve as a summary of the findings of Van Engelen *et al.* (2001). Thereafter the findings for the period after 1995 will be presented. The aspects of industrial policy are discussed well as the macro-economic situation of Tanzania. At the end of this chapter the results are integrated and an overview of the different policy periods is given.

5.1.1 Industrial strategy

When Tanzania became independent in 1961 most policy instruments where similar to that of the late colonial period. Foreign investment was encouraged and there was a low degree of regulatory control. This is changed with the signing of the Arusha declaration in 1967. The Tanzanian government aims at becoming self-reliant in industrial production from that moment on. There is a shift from the private sector to the public sector and large (foreign owned) firms are nationalised. The National Development Corporation (NBC) is established with the purpose of developing the public sector.
Also, from 1967 onwards all the imports and exports are channelled through the State Trading Corporation (STC) and from 1971 the internal wholesale trade is nationalized. Manufacturers are now forced to buy from and sell their goods to this organization. At the same time a price control system is set up.
The Tanzanian government starts to control the exchange rate which eventually leads to exchange rate appreciation. This combined with protection through tariff barriers, import quota and import licensing, leads to a strategy that can be classified as import substitution.

In the beginning of the 1970s the inflow of foreign direct investment is decreasing and substituted by the inflow of foreign aid. During these years the share of capital expenditures in the form of aid increases to one third of total capital expenditures mostly in the form of donor-tied capital intensive projects. The direct regulatory control imposed by the government is also increased. In 1973 a new import licensing system is introduced along with a system for the administrative allocation of foreign

exchange, and imports of goods are fully controlled. There is no clear policy for the allocation of the import licenses which leads to preferential treatment of certain firms.
In 1973 a price control system is introduced with the purpose to limit the influence of monopolies of domestic producers but still ensure a financial profitability for these firms.
Also the confinement strategy is maintained but the State Trading Corporation is reorganized and decentralized. The STCs tasks are now taken care of by 6 parastatal importing companies and 18 regional trading companies.
All these factors indicate a high degree of regulatory control. Import licensing restricts competitive imports to enter the country while price controls and the confinement strategy raise the prices and availability of imported products and limit their distribution opportunities.
This, in combination with the still overvalued exchange rate, implies in a continuation of the import substitution strategy, and in some cases reaches effective rates of protection up to 470%.

In 1981 some adjustments are made to counterbalance the import substitution strategy. The Export Rebate Scheme (ERS) is introduced which serves as a subsidy for exporting producers and compensates them for losses from selling at world market prices. In 1983 the General Retention Scheme (GRS) is introduced and serves as another incentive for export promotion. This scheme allows exporters to keep a share of the foreign exchange they gained while exporting, and use this for importing production inputs. However at that time these measures were not really effective. The strategy of the government is still aimed at the development of the public sector in stead of the private sector. 1984 marks the beginning of a new policy strategy. In that year the own funds import scheme is introduced. This scheme encourages Tanzanian citizens to obtain foreign exchange on the market other than official foreign exchange channels. This marks a shift away from direct regulatory control as imports under this scheme are not subjected to price controls or confinement rules.
In 1988 imports are partially liberalized with the introduction of the Open General License (OGL). The foreign exchange is provided by the World Bank and serves to finance high priority imports. Decontrol is not limited to foreign exchange allocation. Between 1983 and 1986 the number of domestic products that are price controlled is halved and the price control of imported products is abolished. The system of confinement is almost entirely abolished in 1989.
Also the policy of exchange rate rigidity is abandoned. The exchange rate is devaluated which in return provides incentives for manufacturers of export products. All these measures result in lower effective rates of protection endorsing the shift towards export promotion.

From 1990 onwards the government strategy starts to focus on the development of the private sector. In 1990 the National Investment Act (NIA) is implemented which provides various instruments such as custom duty exemptions, guarantees against nationalization, foreign exchange retention. These are all aimed to encourage private investments in industry. Also the Investment Promotion Centre (IPC) is established which serves as an institution that supports private investors.
Besides these measures to promote the private sector also the public sector is reformed. In 1992 the Public Corporations Act (PCA) is introduced and the Parastatal Sector Reform Commission (PSRC) is established. The task of this commission is to decide which public enterprises should be retained and which should be privatized or wound up.
Furthermore parastatal companies can no longer count on preferential treatment regarding credit allocation as the financial sector is liberalized and commercial banks enter the market. Also the trade regime is liberalized and from 1991 onwards price control is no longer operative. From 1992 onwards companies are allowed to sell and buy foreign exchange at market rates and there no longer is exchange rate appreciation.
The only way domestic firms are protected against imports now is through the tax system. However at that time the system functioned poorly and the collection of import duty was far below official tariff rates. This was implying large scale exemptions and evasions from taxes of imported goods and meaning a threat to domestic manufacturers from imported goods.
In this period export is promoted with the devaluation of the nominal exchange rate. Furthermore the introduction of the Export Credit Guarantee Scheme (ECGS) encourages credit provision for exporters. From 1990 onwards liberalization of the market continued and the production for the export market is stimulated. Also the flow of foreign aid decreased and the emphasis laid at attracting foreign direct investments.

5.1.2 Macro Economic situation

Two approaches are used to determine the macro-economic situation of Tanzania, changes in the internal macro-economic situation, and external influences to the Tanzanian economy.
Up to 1973 the macroeconomic situation is relatively stable. In 1973 the first worldwide oil crisis takes place and the causes the Tanzania current account deficit to rise. Also inflation rates start to rise. Thank to the policy measures and the coffee boom of 1977 Tanzania initially manages to stabilize the external and internal imbalances and the inflation rates and current account deficit decreases.
However in 1978 the tide changes again. The current account deficit increases again and external influences result in a balance of payment crisis. The external influences causing this are the dissolution of the East African Community in 1977, the second oil crisis in 1979, the war with Uganda in 1979, and severe droughts and deteriorating terms of trade.
In 1980 an inflation rate of 30.3% is recorded and macro economic growth comes to halt in 1981. Negative growth rates, high inflation rates and current account deficits show that the Tanzanian economy is in crisis from 1980 onwards. The crisis persists up to 1984. In that year the own funds import scheme is introduced and from that moment onwards positive real growth rates of GDP are recorded. Nevertheless the inflation rates and current account deficits remain high and external and internal imbalances persist. In the period 1985-1993 the debt of Tanzania rises from 74% to 241%.

When integrating the macro economic situation with the policy periods Van Engelen *et al.* (2001) conclude that a there are four periods that can be identified in the period 1973-1995. The first period is from 1973-1980 and can be categorized as a period with import substitution, a high degree of regulatory control, public sector promotion and dependence on development aid. The second period starts in 1980 when the macro economic situation changed and the Tanzanian economy was in crisis. This crisis forced the government to think about its policy strategy. Under influence of the IMF and the World Bank Tanzania changed its strategy in 1984 and started to liberalize the market and promote exporters. In 1990 the process of liberalization was continued and there was more focus on the private sector and on attracting foreign investors. The schematic overview of the policy periods from 1973 to 1995 is presented in Table 5.1

Table 5.1: Policy periods 1973-1995

Characteristics	1973-1980	1980-1984	1984-1990	1990-1995
Industrial strategy	IS	IS	IS - EP	EP
Trade strategy	High	High	Moderate	Low
Regulatory Control	Public sector	Public sector	Public sector	Public / Private
Sector promotion	Aid	Aid	Aid	Aid - FDI
Foreign finance				
Macro-economic situation	first signs of imbalance	crisis	internal and external imbalance	internal and external imbalance

Notes: IS = Import substitution, EP = Export promotion, FDI = Foreign Direct Investment
Source: Van Engelen *et al.* (2001)

5.2 Results from 1995 onwards

In 1990s the government continued the process of transformation of the public sector. With the establishment of the Parastatal Sector Reform Commission (PSRC) in the early 1990s many parastatal companies and state owned enterprises were privatized or wound up. A result of the program was that by the end of 1999 more than 200 former parastatal companies were now owned by foreign investors (Portelli, 2006)

The introduction of the National Investment Act (NIA) and the establishment of the Investment Promotion Centre (IPC) were the main tools to promote (foreign) private investment. However, by the mid-1990s it was recognized that the investment policy was not meeting international investor requirements because of conflicts between the policy and the legislation.
After a review on this matter a new policy and Act were formulated. In 1996 the National Investment Promotion Policy (NIPP) was adopted and in 1997 the Tanzanian Investment Act (TIC) was formulated. Key features of the investment framework included the establishment of the Tanzania Investment Centre (TIC), replacing the Investment Promotion Centre. The TIC is aimed to facilitate and support investors. The Centre helps potential investors with handling the many regulatory procedures they have to go through before they can enter the market. To do this properly, the TIC has staff working at the various agencies and ministries to deliver the right authorisations. Large investors (>300.000USD) can get a "certificate of incentives" through the TIC which provides them with certain advantages, such as immigration and tax advantages. Besides this the TIC is active in areas such as research on investment opportunities and the promotion of investment (Royal Netherlands Embassy, 2005b).
The TIC also gives advice to the government on these matters and is still active today. Since its establishment a number of sectored policies and regulations have been reviewed and changed in favour of private investment (Portelli, 2006)

Other measures are aimed at improving the business environment. In 1999 commercial courts were established to speed up the hearing of commercial disputes with the aim to improve the investor's confidence in the local business sector. At the same time international treaties were signed to protect foreign investors from losses due to nationalization or armed (international) conflicts. An example of this is the "Agreement to promote and protect investments" signed by the governments of Tanzania and the Netherlands in April 2004. This agreement covers a wide range of issues which are aimed at to contribute to a more stable and attractive investment climate in both countries. This includes issues such as the security of firms against nationalization, the promotion of investments, making sure that investors from all countries are treated on an equal basis, and the provision of security or compensations in case of war or political disruptions. (Royal Netherlands Embassy, 2005b).

In January 2004 the Tanzanian Government launched the BEST program. This program is aimed at improving the environment of the private sectors. The objectives are twofold; the first objective is to reduce the number of procedures and administrative barriers laid down by the government by removing unnecessary regulations and establishing new "business-friendly" regulations and procedures.
The second objective is to improve the quality of services by the government to the private sector, such as more efficient and transparent government institutions and commercial dispute resolution by the introduction of commercial courts. This program is set to run from 2004-2008 and is sponsored by international donors. Despite the good objectives there are reports that the program has some shortcomings and is yet to function as planned.

A wide range of policies are also formulated in the development of the private sector some of which will be pointed out shortly here. In 1996 the Sustainable Industrial Development Policy (SIDP) (1996 – 2020) was designed with emphasis on promotion of Small and Medium Enterprises (SME) by supporting existing and new promotion institutions, simplification of taxation and licensing and registration of SME and improving access to financial services (Ministry of Industry and Trade, 1996).

The National Trade Policy (Ministry of Industry and Trade, 2003a & 2003b) has the main goal of creating an economy with export-led growth and integrate and participate in the global markets. The policy is in accordance with the National Development Vision 2025 which is aimed at poverty reduction and to transform the country from a low productive agricultural country to a semi-industrialized one. In order to achieve this, a GDP growth rate of 7% is needed which indicates a rate 14% of trade growth. For reaching these goals a diversified competitive export-led sector must be created (Ministry of Industry and Trade, 2003a & 2003b)

The tax regime has also improved, especially in the field of tax revenues. The organisation that is responsible for tax administration is the Tanzania Revenue Authority. The increase in revenue collection is attributed to improvements in Value Added Tax (VAT) and income tax receipts which were made more efficient. Also the implementation of the Income Tax Act (ITA) of 2004, eliminating evasion loopholes, was an improvement to the tax regime. As far as monetary policy is concerned the main aim is to ensure price stability (OECD, 2006).
Despite these measures the tax administration procedures are still regarded as bureaucratic and complex, especially for Small and Medium Scale companies. There is no clear distinction between the responsibilities of national and regional authorities. The so-called nuisance taxes are supposed to be abolished in 2002 but are sometimes still being levied by local authorities. In practice however, some of the tax exemptions that were promised by the TIC are not always maintained. The Tanzania Revenue Authority (TRA), the organization that is responsible for the tax administration, does not always honour these agreements (Royal Netherlands Embassy, 2005b).

The emphasis on export promotion is continued. The Export Development Strategy (EDS) was formulated in 1996 and adopted in 1999 with the objective to stimulate growth of exports in the face of a persistently worsening balance of payments.
In addition the government also introduced Export Processing Zone Act in April 2002 and formulated the "Tanzania Mini-Tiger Plan 2020". This plan is inspired by the success-stories of the South East Asian countries and aim of the plan is to create a favourable climate for both domestic and foreign investment by creating Special Economic Zones, a revised regulatory framework and a supportive legal framework (OECD, 2006)

In the world a number of poor countries are still struggling with high debts. In order to overcome the struggle of the so called Heavily Indebted Poor Countries (HIPC) the international community initiated a debt relief program. This HIPC initiative was first implemented in 1996 through the IMF and The World Bank. In 1999 this initiative was reviewed and enhanced in order to provide more and faster debt relief and a stronger focus at reducing poverty.
Tanzania is one of the countries that contribute from this initiative. Tanzania's external debt is about US$7.3 billion in 2003 which is about 100% of GDP (Bigsten *et al.,* 2001). According to World Bank data the amount of debt relief that is committed to Tanzania is a total of USD 2.0 billion in terms of reduction of NPV and USD 3.0 billion of US dollar in terms of Nominal Debt service relief (World Bank, 2004). This amount is to be committed from 2000 onwards and the debt service-fiscal revenue ratio is expected to decline from 15% to 9% during 2000-2009 (Bigsten *et al.,* 2001).
One of the key objectives is to reduce poverty. Tanzania will receive assistance under the enhanced HIPC initiative if it reaches a number of conditions such as the adoption and implementation of a poverty reduction strategy paper.

Table 5.2: Key economic indicators of Tanzania

KEY INDICATORS		1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Population[a]	millions	29.1	30.0	30.9	31.8	32.6	33.3	34.0	34.8	35.5	36.2	36.9	37.6	38.3
GDP, production based[a]	millions TSH	1726	2299	3021	3768	4703	5571	6433	7268	8275	9432	10678	12366	14209
GDP/capita[c]	USD	123.7	146.3	177.4	199.1	231.3	245.6	237.0	260.3	254.5	266.8	271.9	315.1	318.1
Real GDP growth[a]	(%)	0.4	1.4	3.6	4.2	3.3	4.0	4.7	4.9	5.7	6.2	5.7	6.7	6.8
PRICES														
Consumer Price Index[b]	1995=100	58.5	77.9	100	121	140.4	158.4	170.9	181	190.3	199	206	214.7	224.1
Inflation rate[b]	(%)	26.6	33.2	28.4	21.0	16.0	12.8	7.9	5.9	5.1	4.6	3.5	4.2	4.4
Exchange rate[a]	1USD – TSH	479.9	523.5	550.4	595.6	624.6	681.0	797.3	803.3	916.3	976.3	1063.6	1043.0	1165.5
TRADE														
Exports[a]	millions USD	764.8	937.65	1265.2	1372.2	1209.4	1144.4	1143.6	1290.7	1765.9	1899.7	2163.9	2590.4	2890.3
Imports[a]	millions USD	-2021	-1813	-2139	-2167	-1962	-2353	-2210	-2050	-2210	-2144	-2659	-3305	-3825
Resource balance[a]	millions USD	-1256	-875	-874.2	-794.3	-752.4	-1209	-1067	-759.3	-444.1	-244.1	-495.2	-714.7	-934.9

Sources: [a] IFS Statistics database, [b] World Bank data, [c] Calculated from data

Figure 5.2: GDP per capita in USD

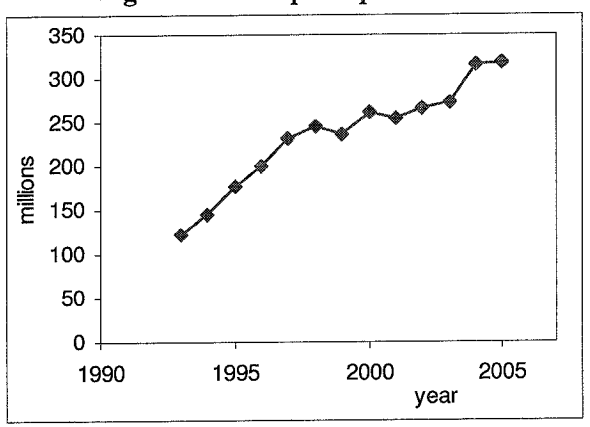


Figure 5.3: Real GDP Growth

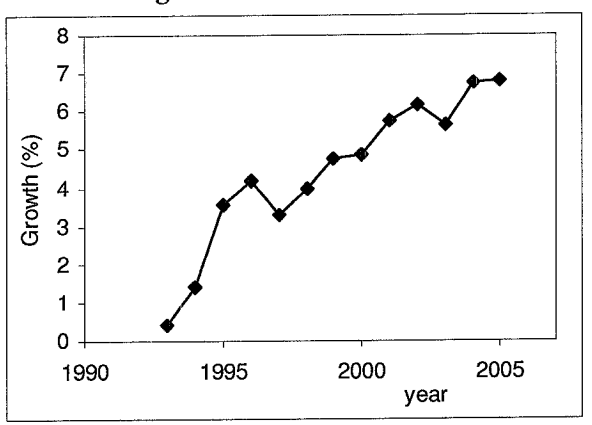
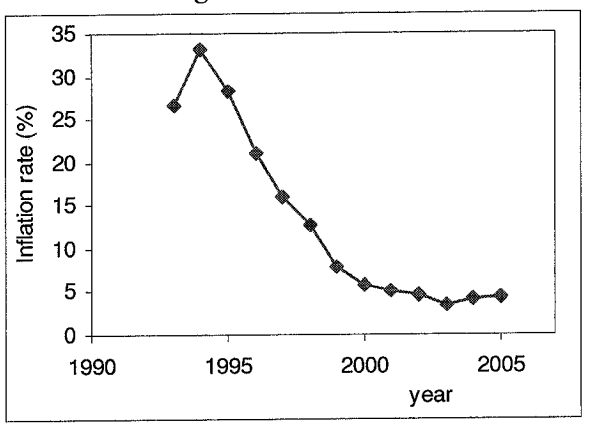


Figure 5.4: Inflation rate



5.3 Macro economic environment

The analysis of the macro-economic environment is based on macro-economic indicators. Three sources are used to collect this data, Tanzanian sources (Bank of Tanzania, National Bureau of Statistics), the database of the IMF which is the IFS statistics database, and data from the World Bank. During the review of the data it showed that the three different sources almost always showed different results. The trends however are quite similar and therefore the differences in results are not discussed here. The results are presented in Table 5.2.

As far as the macro-economic environment is concerned also some change is seen. From 1994 onwards the inflation rate is decreasing and is under 10% from 1999 onwards. Also the exchange rate is relatively stable. The GDP growth on the other hand increases steadily reaching a growth of 7% in 2005. These signs indicate that the economy has stabilized and that the economy is growing at the moment.
In terms of trade the position is also improving. The prices of export rise while the prices of import decline in 2001 and 2002, allowing Tanzania to buy a larger quantity of imports with the same quantity of export. The Balance of payments figures show some differences between IMF data and data from the Bank of Tanzania. Both trends are somewhat similar however. Both imports and exports are increasing steadily and the gap in relative terms seems to be narrowing. Still there is a large trade gap between imports and exports.

The conclusion from this analysis is that the Tanzanian economy is still in the process of transformation. There is a continuing emphasis on export promotion, public firms are still being privatized and there are large incentives for foreign direct investment. From 1999 onwards the economy reached a point where one can say it is relatively stable with low inflation rates and stable rate of GDP growth.

Integrating this view into the framework of Van Engelen *et al.* (2001) some small adjustments can be done and one period can be added. The period 1990-1995 is expanded to 1999, and from 1999-2005 a new period is visible when there is a relatively stable macro-economic situation. The new scheme is presented in Table 5.3.

Table 5.3: Policy periods 1973-2005

Characteristics	1973-80	1980-84	1984-90	1990-99	1999-2005
Industrial strategy					
Import Substition/Export Promotion	IS	IS	IS - EP	EP	EP
Regulatory Control	high	high	moderate	low	low
Private/Public sector	public	public	public	public-private	private
Foreign finance (FDI / Aid)	aid	aid	aid	aid - FDI	aid - FDI
Macro-economic situation	first signs of imbalance	crisis	internal & external imbalance	internal & external imbalance	relatively stable

5.4 TAMECO and the influence of government policy

In this section the influence and incentives of the government explained in the view of TAMECO. The aim of this discussion is to contribute to the insight in the relationship of government policy and response or performance of the firm.

5.4.1 Period 1973-1980

TAMECO was established in 1972 and was first active as a motor vehicle repair shop. In 1977 the first attempts were made to start the production of knives on a large scale eventually leading to the instalment of a complete production line in 1981. Development aid played an important role in this stage as it was very difficult for TAMECO to get local finance for the purchase of the machines.
HIVOS, a Dutch aid organization, was preparing to help and served as the main donor by providing loans and grants to implement the project. The Eindhoven University of Technology (TU/e) contributed by giving advice and helping to collect the adequate machinery. The production capacity increased to 250,000 knives a year.
The import of raw materials was difficult in that period. Tanzania at the time had shortages in foreign exchange which made it difficult to import goods and services. If TAMECO wanted to import goods, first the import licenses needed to be acquired. This process was difficult and time consuming and when the license was finally granted often only a part of the foreign exchange was provided. This leaded to a situation that TAMECO applied for higher amounts of foreign exchange than the amount that was really needed and also the dependency on HIVOS and TU/e to get enough foreign finance.

The market situation was relatively simple as all trade was confined to the State Trading Corporations. The entire production of TAMECO was bought by one of these trading corporations, the Household Supply Company (HOSCO). This company also had the right to impose price control and the price of TAMECO knives were negotiated at a fixed price. HOSCO marketed the knives through the Regional Trading Companies (RTC) to wholesalers and retailers. TAMECO in that period did not have to worry about quality of the knives because still their entire production would be succumbed by HOSCO.

5.4.2 Period 1980-1990

In the period 1982-1986 there were hardly any changes in the setting. TAMECO still was dependent on the help of HIVOS and the TU/e for the generation of foreign exchange in order to import of raw materials. According the report of Op het Veld (1985) the TU/e and HIVOS were held more or less responsible the continuation of production at the time.

This situation changed in the summer of 1987. From that moment on HOSCO was no longer prepared to buy TAMECO's entire production. The consequence was that TAMECO now had to develop their own marketing channels which also had implications for price and quality. Furthermore the market liberalized with the introduction of the Open General License in 1988. This made it possible to import goods and led to an inflow of products such as knives from China and India. Although these imports were still in low amounts this meant that TAMECO was facing more competition and had to change its vision from a production oriented to a market oriented approach.

TAMECO responded quite well and from 1987-1990 progress was made in terms of market orientation and the marketing mix (product, price, promotion and place). The product was made more attractive to customers as quality was improved. The main changes in the product were the change from wooden handles to plastic handles and an improved resistance to rust. The price was set at a market conform rate. At first customers were reluctant to place orders but this changed when TAMECO decided to lower the prices. The downside however was that the lower prices combined with high inflation rates and the devaluation of the shilling resulted in very low profit margins. As for promotion TAMECO at the time regularly placed advertisements in newspapers and had a weekly radio program were knives were promoted.

In that period TAMECO was able to increase the number of customer-records from 4 to 36 of which 10 customers ordered on a regular basis and accounted for 80% of the total sales. The entire production was sold to wholesalers and retailers that were located in Dar es Salaam. Despite good initial results in terms marketing no efforts were made to expand the distribution channels to all over the country. At the time there were no market constraints as the entire production could be sold and TAMECO had a wide client base (Op het Veld; 1989, 1990)

The major concern of TAMECO was the continuation of production. The issue of importing raw materials was still a problem. In 1989 the Bank of Tanzania expanded the Open General License which allowed the import of more items with a letter of credit. This enabled TAMECO to import raw materials using local funds. Despite this expansion of the OGL finance remained a problem and TAMECO was still dependant on loans and grants from HIVOS and TU/e.
As for local finance things became easier. With the establishment of commercial banks companies now had the opportunity to get local finance, in the form of loans, for capital investments. TAMECO for applied for a loan from THB bank of in order to finish the office building at an interest rate of 27%. In 1989 TAMECO also applied for a loan through CRDB bank at an interest rate of 20%. Both loans increased the liquidity of the company at first but the downside was that the costs for financing were high. These loans eventually became a burden for TAMECO.

5.4.3 Period 1990-present

In the beginning of the 1990s TAMECO is still well able to sell the entire amount of produced knives. In 1993 there are no real market constraints and competition is weak. To give an indication, at that time TAMECO sold its carbon-steel kitchen knives at a retail price of 275 TSH, while competitors, mostly Chinese and Korean fabricated knives from stainless steel sold for 650 TSH (Looijen and Sonke, 1993). When TAMECO decided to increase the price some of the customers refused to buy knives, but this did not lead to problems as TAMECO was still able to sell their entire production.
Despite the market situation, the threat of imports was increasing. The government was opening its borders and the approval that was previously needed to get foreign exchange was abolished. These measures made it easier for wholesalers to get foreign exchange and import knives form China and India.
For TAMECO the problem of importing raw materials and the process of getting foreign exchange remained complicated. TAMECO remained to be dependent on the foreign organizations. HIVOS decided to withdraw from the project and TAMECO had to search for new channels that could provide foreign exchange. Commercial banks however were reluctant to provide loans to co-operatives. Co-operatives were seen as unprofitable and static companies that were unable to make good management decisions and adapt quickly to the changed market setting because of their organization structure. TAMECO was unable to get finance through commercial channels and eventually TAMECO turned to the Import Support Program of the Royal Netherlands Embassy in Tanzania for the provision of foreign exchange.
In that period also the Promotion Investment Centre (IPC) was established and provided incentives for firms to import goods. TAMECO started negotiating with the IPC in order to get a "certificate of approval". This certificate allowed a company to get exemptions on import duties and import taxes of materials and equipment but it is not clear whether TAMECO was actually granted this certificate.
In that period TAMECO was introduced with the concept of Value Added Tax (VAT). The government enforced tax control and a TAMECO was forced to charge a tax of 10% upon each sold item. From 1995 onwards TAMECO was making big losses and the production was on a low scale, mainly due to the lack raw materials and the lack of finance to import these materials.

In 1997 the market is penetrated by Chinese, Korean and Indian knives. According to a survey (Zijl and Lassche, 1997) the stainless steel knives from China are sold at a slightly lower price and have better looks than the TAMECO knife. The quality however is not as good as the TAMECO knife in terms of durability. The present situation is quite similar. The economy has stabilized and the market is liberalized.

Chapter 6. Discussion

The main goal of this report is to identify the causes for TAMECO's failure to survive in the new policy setting. This discussion is aimed at providing some of the answers why TAMECO failed to survive. This will eventually lead to the conclusions in Chapter 7.

The main reason TAMECO is not producing anymore is found in Chapter 4. From the income and expenditure accounts it can be seen that from 1995 onwards the company was making big losses. The accounts also show that TAMECO is making losses from 1991 onwards. In Table 6.1 an overview is given of the income and expenditure of TAMECO for only the knife making section. The costs of knife manufacturing include the input of raw materials, salaries of the production and engineering department and the depreciation of the machines. The operational expenses include overhead costs such as banking and finance expenses, salaries of the office employees, office expenses and other business expenses. The table shows that from 1991 onwards TAMECO is making losses in terms of knife production. From 1995 onwards these relatively small losses turn into big losses. The cause of this is found in the decreased income from sales of knives. The costs and expenses remained high because of fixed costs such as depreciation of the machinery and interest payments on loans.

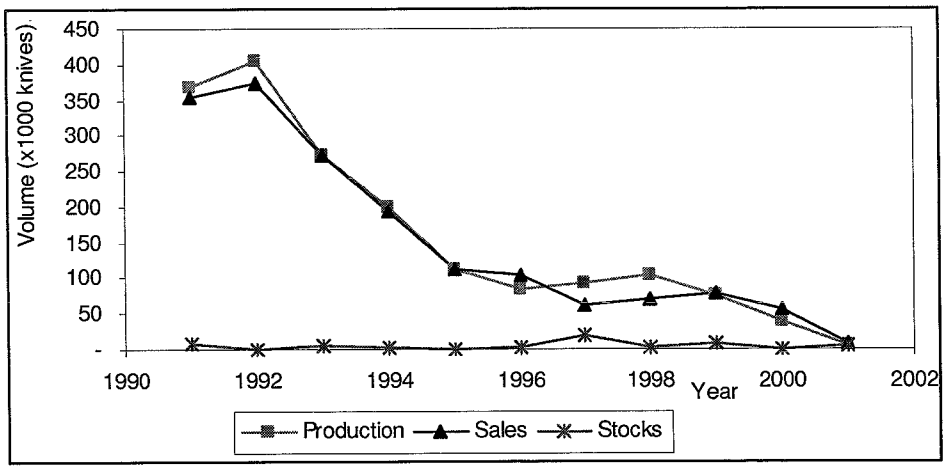
Table 6.1: Profits from knife manufacturing in millions of TSH

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
income from sales of knives	65.9	72.3	75.4	88.8	112.3	73.7	44.7	50.4	47.8	45.5	31.6
costs of knife manufacturing	30.0	29.2	41.7	44.8	53.2	77.3	46.0	58.3	34.4	64.3	61.6
operational expenses	30.1	45.7	48.9	49.2	68.7	67.5	59.8	72.8	60.8	32.3	26.5
Net result	5.7	-2.6	-15.2	-5.2	-9.6	-71.2	-61.1	-80.8	-47.4	-51.1	-56.5

Source: Income and expenditure accounts

The next question that arises is why the income from sales dropped. For the answer of this question some scenarios are possible. The first scenario is that sales dropped and TAMECO was unable to sell its products on the market. The second scenario is that TAMECO had troubles in production which led to a decreasing amount of knives to sell. The answer for which factors caused the sales income to is found in Figure 6.1. This figure presents the amount of knives TAMECO produced, the amount of knives sold and the amount of stocks and is based upon data from stores ledgers and sales reports. The figure shows that the production and sales volume is quite similar. It also shows that there is no built up in stocks which indicates that TAMECO was able to sell most of its knives on relatively short notice. The first scenario is unlikely as there was no stock built up, this makes the second scenario is more viable.

Figure 6.1: Volume of Production, sales and stocks of knives

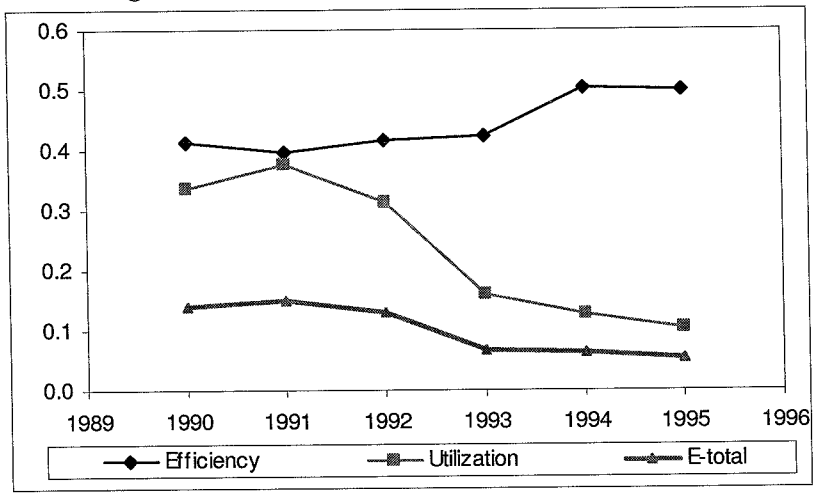


A third option might be that TAMECO was selling the produced knives at a lower price in 1996. If this is the case there could be a high volume of sold products but the sales income would still be low. From an analysis of the sales reports this does not really seem the case. TAMECO was selling its

goods for 575 TSH in 1994 and 645 TSH in 1996. The price of the knives increased in that period. If one takes in mind that the inflation rate in that period was 30% one can say that the price of a TAMECO knife did not follow the price index of the goods in Tanzania in general. This might be caused by TAMECO's response to market influences with lower priced knives penetrating the market. Still in my opinion this is not the main reason why TAMECO was generating losses.

This is found in fact that production output dropped considerably from 1991 onwards. The reason for this drop in production output can be found in Chapter 3. According the data on productivity and production efficiency the drop is mainly caused by underutilization of the production line as can be seen in Figure 6.2. When the determinants of this drop in production efficiency (E-total) are analysed it becomes clear that this drop is mainly caused by shortages in raw materials, especially from 1993 onwards.

Figure 6.2: Efficiency figures of the grinding machine



This brings us to a new question; what caused the shortages in raw materials? From what we know about the production process the raw materials where ordered through CICA (TU/e). Because the materials had to come from Holland there were very long lead times. The time between the moment the goods were ordered and the moment the goods were delivered could take up to 1 year. This also implies that if the management of TAMECO was unaware of the amount of stocks and was too late in ordering the goods this would lead to shortages.

Before ordering goods TAMECO needed to have sufficient foreign exchange. In the 1980s TAMECO was able to get this through the loans of HIVOS. The loans at low interest rates and could be repaid in local currency and at a fixed exchange rate. With the devaluating exchange rate these conditions were very favourable for TAMECO. In the beginning of the 1990s HIVOS changed its policy and decided to stop its relation with TAMECO. From that moment on TAMECO had to find its own sources for finance. In 1989 TAMECO received a loan through CRDB bank for the purchase of raw materials. The loan was at the commercial interest rate of 20%. Besides this TAMECO also had a loan from THB bank at an interest rate of 27% which was for the construction of the office building. The income TAMECO generated from sales was not fully used to repay the loans.

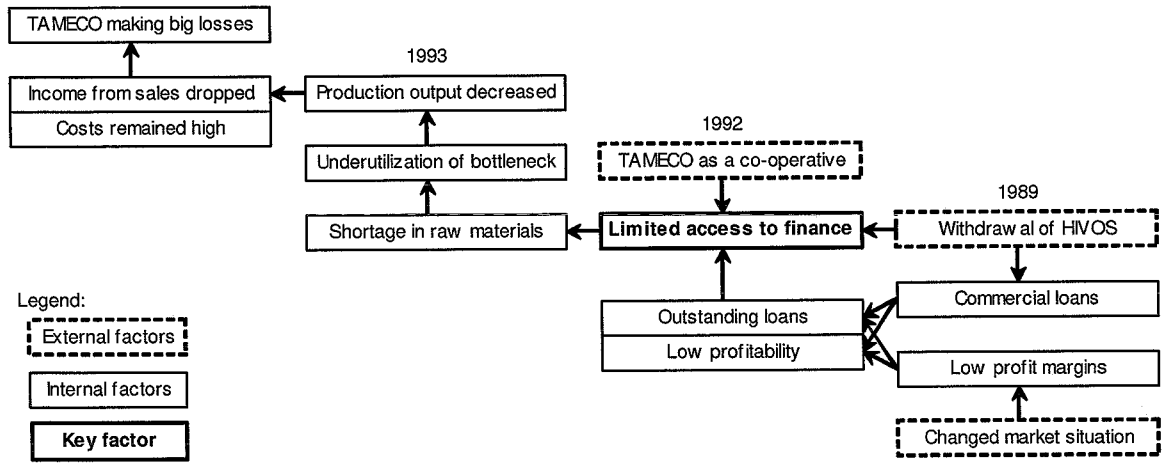
In January 1990 TAMECO had stocks in raw materials for at least 27 months of production, see Figure 4.5. In 1992 TAMECO the stocks were reducing and the company had to look for new channels to get foreign exchange. First TAMECO tried to obtain foreign financing through the normal channel of banks. These commercial banks however were reluctant to approve loans to TAMECO. The reasons for this are not precisely known but given the situation the following causes seem valid. First, TAMECO had outstanding loans from HIVOS, CRDB bank and THB bank which still had to be repaid. Second, TAMECO had not proven itself as a profitable organisation. The third reason, and probably most important was that TAMECO was a co-operative. This type of organisation structure was associated with companies that were not operating on a commercial and

efficient basis. The organisation structure, with a general meeting as the highest making decision body, was unfavourable in a liberal policy setting. In this type of organisation it generally was difficult to make good management decisions and quickly respond and adapt to the changing market situation. This made commercial banks very reluctant in providing loans to co-operatives in general.

In that period TAMECO was unable to get foreign finance through normal market channels. Eventually in February 1993 TAMECO applied for the Import Support Program through the Royal Netherlands Embassy in Tanzania. The application was approved and an amount DFL 170,000 was reserved for TAMECO. This program was under the conditions that 20% was paid as a cash cover in advance and 80% needed to be repaid afterwards. Because of liquidity problems TAMECO first used only DFL 70,000 for the purchase raw materials. In this way TAMECO could produce some knives and the generated income from sales could be used for the cash cover of the rest of the amount. During to process of procurement there was a delay in delivery. In October 1993 TAMECO finally received some goods and production was restarted. At the end of April 1994 TAMECO applied for the rest of the amount but it turned out that the conditions for this program were expiring and that the reserved funds were already allocated to other sources. TAMECO was unable to secure the amount and had to look for new options.

The problem of finance was not solved and production declined further. In 1996 TAMECO was able to obtain raw materials for 170,000 knives through CICA. According to the documents this was a gift from CICA. However production never reached the level of the beginning of the 1990s because of the liquidity problems. In 1999 TAMECO was able to obtain materials for the production of Stainless steel knives. Production however remained on a low scale and big losses were made, eventually culminating in the exit of TAMECO as a knife producer in 2003.

Figure 6.3: Problem tree of TAMECO



Chapter 7. Conclusions and Recommendations

The conclusions are given by answering the research questions as given at the beginning of this report. This is followed by recommendations for TAMECO if they want to restart production.

7.1 Conclusions

What are the main causes of TAMECO's failure to survive in the new policy setting?
The main cause TAMECO is not producing anymore can be found in the limited access to finance. In the beginning of 1990s TAMECO had difficulties to get finance for the purchase of raw materials. This eventually led to a shortage in raw materials and a standstill in production. Costs remained high while income from sales declined which caused big losses for the company.
The reason that TAMECO was unable to get finance was caused by both internal and external factors. The external factors were that the Dutch aid organisation HIVOS was withdrawing and TAMECO had to explore new channels for financing. Also Co-operatives were not seen as favourable for banks to provide loans to. Besides this the market situation had changed and imported knives were penetrating the market. The internal factors that caused the limited access to finance are found in financial management. In 1989 TAMECO applied for commercial loans from CRDB bank and THB bank. This in itself is not a bad thing but the fact the loans were not fully repaid eventually led to a high burden of interests and repayments. Furthermore with the changed market situation TAMECO decided to lower the profit margins to a price mark-up of 5% which led to a reduced the profitability of the company. Both measures made it difficult for TAMECO to find new channels for access to finance.

What is the technological performance of TAMECO?
TAMECO made changes in the product and the production process. With the purchase of an injection moulding machine the product changed from wooden handles to plastic handles. The product was improved and the production process was simplified.
In terms of technological capabilities the initial level was low. Most of the workforce, even some of the management, only had primary education. The managers of TAMECO all received training through a variety of courses. The technical department also received some training through courses. Most employees gained skills and knowledge through experience and on the job training.

What is the productive performance of TAMECO?
The results show that the labour productivity reached its highest level in the beginning of the 1990s. The capital productivity was highest in the 1980s. The purchase of machines caused the capital productivity to decrease and the labour productivity to increase in the 1990s.
The total factor productivity was at a maximum in 1988. This shows the purchase of the grinding machines had a positive effect and that the purchase of the injection moulding machine had a negative effect in terms of total factor productivity.

All productivity figures show a downwards trend after 1993. At that period the total output of the production started to decrease. The factors for this decrease are determined by analysing data from the bottleneck in the process. The daily production records of the grinding machines are analysed for this matter. The results show that the drop in output was not caused by the efficiency in production. The production per hour was relatively constant at a rate of 40-50% of the optimum and even increasing slightly in the period 1990-1995. In stead, the decrease in production was caused by the decreased utilization of the production line bottleneck. The initial level of utilization of the bottleneck was already quite low at a rate of 35% of the optimum in 1990 and 1991. In 1995 however this level had dropped to only 10%.
Also the factors are analyzed that caused the decrease in overall efficiency. The results show that shortage in raw materials had the biggest impact on the production efficiency from 1993 onwards. In 1995 also electricity problems were a big problem.

What is the financial performance of TAMECO?
TAMECO was able to earn small profits in the 1980s. In the beginning of 1990s the operational costs increased. This was mainly due to increased expenditure on interests and loans. At that time TAMECO was making small losses and got in financial trouble. They were unable to access new sources of finance which eventually led to a standstill of production. This caused the income from sales to drop while costs remained high, eventually leading to heavy losses and the end of TAMECO as a knife producers.

What relation can be identified between the total firm performance and the economic policy?
There is a relation between firm performance and economic policy. The economic policy allowed imports in the market. Also access to finance was liberalized and commercial banks were established. This changed the situation of TAMECO which was inexperienced in dealing with competition.
TAMECO applied for loans and reduced the price mark-up. Both decisions led to the situation that TAMECO was unable to get finance when HIVOS had withdrawn. This influenced the overall performance of TAMECO.

What lessons can we learn for the future?
If TAMECO wants to restart production the most important thing they need to realize is that the bottleneck in production must be fully utilized. This means running maximum shifts in the bottleneck. Making sure the buffers are large enough and there are enough stocks of raw materials to produce. Management is important in this and there must be proper stock control.
From a financial point of view the cost-price must be monitored regularly. In stead of reducing price mark-ups to make the price more attractive first the costs must be cut down. Especially in the case of fringe benefits such as housing schemes or pension funds.

7.2 Recommendations

Technology
The product needs to get better in terms of quality control. The appearance can be improved through the purchase of a new dye for the injection moulding machine and the using of Stainless steel as a blade material. The state of the machines is in my opinion good enough for a restart. It is important however that the machines are overhauled properly so that the machines are good enough to run for at least five years without many problems. Special attention needs to go to the bottlenecks in the production line. If it is possible to upgrade the grinding machines and injection moulding machines this should be taken into serious consideration.

Production
Fully utilize the capacity of the production line, especially in the bottleneck. This means that for the grinding of the blades and the moulding of the handle the machines must be at a maximum utilization, preferably 24 hours a day and 7 days a week.
An electric generator must be part of the project proposal so that electricity problems do not lead to downtime in the production process.

Finance
Access of finance will be the major problem for restarting production. Initial capital is needed to overhaul the machines, buy raw materials and refurbish the offices. Make effort to explore the possibilities and look for loans with low interest rates. Perhaps non governmental organisations are willing to provide loans. It is important that TAMECO becomes a private company so that access to finance is easier.
If finance is available than it is important for TAMECO to realize that loans cost interest. TAMECO must have proper cost control in order to be profitable.

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Appendices

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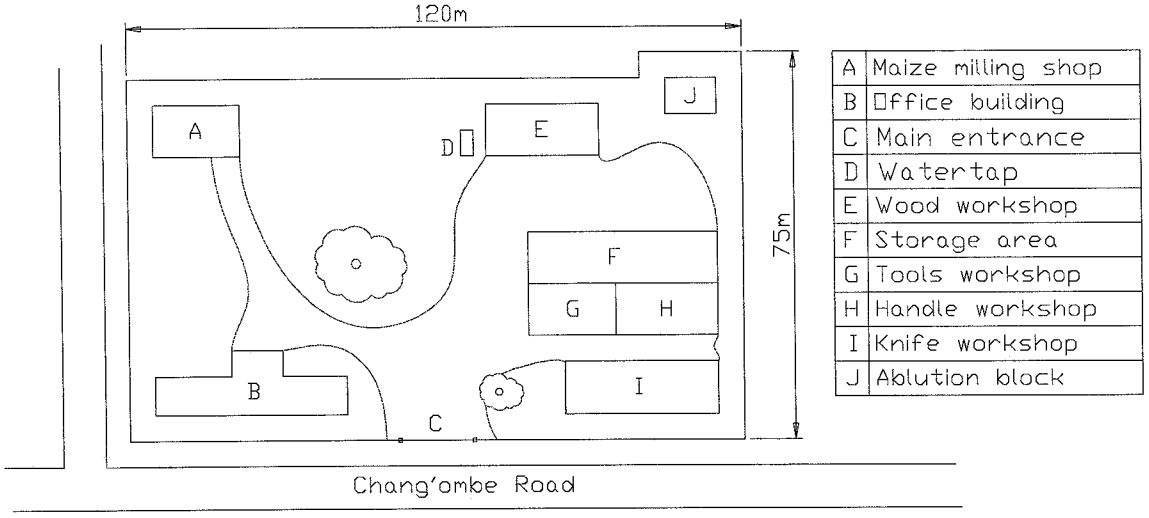
Appendix A. The TAMECO factory

From the start up of the company TAMECO has been situated at Keko Toroli, in Temeke district, Dar es Salaam. Here TAMECO can be found along Chang'ombe road, Plot No. MZ 307. The plot is situated in an Industrial services Trade area, developed in accordance to use Group "M". This property is owned by TAMECO on a long term rights of occupancy of 33 years, starting form July 1st 1976. The plot has a surface area of approximately 9000 square meters, all of which is surrounded with a chain link fence. There are 7 buildings on the site all of which have electricity. The situation in the 1990s is presented in the figure. It all started in building E in the 1970s where the knife production at the time took place. Building A at the time was already used for maize milling activities. These two buildings are relatively simple constructions made of wood and steel plates. With the arrival of the new production line also new buildings were needed. At the end of the 1970s two concrete buildings were constructed, the knife workshop (I) and the building that contained three separate areas for storage, tools making and handle making (F, G and H). In the middle of the 1980s the office building was constructed.

Figure A.1: Map of TAMECO factory



The present situation is quite similar to the situation in the 1990s. All the buildings are still intact and used, though there are some changes. The maize milling building (A) still serves as such. Also the office building (B) is still used by the TAMECO management. At the moment TAMECO operates as a technical education centre and some of the offices are used as classrooms. Besides this, a part of the office is hired by a driving school. Also the area in front of the office is hired by a person that sells second hand cars. Cars are parked in front of the office, ready to be sold.

The wood workshop (E) still maintains a number of wood processing machines. TAMECO generates income from this by sawing and planning wood. The main customers are furniture makers from the area and the wood workshop is used daily. In March 2006 a telephone antenna was constructed at the place where ablution block (J) used to be. This antenna was placed by the Tanzanian mobile phone network provider CELTEL who rents the area from TAMECO.

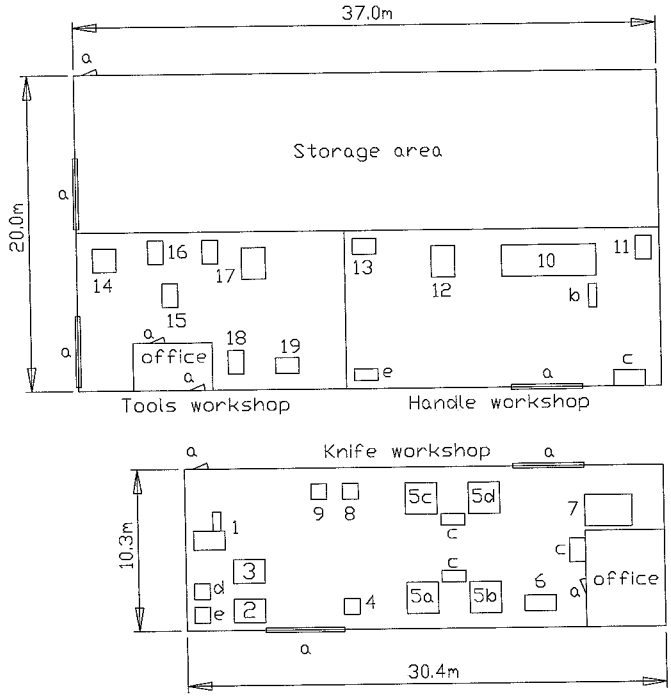
The knife workshop (I) has stayed unchanged from the 1990s. The machines for making knives are still there but they are not used anymore. The machines are checked and lubricated on a weekly basis.

The same counts for the handle workshop (H), where the injection moulding machine is placed. As for the tools workshop (G), this area is not really used by TAMECO anymore but the machines are still there. Some of the machines are hired by local manufacturers. For example the lathes are used by a manufacturer of steel doors. The storage area is now used for storage of all kinds of things such as drawing boards, old computers and office equipment.

At the moment TAMECO has plans are to restart knife production if finance is available. According to the plans the site in the figure above will be reserved for the technical education centre and the knife production will be moved to a different area. TAMECO owns another plot in Mbagala, in the south-east of Dar es Salaam, and the plan is to rebuild the factory there.

Appendix B. Machine park

Figure B.1: Map of the workshops and machine layout in 1994



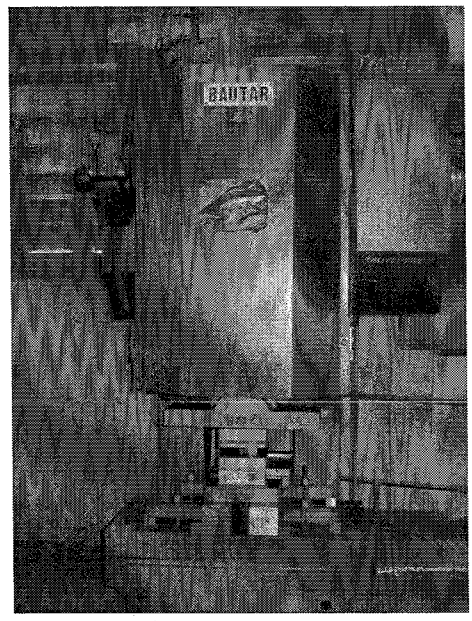
1	Excentric press
2	Hardening furnace
3	Cooling bath
4	Tempering furnace
5a	Left hand grinding machine (old)
5b	Right hand grinding machine (old)
5c	Left hand grinding machine (new)
5d	Right hand grinding machine (new)
6	Polishing machine
7	Pneumatic hammer (out of order)
8	Manual grinder
9	Manual polisher
10	Injection moulding machine
11	Pumps and compressor
12	Plastic recycler
13	Compressor
14	Milling machine
15	Sawing machine
16	Drilling machine
17	Lathes
18	Manual Grinder
19	Surface polisher

a	Doors
b	Control panel
c	Work bench
d	Production buffer
e	Scrap box

Figure B.2: The knife workshop in 2006

B.1 Excentric Press

The excentric press was installed in 1980. The machine manufacturer is Bautar from Spain. The type number is BRE 100 / 4451. The motor has a power of 7.5 horsepower and runs on a current of 380V. The speed of the machine is 80/100 turns a minute.



There are to dyes available for pressing the blades. One dye is a bit wider than the other and in a better state. This dye punches a blade with a longer tail and two holes in it so it is better to mount on the knife handle. The other dye is shorter and has only one hole in the tail. After the punching an extra hole is drilled in the tail to improve the strength of the mounting of the handle to the blade.

Replacement costs in 1992: 6.5 mln TSH

Table B.1: Production records of the Excentre press

Excentre press	TOTAL				AVERAGE		
	sample size	operational time (hours)	production (units)	labour input (hours)	labour units per shift	shift time (hours)	production / hour
1990	32	157.00	259796	543.8	3.46	4.91	1654.8
1991	36	197.58	293982	790.33	4.00	5.49	1487.9
1992	21	75.88	171798	239.42	3.16	3.61	2264.0
1993	-	-	-	-	-	-	-
1994	-	-	-	-	-	-	-
1995	-	-	-	-	-	-	-
TOTAL	**89**	**430.47**	**725576**	**1573.55**	**3.66**	**4.84**	**1685.6**
labor=3	35	148.32	280676	444.95	3.00	4.24	1892.4
labor=4	54	282.15	444900	1128.60	4.00	5.23	1576.8
TOTAL	**89**	**430.47**	**725576**	**1573.55**	**3.66**	**4.84**	**1685.6**

The production records for 1993, 1994 and 1995 could not be retrieved. The production records show most of the time 4 workers were used for pressing the blades but that the production per hour is actually higher when only 3 workers are used in shorter shifts.

The current state of the machine is good. It has a slight metallic sound when running which might be an indication that the bearings need to be replaced. The machine is a bit greasy and the inside of the machine is covered with spider rags.

B.2 Hardening furnace

The hardening furnace was manufactured by Artur Nolzen in 1980. The type is 4KT 32/5/40 and the serial number is 13407. The machine runs on a current of 380V and 50 Hz and uses 30 kW

The maximum temperature of the furnace is 1070°C.
The machine has four chambers. It takes about 4 hours to get the furnace at the desired temperature. The machine is therefore very sensitive to electricity failures.

The current state of the furnace is relatively good. The top two chambers are not working at the moment which is probably caused by a broken heating element. If this is the case the machine can be fixed quite easily.

Replacement costs in 1992: 2.0 mln TSH

Table B.2: Production records of the Hardening furnace

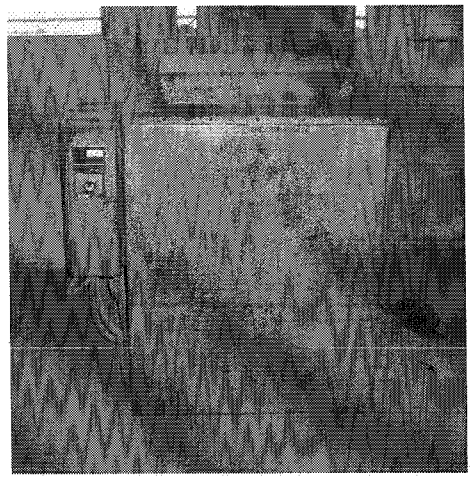
Hardening furnace	TOTAL				AVERAGE		
	sample size	operational time (hours)	production (units)	labour input (hours)	labour units per shift	shift time (hours)	production / hour
1990	36	170.25	75026	526.77	3.09	4.73	440.7
1991	36	198.18	89620	587.92	2.97	5.51	452.2
1992	36	177.77	140200	533.30	3.00	4.94	788.7
1993	36	123.05	76819	162.88	1.32	3.42	624.3
1994	36	80.70	58549	245.87	3.05	2.24	725.5
1995	36	89.70	66788	266.95	2.98	2.49	744.6
TOTAL	**216**	**839.65**	**507002**	**2323.68**	**2.77**	**3.89**	**603.8**
labor=1	25	83.22	52619	83.22	1.00	3.33	632.3
labor=2	39	106.47	64035	212.93	2.00	2.73	601.5
labor=3	133	572.33	345208	1717.00	3.00	4.30	603.2
labor=4	19	77.63	45140	310.53	4.00	4.09	581.5
TOTAL	**216**	**839.65**	**507002**	**2323.68**	**2.77**	**3.89**	**603.8**

The production records show that in the period 1992-1995 the production per hour was substantially higher than in the period 1990-1991. It is not clear what caused this increase in efficiency but a possible assertion is that more blades where put into the furnace at the same time. The time for a shift also decreased in the period.

The labour input figures also show interesting results. Most of the time 3 workers were used in this process step, but the table also shows that it does not make a large difference how much workers are actually used. What is really interesting and perhaps striking is that if only 1 worker is used the production per hour is even higher than when multiple workers are used.

B.3 Tempering furnace

The tempering furnace was manufactured by the same manufacturer as the hardening furnace, Artur Nolzen. The type is a LS3 and the serial number is 13279. The furnace was installed in 1980 and it runs on a current of 80V, 50 Hz and has a power of 8 kW.



The maximum temperature of the furnace is 420°C.
At the moment the furnace is working properly.

Replacement costs in 1992: 1.1 mln TSH

Table B.3: Production records of the Tempering furnace

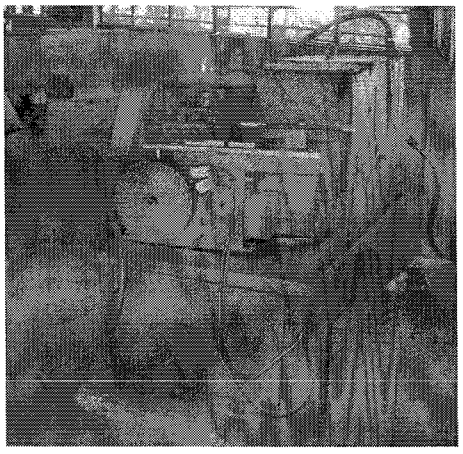
Tempering furnace	TOTAL				AVERAGE		
	sample size	operational time (hours)	production (units)	labour input (hours)	labour units per shift	shift time (hours)	production / hour
1990	36	155.12	64972	479.33	3.09	4.31	418.9
1991	36	217.13	84520	631.08	2.91	6.03	389.3
1992	36	222.82	133400	668.45	3.00	6.19	598.7
1993	36	104.28	69256	249.70	2.39	2.90	664.1
1994	36	116.67	60678	369.10	3.16	3.24	520.1
1995	36	131.93	70894	395.80	3.00	3.66	537.3
TOTAL	**216**	**947.95**	**483720**	**2793.47**	**2.95**	**4.39**	**510.3**
labor=1	6	19.75	12700	19.75	1.00	3.29	643.0
labor=2	40	117.23	62832	234.47	2.00	2.93	536.0
labor=3	144	704.62	353481	2113.85	3.00	4.89	501.7
labor=4	26	106.35	54707	425.40	4.00	4.09	514.4
TOTAL	**216**	**947.95**	**483720**	**2793.47**	**2.95**	**4.39**	**510.3**

The production records of the tempering furnace show similar results as the production figures of the hardening furnace. The production per hour increased substantially after 1991 and the shift time was reduced after 1992.

Also in terms of labour input similarities with the hardening process can be seen. If only 1 worker was assigned for tempering than the production per hour was the highest. Despite this observation most of the time 3 workers were used for this process step.

B.4 Grinding machines

TAMECO owns a total of four grinding machines. The machines are fabricated by Heinz Berger from Wuppertal Germany. One set of grinders, a left and a right hand grinder, was installed in 1980. The other set was installed in 1988. Both sets are of the type AS 1. The machines have a power of 8.5 kW.



At present only the set of 1988 is running properly although there are no grinding stones present. The 'old' set of 1980 is dismantled as the electric motors are detached. Both sets have a rusty appearance and during the running of the set of 1988 a metallic sound was heard and some leeway on the axes was noticed, indicating that the bearings need to be replaced.

Replacement costs in 1992: 17.0 mln TSH per set of machines

Table B.4: Production records of the Grinding machine

Grinding machine	TOTAL				AVERAGE		
	sample size	operational time (hours)	production (units)	labour input (hours)	labour units per shift	shift time (hours)	production / hour
1990	36	277.23	32240	554.47	2.00	7.70	116.3
1991	36	358.20	37149	716.40	2.00	9.95	103.7
1992	36	250.92	26809	250.92	1.00	6.97	106.8
1993	36	230.05	22187	230.05	1.00	6.39	96.4
1994	36	207.53	23927	415.07	2.00	5.76	115.3
1995	36	185.80	22533	331.05	1.78	5.16	121.3
TOTAL	**216**	**1509.73**	**164845**	**2497.95**	**1.65**	**6.99**	**109.2**
labor=1	81	521.52	53873	521.52	1.00	6.44	103.3
labor=2	135	988.22	110972	1976.43	2.00	7.32	112.3
TOTAL	**216**	**1509.73**	**164845**	**2497.95**	**1.65**	**6.99**	**109.2**

Comparing the overall production records it can be concluded that the grinding process is the bottleneck in the production process. In the period 1990-1995 the time per shift decreased from 7.7 hours to 5.16 hours per shift. The production per hour is reaches a low in 1993.
The labour input figures show that most of the time 2 workers are used for 1 set of machines and with 2 workers the production per hour is higher than with 1 worker.

B.5 Polishing machine

The Polishing machine was manufactured by Heinz Berger. The type is HSP 1 and the serial number is 3623/59. The machine was installed in 1980 and has a power of 18 kW

The machine is working properly although the polishing rolls need to be replaced.

Replacement costs in 1992: 7.5 TSH

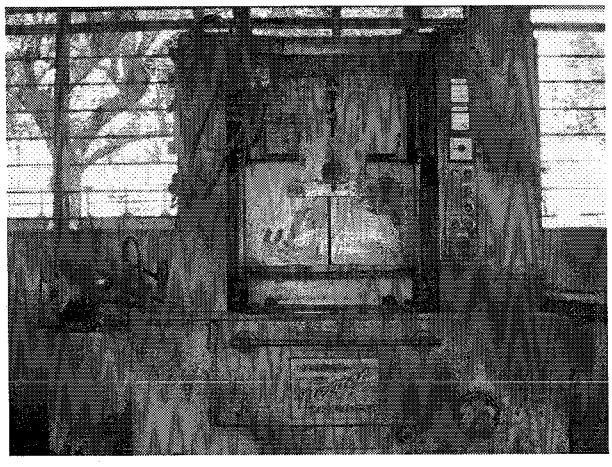


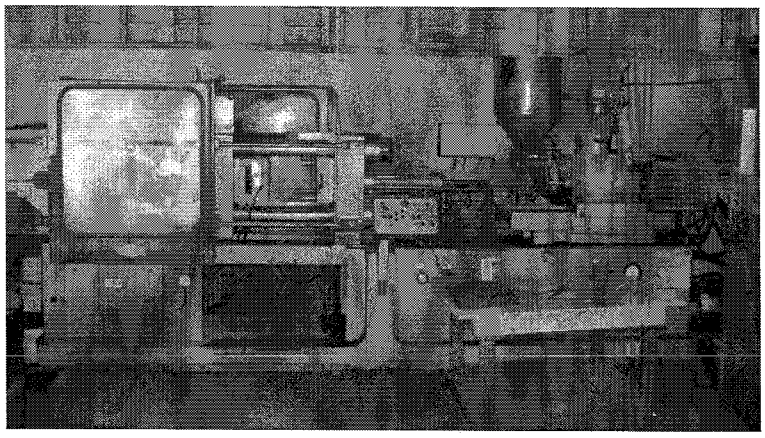
Table B.5: Production records of the Polishing machine

Polishing machine	TOTAL				AVERAGE		
	sample size	operational time (hours)	production (units)	labour input (hours)	labour units per shift	shift time (hours)	production / hour
1990	36	234.08	63581	468.17	2.00	6.50	271.6
1991	36	259.33	59488	518.67	2.00	7.20	229.4
1992	36	237.35	100622	474.70	2.00	6.59	423.9
1993	36	177.33	46835	177.33	1.00	4.93	264.1
1994	36	188.83	77128	377.67	2.00	5.25	408.4
1995	13	65.28	28148	130.57	2.00	5.02	431.2
TOTAL	**193**	**1162.22**	**375802**	**2147.10**	**1.85**	**6.02**	**323.3**
labor=1	36	177.33	46835	177.33	1.00	4.93	264.1
labor=2	157	984.88	328967	1969.77	2.00	6.27	334.0
TOTAL	**193**	**1162.22**	**375802**	**2147.10**	**1.85**	**6.02**	**323.3**

The production records show that the maximum production per hour is achieved when 2 units of labor are used. The production per hour has increased from 270 products per hour in 1990 to 430 products per hour in 1995

B.6 Injection moulding machine

The Polishing machine was manufactured by Netstall. The type is N350/130 and the machine uses a current of 33 kW.



The moulding was bought second hand from Philips.

Also a plastic recycler is present. This machine was manufactured by H. Dreher and the type number is S15/20 GFS Spez-2.

Replacement costs in 1992: 30.6 mln TSH

Table B.6: Production records of the injection moulding machine

Injection moulding machine	TOTAL				AVERAGE		
	sample size	operational time (hours)	production (units)	labour input (hours)	labour units per shift	shift time (hours)	production / hour
1990	36	232.08	39983	438.37	1.89	6.45	172.3
1991	36	245.22	57814	490.43	2.00	6.81	235.8
1992	36	221.10	52296	221.10	1.00	6.14	236.5
1993	36	182.68	51287	182.68	1.00	5.07	280.7
1994	36	203.22	48048	243.82	1.20	5.64	236.4
1995	36	198.35	40684	252.77	1.27	5.51	205.1
TOTAL	**216**	**1282.65**	**290112**	**1829.17**	**1.43**	**5.94**	**226.2**
labor=1	132	736.13	177666	736.13	1.00	5.58	241.4
labor=2	84	546.52	112446	1093.03	2.00	6.51	205.8
TOTAL	**216**	**1282.65**	**290112**	**1829.17**	**1.43**	**5.94**	**226.2**

The production figures show that in 1990 the production per hour is 172.3 and substantially lower the later years. At the time the machine was relatively new and this could be caused by start up problems. From 1990 onwards the production per hour increases to 280.7 in 1993 but after 1993 the production per hour decreases again. It is not clear what caused this decrease.
The labour input is at a optimum if only 1 worker is assigned to this task. With 2 workers the production per hour is substantially lower.

Most machines are working properly but if production really is going to be restarted it is advisable to 'update' the machines. The machines that need basic repairs are the hardening furnace and the old grinding machines. The rest of the machines have an old, greasy and rusty appearance and it is wise to do large maintenance work such as replacing most of the bearings and a painting rusty parts. Considering the electricity problems in Tanzania it may be wise to buy an electric generator.

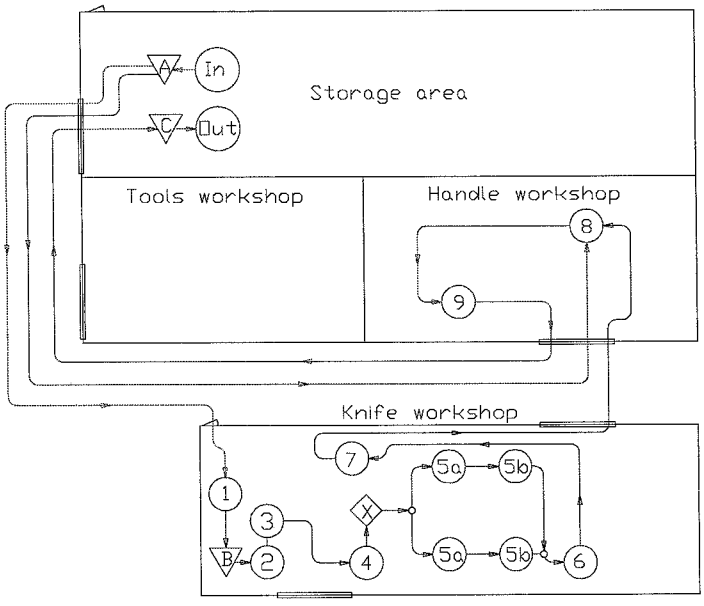
Appendix C. Production Process

The production process is explained in the report. In this section some additional information on the production process is presented such as material flows and process times. In Figure C.1 the material flows are presented. The figure does not show the back loop in the heat treatment and the outbound buffers bottleneck for practical purposes.

Metal sheets are transported to the knife workshop for processing. Blades are pressed and stored in a buffer. The heat treatment consists of hardening, quenching and tempering of the blades. Next process steps consist of grinding, polishing and additional sharpening, shaping and polishing. The blades transported to the handle workshop and ready for the final production step, the moulding of the handle onto the blade

Polypropylene is transported from the storage area to the handle workshop. There they are moulded onto the blades in an injection moulding machine. This results in the end product, the knife. The knife is packed into boxes containing 12 pieces and cartons containing 12 boxes. After this, the finished products are transported back to the storage area where they are stored, ready to be sold.

Figure C.1: Production flow layout



In	Delivery of raw materials
A	Storage of raw materials
1	Pressing blades
B	Storage of blades
2	Hardening blades
3	Quenching blades
4	Tempering blades
X	Testing blades
5a	Left hand grinding
5b	Right hand grinding
6	Polishing blades
7	Additional sharpening
8	Moulding handle
9	Packing knives
C	Storage of finished knives
Out	Knives sold to customers

Carbon steel sheets
Knife blades
Polypropylene
Finished knives

The maximum capacity of the production line is determined by the bottleneck of the production line which is the grinding of the blades. Besides this, the total processing time of a knife can also be determined. TAMECO produces to stock, meaning that production is not based on the customers orders it but on creating stocks.

The steps can be divided into production, transport, and storage steps. See Table C.1 for a complete overview of each step. In the production process there are 9 steps that add value to the product, 13 times the product is transported, and 8 times the product is stored.

The production, transport and storage take place in batches. A batch means that multiple products are processed at the same time. In practice this means that transport consists in crates containing approximately 500 blades.

With this analysis the time can be determined that it takes to produce a knife from beginning to end. The production capacity of the machines is based on the production records. Process time can be calculated if the batch size is known.

The net processing time, without transport, of the manufacturing a knife is 1285 seconds or 21 minutes and 15 seconds. However, transport adds some time to the total processing time. Between the process steps 180 meters of transport has to be bridged. With the assumption that 1 meter of transport takes 5 seconds this makes a total transport time of 900 seconds, 15 minutes. If a knife is produced from beginning to end it would take a total 36 minutes and 15 seconds

Table C.1: Production process times

		action					transport			production			Storage	
		Value added	Non Value added	Transport	Inspection	Storage	distance (m)	batch size (units)	time (sec)	production / hour[b]	batch size (units)	process time (sec)	buffer size (units)	time (days)
IN	Delivery raw materials				1									
A	Storage of raw materials					1							-	-
	transport			1			50	500	250					
1	Pressing blades	1								1600[b]	1	2,25		
	transport			1			1	500	5					
B	Storage of blades					1							15000	10[a]
	transport			1			2	55	10					
2	Hardening blades	1								600[b]	50	300[c]		
	transport			1			1	55	65					
3	Quenching blades	1								-	50	20[a]		
	transport			1			5	55	25					
4	Tempering blades	1								510[b]	85	600[c]		
	transport			1			2	55	10					
X	Testing blades				1					-	1	10[a]		
	transport			1			2	-	10					
	outbound buffer					1							4500	3
6a	Left hand grinding	1								110[b]	1	33		
	transport			1			2	500	10					
	outbound buffer					1							4500	3
6b	Right hand grinding	1								110[b]	1	33		
	transport			1			5	500	25					
	outbound buffer					1							4500	3
7	Polishing	1								320[b]	16	180		
	transport			1			15	500	75					
	outbound buffer					1							4500	3
8	Additional sharpening	1								-	1	18[a]		
	transport			1			30	500	150					
	outbound buffer					1							4500	3
9	Handle making	1								225[b]	4	64		
	transport			1			5	12	25					
10	Packing knives		1							-	12	24[a]		
	transport			1			60	144	300					
C	Storage of knives					1							-	-
OUT	Knives sold to customer		1											
	TOTAL	9	2	13	2	8	180	-	900	-	-	1285	37500	25

Notes: a=estimate, b=actual production per hour from production records, c=heat treatment times

The knives are not produced from beginning to end at once. In order to make the production process as smoothly, stable and efficient as possible buffers are built in the production line. In case of TAMECO a storage buffer is placed after the pressing of the blades. This buffer is estimated at 10 days of production. With a production target of 1500 a day this makes a total of 15000 blades. Besides this, outbound buffers are placed in the bottleneck steps of the production process. These buffers have a size of approximately three days (Schaapherder, 1994). This makes a total of 37500 knives in buffers.

If these buffers are used in a First-In-First-Out (FIFO) manner this would add 25 days to the time the knife is in the process. The total time the knife is in the production process would then be 25 days, 36 minutes and 15 seconds. This indicates there was still a lot progress possible in terms of reducing costs of stocks, buffers and work in progress. As TAMECO was facing other and bigger problems the reduction of stocks was never a priority.

Appendix D. Production inputs

Table D.1: Intermediate inputs in the production process

Production inputs	price 1994	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Produced knives	**575.00**	**197,921**	**330,000**	**115,159**	**278,971**	**234,699**	**401,491**	**368,848**	**406,342**	**272,440**	**198,674**	**113,054**	**83,742**	**93,759**	**103,776**	**76,896**	**39,536**
carbon steel (kg)	670.53	18,700[a]	4,950[a]	13,012	6,337[a]	26,520	51,015[a]	62,350[a]	45,914	26,000[a]	20,300[a]	23,000[a]	7,056[b]	2,254[c]	11,726	4,960[c]	8,363[b]
Polypropylene (kg)	472.40	8,247*	13,750*	4,798*	11,624*	9,779	6,025[a]	18,740[a]	16,931	11,730[a]	10,675[b]	6,550[a]	4,675[b]	2,700[c]	4,324	4,612[c]	4,183[b]
grinding stone (pcs)	14,000.00	9	13	5	12	10	15[a]	10[a]	16	30[a]	20[a]	8[a]	6[b]	2[c]	7[a]	8[c]	21[b]
hardening oil (ltr)	459.60	1,583	2,640	921	2232	1,878	6[a]	1,821[a]	3,251	200[a]	400[a]	800[a]	1,200[b]	0[b]	3[a]	615	316
grinding wheels (pcs)	4,518.05	184[a]	500[a]	120	2,830[a]	244	165[a]	251[a]	423	192[a]	186[a]	156[a]	70[b]	18[c]	84[a]	15[c]	121[b]
polishing paste (bars 2,5kg)	4,634.00	2,128[a]	1,130	394	955	804	1,375	731[a]	1,392	383[a]	211[a]	192[a]	86[b]	31[c]	76[a]	62[c]	24[b]
polishing buffer (pair)	876.34	11	18	6	15	13	22	12[a]	22	920[b]	560[a]	4[a]	160[b]	43[c]	140[a]	141[c]	191[b]
emery discs (pcs)	3,422.22	4,123	50[a]	2,399	5,812	4,890	0[a]	301[a]	8,465	111[b]	41[a]	6[b]	2[b]	1,953	2,162	1,602	824
hacksaw blades (pcs)	150.00	98,961	165,000	57,580	139,486	117,350	2,811[a]	0[a]	203,171	20[b]	12[a]	4[b]	41,871	1[c]	1[b]	38,448	19,768
boxes L/S (pcs)	174.67	5,889[a]	2,292	800	1,937	1,630	2,788	2,749[a]	2,666[b]	1,789[a]	1,338[a]	815[a]	664[b]	330[c]	721	553[c]	435[b]
boxes S/S (pcs)	732.11	16,493	27,500	9,597	23,248	19,558	35,595[a]	31,590[a]	30,920[b]	20,256[a]	16,556	9,165[a]	7,718[b]	3,833[c]	8,648	6,901[c]	5,453[b]
glue (ltr)	2,375.00	300[a]	232[a]	228	590[a]	466	840[a]	214[a]	806	58[a]	60[a]	52[a]	32[b]	32[c]	40[a]	75[c]	45[b]
rust preventive (kg)	2,470.72	0[a]	1,000[a]	120	1,190[a]	244	11[a]	1,169[a]	13[b]	375[a]	225[a]	150[a]	175[b]	25[c]	100[a]	25[c]	41
drill bits (pcs)	292.55	8	13	5	11	10	16	15	19[b]	9[b]	6[a]	5	8[b]	8[c]	4	3	2
leather gloves (pcs)	2,500.00	21[a]	13	5	11	10	16	38[a]	30[b]	16[b]	8[a]	5	11[b]	3[c]	4	3	6[b]
cello tape (rolls)	500.00	6	6	6	6	6	6	15	16	51[b]	42[a]	29[b]	24[b]	19[c]	12[a]	12[c]	12[b]
safety glasses (pcs)	219.91	6	6	6	6	6	6	15[a]	9[b]	5[b]	3[a]	5	3	4	4	3	4[b]
Thenkoil oil x4 (ltr)	888.62	44	44	44	44	44	44	8[a]	117	75[a]	25[a]	32	24	25[c]	30	22	11
planer blades(pcs)	9,000.00	6	6	6	6	6	6	15	16	11	24[a]	5	12[c]	15[c]	30[a]	28[b]	2

Notes: * = data based on amount of wooden handles, [a] actual quantities from budget forms, [b] data from stores ledgers, [c] data from material requisition forms

Sources: Budget forms, stores ledgers, material requisition forms

Appendix E. Production data grinding machine

Table E.1: Production data of the grinding machine 1990

1990		Daily average for 1 set of grinding machines				Efficiency rates		
	days	production	rejects	hours	prod/hr	Efficiency	Utilization	E-total
normal	170	919.7	5.3	8.8	104.1	0.434	0.245	0.106
no knives	11	183.6	1.2	2.2	84.0	0.350	0.061	0.021
electricity	25	447.9	3.1	5.8	77.8	0.324	0.160	0.052
breakdown	32	653.3	5.4	7.6	85.7	0.357	0.212	0.076
maintenance	1	0.0	0.0	0.0	0.0	0.000	0.000	0.000
absent	19	832.5	3.8	9.0	92.1	0.384	0.251	0.096
multiple	5	729.7	8.7	7.1	102.7	0.428	0.197	0.084
holiday	10	55.0	0.5	0.5	101.2	0.422	0.015	0.006
meeting	1	0.0	0.0	0.0	0.0	0.000	0.000	0.000
Sunday	52	158.7	0.8	1.5	102.5	0.427	0.043	0.018
unknown	39	0.0	0.0	0.0	0.0	0.000	0.000	0.000
SOM	**365**							

Table E.2: Production data of the grinding machine 1991

1991		Daily average for 1 set of grinding machines				Efficiency rates		
	days	production	rejects	hours	prod/hr	Efficiency	Utilization	E-total
normal	177	951.8	4.6	9.8	96.7	0.403	0.273	0.110
no knives	21	81.0	0.3	1.2	65.4	0.273	0.034	0.009
electricity	18	933.3	5.8	9.6	97.6	0.407	0.266	0.108
breakdown	41	749.9	4.4	8.1	92.6	0.386	0.225	0.087
maintenance	26	0.0	0.0	0.0	0.0	0.000	0.000	0.000
absent	6	871.0	9.3	8.0	109.0	0.454	0.222	0.101
multiple	8	589.1	3.9	6.2	95.8	0.399	0.171	0.068
holiday	11	112.2	0.2	1.1	98.5	0.411	0.032	0.013
meeting	1	0.0	0.0	0.0	0.0	0.000	0.000	0.000
Sunday	52	138.5	0.6	1.6	86.5	0.360	0.044	0.016
unknown	4	258.4	0.9	3.8	67.3	0.280	0.107	0.030
SOM	**365**							

Table E.3: Production data of the grinding machine 1992

1992		Daily average for 1 set of grinding machines				Efficiency rates		
	days	production	rejects	run time	prod/hr	Efficiency	Utilization	E-total
normal	94	897.9	4.4	8.6	104.7	0.436	0.238	0.104
no knives	42	100.8	0.8	1.0	101.4	0.422	0.028	0.012
electricity	44	533.9	2.5	5.5	96.6	0.403	0.153	0.062
breakdown	58	795.6	5.8	8.2	96.6	0.402	0.229	0.092
maintenance	16	130.4	1.1	1.4	0.0	0.000	0.039	0.000
absent	5	1095.4	4.3	11.2	98.1	0.409	0.310	0.127
multiple	32	822.3	5.0	8.6	95.2	0.397	0.240	0.095
holiday	8	0.0	0.0	0.0	0.0	0.000	0.000	0.000
meeting	4	65.1	0.6	1.2	0.0	0.000	0.033	0.000
Sunday	52	163.1	0.6	1.5	106.5	0.444	0.043	0.019
unknown	11	458.7	1.1	4.2	108.1	0.450	0.118	0.053
SOM	**366**							

Table E.4: Production data of the grinding machine 1993

1993	days	Daily average for 1 set of grinding machines				Efficiency rates		
		production	rejects	hours	prod/hr	Efficiency	Utilization	E-total
normal	115	598.6	3.2	5.8	103.7	0.432	0.160	0.069
no knives	106	25.3	0.1	0.3	94.8	0.395	0.007	0.003
electricity	22	349.9	0.5	3.4	101.5	0.423	0.096	0.040
breakdown	19	579.3	2.9	6.2	92.9	0.387	0.173	0.067
maintenance	12	52.1	0.0	0.4	125.0	0.521	0.012	0.006
absent	0	0.0	0.0	0.0	0.0	0.000	0.000	0.000
multiple	4	906.6	9.9	9.7	93.8	0.391	0.268	0.105
holiday	4	0.0	0.0	0.0	0.0	0.000	0.000	0.000
meeting	0	0.0	0.0	0.0	0.0	0.000	0.000	0.000
Sunday	52	249.7	1.5	2.4	104.3	0.435	0.066	0.029
unknown	31	0.0	0.0	0.0	0.0	0.000	0.000	0.000
SOM	**365**							

Table E.5: Production data of the grinding machine 1994

1994	days	Daily average for 1 set of grinding machines				Efficiency rates		
		production	rejects	hours	prod/hr	Efficiency	Utilization	E-total
normal	99	608.3	0.7	5.1	119.9	0.500	0.141	0.070
no knives	82	12.1	0.0	0.1	113.0	0.471	0.003	0.001
electricity	43	248.8	0.3	2.0	125.5	0.523	0.055	0.029
breakdown	27	690.0	1.2	5.8	119.4	0.498	0.161	0.080
maintenance	24	147.8	0.1	1.2	120.1	0.500	0.034	0.017
absent	0	0.0	0.0	0.0	0.0	0.000	0.000	0.000
multiple	2	556.5	0.0	4.2	131.2	0.547	0.118	0.064
holiday	8	0.0	0.0	0.0	0.0	0.000	0.000	0.000
meeting	0	0.0	0.0	0.0	0.0	0.000	0.000	0.000
Sunday	52	107.8	0.0	0.8	126.9	0.529	0.024	0.012
unknown	28	22.0	0.0	0.2	127.9	0.533	0.005	0.003
SOM	**365**							

Table E.6: Production data of the grinding machine 1995

1995	days	Daily average for 1 set of grinding machines				Efficiency rates		
		production	rejects	hours	prod/hr	Efficiency	Utilization	E-total
normal	98	594.6	3.0	4.9	121.1	0.505	0.136	0.069
no knives	79	0.0	0.0	0.0	0.0	0.000	0.000	0.000
electricity	84	58.2	0.1	0.5	111.6	0.465	0.015	0.007
breakdown	9	185.4	0.9	1.8	103.5	0.431	0.050	0.021
maintenance	20	191.0	1.0	1.5	124.1	0.517	0.043	0.022
absent	1	750.0	2.0	6.3	118.4	0.493	0.176	0.087
multiple	0	0.0	0.0	0.0	0.0	0.000	0.000	0.000
holiday	4	0.0	0.0	0.0	0.0	0.000	0.000	0.000
meeting	0	0.0	0.0	0.0	0.0	0.000	0.000	0.000
Sunday	53	234.7	1.0	1.9	122.1	0.509	0.053	0.027
unknown	17	39.7	0.1	0.3	116.5	0.486	0.009	0.005
SOM	**365**							

Appendix F. Balance sheets of TAMECO

BALANCE SHEET PER 31/12	1977	1978	1979	1980	1981	1982	1983	1984	1985
FIXED ASSETS									
at cost	259.316,80	509.577,25			1.680.266,85	1.946.059,65	2.142.109,65	3.706.572,10	4.234.802,50
less: depreciation	20.849,70	51.698,30			341.558,90	536.299,90	736.708,70	1.329.093,90	2.014.925,75
TOTAL FIXED ASSETS	**238.467,10**	**457.878,95**			**1.338.707,95**	**1.409.759,75**	**1.405.400,95**	**2.377.478,20**	**2.219.876,75**
INVESTMENTS	**0,00**	**0,00**			**0,00**	**0,00**	**0,00**	**0,00**	**15.000,00**
CURRENT ASSETS									
stocks	11.700,00	61.475,00			1.521.484,05	630.155,85	701.909,30	329.365,75	1.099.078,20
debtors deposists and prepayments	13.265,60	30.509,85			150.053,50	766.418,75	227.008,40	584.383,40	621.029,55
cash at bank and in hand	151.979,70	174.654,95			13.475,55	161.333,85	226.908,10	377.045,70	413.035,30
TOTAL CURRENT ASSETS	**176.945,30**	**266.639,80**			**1.685.013,10**	**1.557.908,45**	**1.155.825,80**	**1.290.794,85**	**2.133.143,05**
TOTAL ASSETS	415.412,40	724.518,75			3.023.721,05	2.967.668,20	2.561.226,75	3.668.273,05	4.368.019,80
CURRENT LIABILITIES									
creditors and accruals	6.714,95	7.733,45			428.687,75	94.652,00	134.314,60	327.303,50	524.145,60
Tanzania Revenue Authority (VAT)									
bank overdraft					300.751,85				
provisions for taxation							-15.000,00	90.000,00	552.654,00
TOTAL CURRENT LIABILITIES	**6.714,95**	**7.733,45**			**729.439,60**	**94.652,00**	**119.314,60**	**417.303,50**	**1.076.799,60**
LONGTERM LIABILITIES	**129.363,80**	**340.118,75**			**988.542,75**	**852.260,55**	**444.614,85**	**1.176.266,40**	**673.337,05**
MEMBERS SHARE CAPITAL									
share capital	2.265,00	2.900,00			9.400,00	9.800,00	11.300,00	10.100,00	11.000,00
share deposit		10,00			30,00	30,00	70,00	50,00	
capital reserve		377.829,60			1.764.385,00	1.978.525,00	2.016.195,00	2.128.106,00	2.235.943,00
revenue reserve	277.068,65	-4.073,05			-548.361,30	32.400,65	-30.267,70	-63.552,85	370.940,15
donation hivos					80.285,00				
revaluation surplus									
TOTAL MEMBERS SHARE CAPITAL	**279.333,65**	**376.666,55**			**1.305.738,70**	**2.020.755,65**	**1.997.297,30**	**2.074.703,15**	**2.617.883,15**
TOTAL LIABILITIES	415.412,40	724.518,75			3.023.721,05	2.967.668,20	2.561.226,75	3.668.273,05	4.368.019,80

BALANCE SHEET PER 31/12	1986	1987	1988	1989	1990	1991	1992	1993	1994
FIXED ASSETS									
at cost	4.367.512,50	6.141.095,95	6.535.577,65	35.874.057	46.798.143	73.735.019	235.562.133	235.847.353	241.136.338
less: depreciation	2.749.423,30	3.160.178,25	2.165.537,50	5.985.302	11.159.230	17.379.911	28.968.920	40.771.982	60.140.991
TOTAL FIXED ASSETS	**1.618.089,20**	**2.980.917,70**	**4.370.040,15**	**29.888.755**	**35.638.913**	**56.355.108**	**206.593.213**	**195.075.371**	**180.995.347**
INVESTMENTS	**25.000,00**	**25.000,00**	**25.000,00**	**25.000**	**25.000**	**437.000**	**437.000**	**437.000**	**437.000**
CURRENT ASSETS									
stocks	3.907.850,40	2.499.420,30	5.037.804,05	38.355.967	15.823.994	29.574.931	25.978.231	9.719.014	45.748.999
debtors deposists and prepayments	2.336.568,35	3.594.584,45	7.313.726,25	2.213.097	9.543.751	12.843.015	8.394.045	25.110.185	17.587.817
cash at bank and in hand	1.269.820,10	-3.535.636,20	-1.028.701,10	847.485	5.190.945	7.560.132	8.496.115	6.869.363	2.561.418
TOTAL CURRENT ASSETS	**7.514.238,85**	**2.558.368,55**	**11.322.829,20**	**41.416.549**	**30.558.690**	**49.978.078**	**42.868.391**	**41.698.562**	**65.898.234**
TOTAL ASSETS	9.157.328,05	5.564.286,25	15.717.869,35	71.330.304	66.222.603	106.770.186	249.898.604	237.210.933	247.330.581
CURRENT LIABILITIES									
creditors and accruals	637.991,30	210.580,00	1.000.171,15	23.180.497	26.162.417	27.202.695	6.122.817	2.507.118	2.473.440
Tanzania Revenue Athority (VAT)									
bank overdraft				19.915.966					
provisions for taxation	878.470,00	828.470,00	1.554.269,50						
TOTAL CURRENT LIABILITIES	**1.516.461,30**	**1.039.050,00**	**2.554.440,65**	**43.096.463**	**26.162.417**	**27.202.695**	**6.022.817**	**2.507.118**	**2.473.440**
LONGTERM LIABILITIES	**2.587.199,95**	**1.239.254,95**	**5.847.147,95**	**21.921.543**	**21.748.821**	**55.516.073**	**79.468.898**	**72.294.522**	**85.508.007**
MEMBERS SHARE CAPITAL									
share capital	11.300,00	10.500,00	12.100,00	12.100	16.500	20.400	80.900	153.570.900	153.570.900
share deposit						50	50	50	50
capital reserve	4.089.776,40	4.089.776,40	4.894.953,85	4.894.953	12.225.323	13.611.789	167.101.824	13.611.824	4.073.209
revenue reserve	952.590,40	-814.295,10	2.409.226,90	1.405.245	6.069.542	10.419.179	-2.875.885	-4.773.481	1.704.975
donation hivos									
revaluation surplus									
TOTAL MEMBERS SHARE CAPITAL	**5.053.666,80**	**3.285.981,30**	**7.316.280,75**	**6.312.298**	**18.311.365**	**24.051.418**	**164.406.889**	**162.409.293**	**159.349.134**
TOTAL LIABILITIES	9.157.328,05	5.564.286,25	15.717.869,35	71.330.304	66.222.603	106.770.186	249.898.604	237.210.933	247.330.581

BALANCE SHEET PER 31/12	1995	1996	1997	1998	1999	2000	2001	2002	2003
FIXED ASSETS									
at cost	244.256.507	244.256.507	246.658.683	244.456.858	464.898.961	464.898.961	464.898.961	464.898.961	464.898.961
less: depreciation	75.566.964	93.003.202	109.129.158	121.747.757	43.732.098	77.790.005	111.200.968	144.208.875	177.216.782
TOTAL FIXED ASSETS	**168.689.543**	**151.253.305**	**137.529.525**	**126.696.254**	**421.166.863**	**387.108.956**	**353.697.993**	**320.690.086**	**287.682.179**
INVESTMENTS	**437.000**	**437.000**	**437.000**	**437.000**	**437.000**	**437.000**	**437.000**	**437.000**	**437.000**
CURRENT ASSETS									
stocks	14.112.069	33.876.920	7.257.830	9.073.695	8.658.760	5.585.124	1.838.523	0	0
debtors deposists and prepayments	19.195.030	17.306.840	33.103.611	12.890.799	15.428.718	17.171.996	17.815.914	19.956.246	25.143.325
cash at bank and in hand	57.738.923	3.156.124	9.523.982	6.406.335	7.803.548	3.869.128	2.295.568	533.613	923.880
TOTAL CURRENT ASSETS	**91.046.022**	**54.339.884**	**49.885.423**	**28.370.829**	**31.891.026**	**26.626.248**	**21.950.005**	**20.489.859**	**26.067.205**
TOTAL ASSETS	260.172.565	206.030.189	187.851.948	155.504.083	453.494.889	414.172.204	376.084.998	341.616.945	314.186.384
CURRENT LIABILITIES									
creditors and accruals	60.427.401	22.175.240	30.927.240	15.159.269	40.217.474	50.250.076	63.826.086	63.193.293	66.637.723
Tanzania Revenue Authority (VAT)				1.176.535	598.004	3.053.800	3.944.377	3.442.243	3.296.887
bank overdraft									
provisions for taxation									
TOTAL CURRENT LIABILITIES	**60.427.401**	**22.175.240**	**30.927.240**	**16.335.804**	**40.815.478**	**53.303.876**	**67.770.463**	**66.635.536**	**69.934.610**
LONGTERM LIABILITIES	**104.074.385**	**108.302.499**	**144.587.949**	**174.654.603**	**174.654.603**	**174.654.603**	**174.654.603**	**168.866.070**	**168.866.070**
MEMBERS SHARE CAPITAL									
share capital	152.728.024	152.563.932	155.029.734	155.029.734	155.029.734	155.029.734	155.029.734	155.029.734	155.029.734
share deposit	50								
capital reserve	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209
revenue reserve	-61.110.504	-81.064.691	-146.746.184	-194.569.267	-134.590.338	-186.401.421	-238.955.214	-266.499.807	-297.229.442
donation hivos									
revaluation surplus					213.532.203	213.532.203	213.532.203	213.532.203	213.532.203
TOTAL MEMBERS SHARE CAPITAL	**95.670.779**	**75.552.450**	**12.336.759**	**-35.486.324**	**238.024.808**	**186.213.725**	**133.659.932**	**106.115.339**	**75.385.704**
TOTAL LIABILITIES	260.172.565	206.030.189	187.851.948	155.504.083	453.494.889	414.172.204	376.084.998	341.616.945	314.186.384

FIXED ASSETS COST DEPRECIATION									
LAND AND BUILDINGS	1977	1978	1979	1980	1981	1982	1983	1984	1985
cost: balance at 1/1	108.123,75	108.123,75			358.767,50	358.767,50	358.767,50	528.767,50	528.767,50
add: additions		107.223,80					170.000,00		28.334,90
less: disposal of assets									
cost: balance at 31/12	108.123,75	215.347,55			358.767,50	358.767,50	528.767,50	528.767,50	557.102,40
depreciation:balance at 1/1	818,80	818,80			3.347,20	21.285,60	0,00	0,00	0,00
add: depreciation charge		818,80			17.938,40				
less: disposal of assets									
depreciation: balance at 31/12	818,80	1.637,60			21.285,60	0,00	0,00	0,00	0,00
NET BOOK VALUE 31/12	107.304,95	213.709,95			337.481,90	358.767,50	528.767,50	528.767,50	557.102,40
PLANT AND MACHINERY									
cost: balance at 1/1	122.743,55	92.192,50			1.172.492,35	1.270.457,35	1.279.457,35	1.279.457,35	1.403.083,35
add: additions		179.169,25			102.305,00	9.000,00		123.626,00	37.000,00
less: disposal of assets		24.424,10			4.340,00				
cost: balance at 31/12	122.743,55	246.937,70			1.270.457,35	1.279.457,35	1.279.457,35	1.403.083,35	1.440.083,35
depreciation:balance at 1/1	12.274,35	9.219,25			203.201,90	282.572,30	410.527,10	538.472,80	678.781,20
add: depreciation charge		24.693,75			127.045,85	127.954,80	127.945,70	140.308,40	144.008,15
less: disposal of assets		2.442,40			47.675,45				
depreciation: balance at 31/12	12.274,35	31.470,60			282.572,30	410.527,10	538.472,80	678.781,20	822.789,35
NET BOOK VALUE 31/12	110.469,20	215.467,10			987.885,05	868.930,25	740.984,55	724.302,15	617.294,00
MOTOR VEHICLE									
cost: balance at 1/1	15.500,00	15.500,00			35.000,00	27.000,00	273.334,30	248.334,30	1.640.884,30
add: additions		27.000,00				246.334,30		1.390.528,00	424.687,00
less: disposal of assets		4.500,00			8.000,00		25.000,00		
cost: balance at 31/12	15.500,00	38.000,00			27.000,00	273.334,30	248.334,30	1.638.862,30	2.065.571,30
depreciation:balance at 1/1	5.166,65	5.166,65			34.700,00	26.800,00	108.911,40	166.122,80	596.979,50
add: depreciation charge		12.666,65				82.111,40	82.111,40	429.643,50	513.460,20
less: disposal of assets		1.500,00			7.900,00		24.900,00		
depreciation: balance at 31/12	5.166,65	16.333,30			26.800,00	108.911,40	166.122,80	595.766,30	1.110.439,70
NET BOOK VALUE 31/12	10.333,35	21.666,70			200,00	164.422,90	82.211,50	1.043.096,00	955.131,60
FURNITURE AND FITTINGS/EQUIPMENT									
cost: balance at 1/1	12.949,50	4.992,00			0,00	24.042,00	34.500,50	85.550,50	127.040,45
add: additions		7.300,00				10.458,50	51.050,00	67.183,45	45.005,00
less: disposal of assets		3.000,00						16.875,00	
cost: balance at 31/12	12.949,50	9.292,00			24.042,00	34.500,50	85.550,50	135.858,95	172.045,45
depreciation:balance at 1/1	2.589,90	998,40			0,00	10.901,00	16.861,40	32.113,10	47.990,60
add: depreciation charge		1.858,40				5.960,40	15.251,70	22.433,30	33.706,10
less: disposal of assets		600,00							
depreciation: balance at 31/12	2.589,90	2.256,80			10.901,00	16.861,40	32.113,10	54.546,40	81.696,70
NET BOOK VALUE 31/12	10.359,60	7.035,20			13.141,00	17.639,10	53.437,40	81.312,55	90.348,75
TOTALS									
cost: balance at 1/1	259.316,80	220.808,25			1.566.259,85	1.680.266,85	1.946.059,65	2.142.109,65	3.699.775,60
add: additions		320.693,05			102.305,00	265.792,80	221.050,00	1.581.337,45	535.026,90
less: disposal of assets		31.924,10			12.340,00	0,00	25.000,00	16.875,00	0,00
cost: balance at 31/12	259.316,80	509.577,25			1.680.266,85	1.946.059,65	2.142.109,65	3.706.572,10	4.234.802,50
depreciation:balance at 1/1	20.849,70	16.203,10			241.249,10	341.558,90	536.299,90	736.708,70	1.323.751,30
add: depreciation charge		40.037,60			144.984,25	216.026,60	225.308,80	592.385,20	691.174,45
less: disposal of assets		4.542,40			55.575,45	0,00	24.900,00	0,00	0,00
depreciation: balance at 31/12	20.849,70	51.698,30			341.558,90	536.299,90	736.708,70	1.329.093,90	2.014.925,75
NET BOOK VALUE 31/12	238.467,10	457.878,95			1.338.707,95	1.409.759,75	1.405.400,95	2.377.478,20	2.219.876,75

FIXED ASSETS COST DEPRECIATION

LAND AND BUILDINGS	1986	1987	1988	1989	1990	1991	1992	1993	1994
cost: balance at 1/1	557.102,40	622.102,40	2.115.677,90	3.315.134	6.649.286	10.815.573	110.795.326	117.430.000	120.136.750
add: additions	65.000,00	1.493.575,50	1.199.456,70	3.334.152	4.166.287	10.813.126	6.634.674	2.706.750	5.288.985
less: disposal of assets									
cost: balance at 31/12	622.102,40	2.115.677,90	3.315.134,60	6.649.286	10.815.573	21.628.699	117.430.000	120.136.750	125.425.735
depreciation:balance at 1/1	0,00	0,00	0,00	0	0	0	0	0	0
add: depreciation charge									4.027.589
less: disposal of assets									
depreciation: balance at 31/12	0,00	0,00	0,00	0	0	0	0	0	4.027.589
NET BOOK VALUE 31/12	622.102,40	2.115.677,90	3.315.134,60	6.649.286	10.815.573	21.628.699	117.430.000	120.136.750	121.398.146
PLANT AND MACHINERY									
cost: balance at 1/1	1.440.083,35	1.440.083,35	1.606.712,30	1.720.808	17.407.849	19.885.049	87.877.199	90.943.000	92.931.470
add: additions	1.708.333,40	166.628,95	114.095,00	15.687.041	2.477.200	16.301.487	3.065.801	1.988.470	
less: disposal of assets	1.708.333,40								
cost: balance at 31/12	1.440.083,35	1.606.712,30	1.720.807,30	17.407.849	19.885.049	36.186.536	90.943.000	92.931.470	92.931.470
depreciation:balance at 1/1	822.789,35	966.784,70	1.111.699,05	1.269.868	2.992.731	4.981.236	7.397.272	17.037.402	29.441.972
add: depreciation charge	143.995,35	144.914,35	158.168,55	1.722.863	1.988.505	3.509.140	9.640.130	12.404.570	12.615.362
less: disposal of assets									
depreciation: balance at 31/12	966.784,70	1.111.699,05	1.269.867,60	2.992.731	4.981.236	8.490.376	17.037.402	29.441.972	42.057.334
NET BOOK VALUE 31/12	473.298,65	495.013,25	450.939,70	14.415.118	14.903.813	27.696.160	73.905.598	63.489.498	50.874.136
MOTOR VEHICLE									
cost: balance at 1/1	2.065.571,30	2.065.571,30	2.065.571,30	675.043	10.958.179	15.043.683	17.960.000	17.960.000	13.550.000
add: additions				10.529.470	4.085.504				
less: disposal of assets			1.390.528,00	246.334		424.687		4.410.000	
cost: balance at 31/12	2.065.571,30	2.065.571,30	675.043,30	10.958.179	15.043.683	14.618.996	17.960.000	13.550.000	13.550.000
depreciation:balance at 1/1	1.110.439,70	1.659.190,50	1.859.905,90	554.415	2.499.011	5.507.748	8.002.333	10.246.733	8.521.845
add: depreciation charge	548.700,80	200.715,40	84.937,40	2.190.830	3.008.737	2.922.994	2.244.400	1.627.000	1.627.000
less: disposal of assets			1.390.428,00	246.234		424.587		3.351.888	
depreciation: balance at 31/12	1.659.190,50	1.859.905,90	554.415,30	2.499.011	5.507.748	8.006.155	10.246.733	8.521.845	10.148.845
NET BOOK VALUE 31/12	406.380,80	205.665,40	120.628,00	8.459.168	9.535.935	6.612.841	7.713.267	5.028.155	3.401.155
FURNITURE AND FITTINGS/EQUIPMENT									
cost: balance at 1/1	172.045,45	239.755,45	353.134,45	824.592	858.743	1.053.838	9.172.133	9.229.133	9.229.133
add: additions	128.710,00	113.379,00	471.458,00	34.151	195.095	246.950	57.000		
less: disposal of assets	61.000,00								
cost: balance at 31/12	239.755,45	353.134,45	824.592,45	858.743	1.053.838	1.300.788	9.229.133	9.229.133	9.229.133
depreciation:balance at 1/1	81.696,70	123.448,10	188.573,30	341.255	493.560	670.246	559.910	1.684.785	2.808.165
add: depreciation charge	44.951,40	65.125,20	152.681,30	152.305	176.686	213.134	1.124.875	1.123.380	1.099.058
less: disposal of assets	3.200,00								
depreciation: balance at 31/12	123.448,10	188.573,30	341.254,60	493.560	670.246	883.380	1.684.785	2.808.165	3.907.223
NET BOOK VALUE 31/12	116.307,35	164.561,15	483.337,85	365.183	383.592	417.408	7.544.348	6.420.968	5.321.910
TOTALS									
cost: balance at 1/1	4.234.802,50	4.367.512,50	6.141.095,95	6.535.577	35.874.057	46.798.143	225.804.658	235.562.133	235.847.353
add: additions	1.902.043,40	1.773.583,45	1.785.009,70	29.584.814	10.924.086		9.757.475	4.695.220	5.288.985
less: disposal of assets	1.769.333,40	0,00	1.390.528,00	246.334	0		0	4.410.000	0
cost: balance at 31/12	4.367.512,50	6.141.095,95	6.535.577,65	35.874.057	46.798.143	73.735.019	235.562.133	235.847.353	241.136.338
depreciation:balance at 1/1	2.014.925,75	2.749.423,30	3.160.178,25	2.165.538	5.985.302	11.159.230	15.959.515	28.968.920	40.771.982
add: depreciation charge	737.697,55	410.754,95	395.787,25	4.065.998	5.173.928		13.009.405	15.154.950	19.369.009
less: disposal of assets	3.200,00	0,00	1.390.428,00	246.234	0		0	3.351.888	0
depreciation: balance at 31/12	2.749.423,30	3.160.178,25	2.165.537,50	5.985.302	11.159.230	17.379.911	28.968.920	40.771.982	60.140.991
NET BOOK VALUE 31/12	1.618.089,20	2.980.917,70	4.370.040,15	29.888.755	35.638.913	56.355.108	206.593.213	195.075.371	180.995.347

FIXED ASSETS COST DEPRECIATION									
LAND AND BUILDINGS	1995	1996	1997	1998	1999	2000	2001	2002	2003
cost: balance at 1/1	125.425.735	126.816.385	126.816.385	129.218.561	130.639.536	237.757.961	237.757.961	237.757.961	237.757.961
add: additions	1.390.650		2.402.176	1.420.975	107.118.425				
less: disposal of assets									
cost: balance at 31/12	126.816.385	126.816.385	129.218.561	130.639.536	237.757.961	237.757.961	237.757.961	237.757.961	237.757.961
depreciation:balance at 1/1	4.027.589	8.055.178	12.082.767	16.110.356	20.188.200	6.111.560	12.223.120	18.334.680	24.446.240
add: depreciation charge	4.027.589	4.027.589	4.027.589	4.077.844	6.111.560	6.111.560	6.111.560	6.111.560	6.111.560
less: disposal of assets					20.188.200				
depreciation: balance at 31/12	8.055.178	12.082.767	16.110.356	20.188.200	6.111.560	12.223.120	18.334.680	24.446.240	30.557.800
NET BOOK VALUE 31/12	118.761.207	114.733.618	113.108.205	110.451.336	231.646.401	225.534.841	219.423.281	213.311.721	207.200.161
PLANT AND MACHINERY									
cost: balance at 1/1	92.931.470	98.809.189	98.809.189	98.809.189	98.809.189	219.445.000	219.445.000	219.445.000	219.445.000
add: additions	5.877.719				125.482.905				
less: disposal of assets					4.847.094				
cost: balance at 31/12	98.809.189	98.809.189	98.809.189	98.809.189	219.445.000	219.445.000	219.445.000	219.445.000	219.445.000
depreciation:balance at 1/1	42.057.334	54.664.525	66.032.591	77.026.242	86.722.278	33.562.666	60.993.289	87.776.968	114.157.591
add: depreciation charge	12.607.191	11.368.066	10.993.651	9.696.036	27.430.623	27.430.623	26.783.679	26.380.623	26.380.623
less: disposal of assets					80.590.235				
depreciation: balance at 31/12	54.664.525	66.032.591	77.026.242	86.722.278	33.562.666	60.993.289	87.776.968	114.157.591	140.538.214
NET BOOK VALUE 31/12	44.144.664	32.776.598	21.782.947	12.086.911	185.882.334	158.451.711	131.668.032	105.287.409	78.906.786
MOTOR VEHICLE									
cost: balance at 1/1	13.550.000	9.000.000	9.000.000	9.000.000	9.000.000	0	0	0	0
add: additions					9.000.000				
less: disposal of assets	4.550.000				0	0	0	0	0
cost: balance at 31/12	9.000.000	9.000.000	9.000.000	9.000.000	8.999.999	0	0	0	0
depreciation:balance at 1/1	10.148.845	7.857.852	8.847.852	8.999.999	825.000				
add: depreciation charge	990.000	990.000	152.147		9.824.999				
less: disposal of assets	3.280.993				0	0	0	0	0
depreciation: balance at 31/12	7.857.852	8.847.852	8.999.999	8.999.999	0	0	0	0	0
NET BOOK VALUE 31/12	1.142.148	152.148	1	1					
FURNITURE AND FITTINGS/EQUIPMENT									
cost: balance at 1/1	9.229.133	9.630.933	9.630.933	9.630.933	6.008.133	7.696.000	7.696.000	7.696.000	7.696.000
add: additions	401.800				1.716.867				
less: disposal of assets				3.622.800	29.000				
cost: balance at 31/12	9.630.933	9.630.933	9.630.933	6.008.133	7.696.000	7.696.000	7.696.000	7.696.000	7.696.000
depreciation:balance at 1/1	3.907.223	4.989.409	6.039.992	6.992.561	5.837.280	4.057.872	4.573.596	5.089.320	5.605.044
add: depreciation charge	1.082.186	1.050.583	952.569		515.724	515.724	515.724	515.724	515.724
less: disposal of assets				1.155.281	2.295.132				
depreciation: balance at 31/12	4.989.409	6.039.992	6.992.561	5.837.280	4.057.872	4.573.596	5.089.320	5.605.044	6.120.768
NET BOOK VALUE 31/12	4.641.524	3.590.941	2.638.372	170.853	3.638.128	3.122.404	2.606.680	2.090.956	1.575.232
TOTALS									
cost: balance at 1/1	241.136.338	244.256.507	244.256.507	246.658.683	244.456.858	464.898.961	464.898.961	464.898.961	464.898.961
add: additions	7.670.169	0	2.402.176	1.420.975	234.318.197	0	0	0	0
less: disposal of assets	4.550.000	0	0	3.622.800	13.876.094	0	0	0	0
cost: balance at 31/12	244.256.507	244.256.507	246.658.683	244.456.858	464.898.961	464.898.961	464.898.961	464.898.961	464.898.961
depreciation:balance at 1/1	60.140.991	75.566.964	93.003.202	109.129.158	121.747.757	43.732.098	77.790.005	111.200.968	144.208.875
add: depreciation charge	18.706.966	17.436.238	16.125.956	13.773.880	34.882.907	34.057.907	33.410.963	33.007.907	33.007.907
less: disposal of assets	3.280.993	0	0	1.155.281	112.898.566	0	0	0	0
depreciation: balance at 31/12	75.566.964	93.003.202	109.129.158	121.747.757	43.732.098	77.790.005	111.200.968	144.208.875	177.216.782
NET BOOK VALUE 31/12	168.689.543	151.253.305	137.529.525	122.709.101	421.166.863	387.108.956	353.697.993	320.690.086	287.682.179

INVESTMENTS	1977	1978	1979	1980	1981	1982	1983	1984	1985
shares DARMCU Ltd.									5.000,00
shares M.M.S.									10.000,00
shares C.U.T.									
TOTAL	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	15.000,00

STOCKS AT COST	1977	1978	1979	1980	1981	1982	1983	1984	1985
raw materials		18.370,00			1.370.485,05	343.515,50	405.568,95	226.392,45	495.029,05
production means / inputs									
construction materials									
buffing materials									
total materials	**0,00**	**18.370,00**	**0,00**	**0,00**	**1.370.485,05**	**343.515,50**	**405.568,95**	**226.392,45**	**495.029,05**
machinery spares									403.938,15
motor vehicle spares		450,00							
electrical parts									
oils and lubricants									
machine tools materials									
total spare parts	**0,00**	**450,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**403.938,15**
work in progress - knives	11.700,00	30.677,00			96.567,00	136.880,35	125.388,35	48.481,10	141.926,00
finished knives		11.978,00			54.432,00	149.760,00	170.952,00	54.492,20	58.185,00
TOTAL	11.700,00	61.475,00	0,00	0,00	1.521.484,05	630.155,85	701.909,30	329.365,75	1.099.078,20

DEBTORS DEPOSITS AND PREPAYMENTS	1977	1978	1979	1980	1981	1982	1983	1984	1985
sundry / trade / business debtors	13.265,60	26.225,60			135.189,50	734.654,25	124.334,40	471.411,05	399.185,25
staff debtors, loans and advances		4.284,25			12.864,00	29.764,50	100.674,00	110.972,35	208.514,30
deposits and prepayments					2.000,00	2.000,00	2.000,00	2.000,00	13.330,00
TOTAL	13.265,60	30.509,85			150.053,50	766.418,75	227.008,40	584.383,40	621.029,55

CASH AT BANK AND AT HAND	1977	1978	1979	1980	1981	1982	1983	1984	1985
fixed deposit - T.H.B.									
fixed deposit - N.B.C.									
fixed deposit - C.R.D.B. (i and ii)									
fixed deposit (-)							280.000,00	200.000,00	
total fixed deposit							**280.000,00**	**200.000,00**	**0,00**
N.B.C. (0011) / (01111) / (00111/3979)									
current account - N.B.C. (01335)									
current account - N.B.C. (2320)									
current account - N.B.C. (8047)									
total current account N.B.C.									
current account - C.R.D.B. (1375)						121.871,85	-82.061,90	129.524,45	383.813,45
current account - C.R.D.B. (1376)						14.512,90	7.534,40	19.776,00	17.931,05
current account - C.R.D.B. (1377)						601,40	561,95	541,40	511,40
current account - C.R.D.B. (-)									
total current account C.R.D.B.						**136.986,15**	**-73.965,55**	**149.841,85**	**402.255,90**
current account - Akiba C. Bank (7007)									
total cash at bank	**145.190,20**	**172.312,00**				**136.986,15**	**206.034,45**	**349.841,85**	**402.255,90**
cash in hand	6.789,50	2.342,95				24.347,70	20.873,65	27.203,85	10.779,40
TOTAL	151.979,70	174.654,95			13.475,55	161.333,85	226.908,10	377.045,70	413.035,30

INVESTMENTS	1986	1987	1988	1989	1990	1991	1992	1993	1994
shares DARMCU Ltd.	5.000,00	5.000,00	5.000,00	5.000	5.000	5.000	5.000	5.000	5.000
shares M.M.S.	10.000,00	10.000,00	10.000,00	10.000	10.000	422.000	422.000	422.000	422.000
shares C.U.T.	10.000,00	10.000,00	10.000,00	10.000	10.000	10.000	10.000	10.000	10.000
TOTAL	25.000,00	25.000,00	25.000,00	25.000	25.000	437.000	437.000	437.000	437.000

STOCKS AT COST	1986	1987	1988	1989	1990	1991	1992	1993	1994
raw materials	1.190.947,75	1.935.267,65	475.717,85	24.607.637	5.533.940	20.043.943	11.930.218	411.432	24.184.136
production means / inputs			1.887.201,10	5.442.650	6.156.224	4.913.141	7.089.212	3.729.647	13.384.590
construction materials			403.449,00	196.374	378.122	152.480	31.100	13.479	31.229
buffing materials			600,00				159.926	19.250	
total materials	**1.190.947,75**	**1.935.267,65**	**2.766.967,95**	**30.246.661**	**12.068.286**	**25.109.564**	**19.210.456**	**4.173.808**	**37.599.955**
machinery spares	1.934.277,90	218.201,15	370.029,75	427.616	369.974	516.451	623.072	584.467	938.874
motor vehicle spares			46.615,20	68.377	139.872	158.486	51.719	47.718	46.868
electrical parts			35.616,65	28.522	28.036	180.998	149.020	116.787	49.031
oils and lubricants			40.042,40			78.937	88.060	94.480	85.480
machine tools materials			534.009,90					1.967.057	
total spare parts	**1.934.277,90**	**218.201,15**	**1.026.313,90**	**524.515**	**537.882**	**934.872**	**911.871**	**2.810.509**	**1.120.253**
work in progress - knives	781.082,35	325.262,40	614.188,05	3.210.043	1.777.367	3.310.484	4.000.000	1.884.886	6.587.211
finished knives	1.542,40	20.689,10	630.334,15	4.374.748	1.440.459	220.011	1.855.904	849.811	441.580
TOTAL	3.907.850,40	2.499.420,30	5.037.804,05	38.355.967	15.823.994	29.574.931	25.978.231	9.719.014	45.748.999

DEBTORS DEPOSITS AND PREPAYMENTS	1986	1987	1988	1989	1990	1991	1992	1993	1994
sundry / trade / business debtors	1.736.104,90	298.702,80	521.702,80	419.179	6.739.238	9.247.517	8.087.742	6.873.600	16.415.034
staff debtors, loans and advances	556.183,95	566.412,65	682.108,45	669.189	760.950	1.271.256		68.600	408.100
deposits and prepayments	44.279,50	2.729.469,00	6.109.915,00	1.124.729	2.043.563	2.324.242	306.303	18.167.985	764.683
TOTAL	2.336.568,35	3.594.584,45	7.313.726,25	2.213.097	9.543.751	12.843.015	8.394.045	25.110.185	17.587.817

CASH AT BANK AND AT HAND	1986	1987	1988	1989	1990	1991	1992	1993	1994
fixed deposit - T.H.B.			400.000,00	400.000	400.000	400.000	400.000	400.000	400.000
fixed deposit - N.B.C.							6.600.000		
fixed deposit - C.R.D.B. (i and ii)			1.822.628,95						
fixed deposit (-)	1.000.000,00	1.158.249,60							
total fixed deposit	**1.000.000,00**	**1.158.249,60**	**2.222.628,95**	**400.000**	**400.000**	**400.000**	**7.000.000**	**400.000**	**400.000**
N.B.C. (0011) / (01111) / (00111/3979)				152.236			-222.309	5.669.561	1.227.268
current account - N.B.C. (01335)								64.760	558.197
current account - N.B.C. (2320)									
current account - N.B.C. (8047)									
total current account N.B.C.				**152.236**	**0**	**0**	**-222.309**	**5.734.321**	**1.785.465**
current account - C.R.D.B. (1375)	228.300,00	-4.761.225,70	-3.296.820,95				1.566.821	492.411	114.011
current account - C.R.D.B. (1376)	4.977,00	22.072,00	27.691,00				23.741	23.741	23.741
current account - C.R.D.B. (1377)	451,40	451,40	451,40				98.306	98.306	98.306
current account - C.R.D.B. (-)					4.101.429	7.071.031			
total current account C.R.D.B.	**233.728,40**	**-4.738.702,30**	**-3.268.678,55**	**0**	**4.101.429**	**7.071.031**	**1.688.868**	**614.458**	**236.058**
current account - Akiba C. Bank (7007)									
total cash at bank	**1.233.728,40**	**-3.580.452,70**	**-1.046.049,60**	**552.236**	**4.501.429**	**7.471.031**	**8.466.559**	**6.748.779**	**2.421.523**
cash in hand	36.091,70	44.816,50	17.348,50	295.249	689.516	89.101	29.556	120.584	139.895
TOTAL	1.269.820,10	-3.535.636,20	-1.028.701,10	847.485	5.190.945	7.560.132	8.496.115	6.869.363	2.561.418

INVESTMENTS	1995	1996	1997	1998	1999	2000	2001	2002	2003
shares DARMCU Ltd.	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000	5.000
shares M.M.S.	422.000	422.000	422.000	422.000	422.000	422.000	422.000	422.000	422.000
shares C.U.T.	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
TOTAL	437.000	437.000	437.000	437.000	437.000	437.000	437.000	437.000	437.000

STOCKS AT COST	1995	1996	1997	1998	1999	2000	2001	2002	2003
raw materials	1.013.006	2.347.666	250.000	198.343	2.080.289	83.125			
production means / inputs	7.722.019	5.048.653	4.441.844	3.255.836	1.058.495	375.842	243.494		
construction materials	13.852	13.852	8.452	5.451	5.452	5.452	5.452		
buffing materials	420.058		345.000						
total materials	**9.168.935**	**7.410.171**	**5.045.296**	**3.459.630**	**3.144.236**	**464.419**	**248.946**	**0**	**0**
machinery spares	1.064.874	1.208.669	834.741	842.765	633.819	402.227	352.590		
motor vehicle spares	46.867	29.518	174.665	74.891					
electrical parts	44.584	6.869	4.908	80.438	74.663	79.928	3.737		
oils and lubricants	48.536	57.560	18.375		52.000	3.000	1.500		
machine tools materials									
total spare parts	**1.204.861**	**1.302.616**	**1.032.689**	**998.094**	**760.482**	**485.155**	**357.827**	**0**	**0**
work in progress - knives	1.097.868	12.021.563			4.160.380	1.726.032	402.150		
finished knives	2.640.405	13.142.570	1.179.845	4.615.971	593.662	2.909.518	829.600		
TOTAL	14.112.069	33.876.920	7.257.830	9.073.695	8.658.760	5.585.124	1.838.523	0	0

DEBTORS DEPOSITS AND PREPAYMENTS	1995	1996	1997	1998	1999	2000	2001	2002	2003
sundry / trade / business debtors	6.595.613	4.111.989	18.467.254	6.722.449	9.064.548	6.899.076	6.013.258	5.782.390	5.742.910
staff debtors, loans and advances	860.057	1.903.900	2.038.500	1.061.850	1.560.150	5.468.900	6.998.636	9.369.836	14.596.395
deposits and prepayments	11.739.360	11.290.951	12.597.857	5.106.500	4.804.020	4.804.020	4.804.020	4.804.020	4.804.020
TOTAL	19.195.030	17.306.840	33.103.611	12.890.799	15.428.718	17.171.996	17.815.914	19.956.246	25.143.325

CASH AT BANK AND AT HAND	1995	1996	1997	1998	1999	2000	2001	2002	2003
fixed deposit - T.H.B.	400.000	400.000	400.000	400.000	400.000	400.000	400.000		
fixed deposit - N.B.C.									
fixed deposit - C.R.D.B. (i and ii)									
fixed deposit (-)									
total fixed deposit	**400.000**	**400.000**	**400.000**	**400.000**	**400.000**	**400.000**	**400.000**	**0**	**0**
N.B.C. (0011) / (01111) / (00111/3979)	3.081.574	1.867.078	8.308.903	1.043.886	627.567	227.774	850.832	126.463	363.759
current account - N.B.C. (01335)	53.866.476								
current account - N.B.C. (2320)				377.960					
current account - N.B.C. (8047)				3.438.484	5.408.386	2.108.047	87.771		
total current account N.B.C.	**56.948.050**	**1.867.078**	**8.308.903**	**4.860.330**	**6.035.953**	**2.335.821**	**938.603**	**126.463**	**363.759**
current account - C.R.D.B. (1375)	114.011	373.055	373.055	373.055	373.055	373.055	373.055		
current account - C.R.D.B. (1376)	23.741	27.141	27.141	27.141	27.141	27.141	27.141		
current account - C.R.D.B. (1377)	98.306	84.629	84.629	84.629	84.629	84.629	84.629		
current account - C.R.D.B. (-)									117.110
total current account C.R.D.B.	**236.058**	**484.825**	**484.825**	**484.825**	**484.825**	**484.825**	**484.825**	**0**	**117.110**
current account - Akiba C. Bank (7007)				414.650	434.650	407.150	407.150	407.150	407.150
total cash at bank	**57.584.108**	**2.751.903**	**9.193.728**	**6.159.805**	**7.355.428**	**3.627.796**	**2.230.578**	**533.613**	**888.019**
cash in hand	154.815	404.221	330.254	246.530	448.120	241.332	64.990		35.861
TOTAL	57.738.923	3.156.124	9.523.982	6.406.335	7.803.548	3.869.128	2.295.568	533.613	923.880

CREDITORS AND ACCRUALS	1977	1978	1979	1980	1981	1982	1983	1984	1985
(trade) debtors with credit balances									
staff advance with credit balances									
accruals									
unidentified bank deposit (111)									
unidentified bank deposit (8047)									
other									
HIVOS deposit									
other deposits / others / customers deposit									
sundry / business creditors	6.714,95	7.733,45			428.687,75	94.652,00	134.314,60	327.303,50	524.145,60
TOTAL	6.714,95	7.733,45	0,00	0,00	428.687,75	94.652,00	134.314,60	327.303,50	524.145,60

LONG TERM LIABILITIES	1977	1978	1979	1980	1981	1982	1983	1984	1985
hivos loan 3102/1884									
hivos loan 3102/1412									
hivos loan total					**651.323,00**	**621.635,00**	**259.362,50**	**297.549,50**	**369.972,00**
C.R.D.B. material loan								708.245,00	169.465,00
Karadha company									
MEIDA									
SIDO	29.363,80	40.118,75			15.282,75	6.970,75	22.986,05	3.190,00	2.911,00
T.H.B. building loan	100.000,00	300.000,00			321.937,00	223.654,80	162.266,30	167.281,90	130.989,05
other									
TOTAL	**129.363,80**	**340.118,75**			**988.542,75**	**852.260,55**	**444.614,85**	**1.176.266,40**	**673.337,05**

CAPITAL RESERVES	1977	1978	1979	1980	1981	1982	1983	1984	1985
statutory reserve						132.872,00	170.542,00	189.345,00	297.065,00
share transfer fund						983,00	983,00	983,00	1.100,00
grants and donation of fixed assets		377.829,60			1.764.385,00	1.844.670,00	1.844.670,00	1.937.778,00	1.937.778,00
TOTAL	0,00	377.829,60			1.764.385,00	1.978.525,00	2.016.195,00	2.128.106,00	2.235.943,00

REVENUE RESERVE	1977	1978	1979	1980	1981	1982	1983	1984	1985
interest on share capital									
deffered tax									
retained surplus/deficit	277.068,65	-4.073,05			-548.361,30	32.400,65	-30.267,70	-63.552,85	370.940,15
TOTAL	277.068,65	-4.073,05	0,00	0,00	-548.361,30	32.400,65	-30.267,70	-63.552,85	370.940,15

CREDITORS AND ACCRUALS	1986	1987	1988	1989	1990	1991	1992	1993	1994
(trade) debtors with credit balances									
staff advance with credit balances									
accruals					8.527.213	4.476.646	3.935.661	344.103	279.680
unidentified bank deposit (111)									
unidentified bank deposit (8047)									
other				11.496.151	17.285.248	21.222.646	100.000		
HIVOS deposit									
other(s) / customers deposit			184.176,15						
sundry / business creditors	637.991,30	210.580,00	815.995,00		349.956	1.503.403	2.087.156	2.163.015	2.193.760
TOTAL	637.991,30	210.580,00	1.000.171,15	23.180.497	26.162.417	27.202.695	6.122.817	2.507.118	2.473.440

LONG TERM LIABILITIES	1986	1987	1988	1989	1990	1991	1992	1993	1994
hivos loan 3102/1884						23.426.763	20.913.640	21.083.092	21.083.092
hivos loan 3102/1412				19.990.488		12.695.700	11.569.675	10.970.576	10.970.576
hivos loan total	**2.488.740,00**	**1.224.947,00**	**5.847.147,95**	**19.990.488**	**14.987.060**	**36.122.463**	**32.483.315**	**32.053.668**	**32.053.668**
C.R.D.B. material loan						19.970.819	25.426.840	19.021.103	28.041.503
Karadha company	3.212,00	3.212,00							
MEIDA						1.500.000	-416.583	-416.585	
SIDO						6.835.300	9.454.079	9.454.079	9.454.079
T.H.B. building loan	95.247,95	11.095,95		1.931.055	6.761.761	12.310.137	12.521.247	12.182.257	15.958.757
other						-21.222.646			
TOTAL	2.587.199,95	1.239.254,95	5.847.147,95	21.921.543	21.748.821	55.516.073	79.468.898	72.294.522	85.508.007

CAPITAL RESERVES	1986	1987	1988	1989	1990	1991	1992	1993	1994
statutory reserve	442.535,00	442.535,00	1.247.632,45	1.247.632	2.685.058	4.071.129	4.071.129	4.071.164	4.071.164
share transfer fund	1.130,00	1.130,00	1.210,00	1.210	1.650	2.045	2.045	2.045	2.045
grants and donation of fixed assets	3.646.111,40	3.646.111,40	3.646.111,40	3.646.111	9.538.615	9.538.615	163.028.650	9.538.615	
TOTAL	4.089.776,40	4.089.776,40	4.894.953,85	4.894.953	12.225.323	13.611.789	167.101.824	13.611.824	4.073.209

REVENUE RESERVE	1986	1987	1988	1989	1990	1991	1992	1993	1994
interest on share capital						1.848	1.848	1.848	1.848
deffered tax				1.334.146	250.000	440.996	290.996		
retained surplus/deficit	952.590,40	-814.295,10	2.409.226,90	71.099	5.819.542	9.976.335	-3.168.729	-4.775.329	1.703.127
TOTAL	952.590,40	-814.295,10	2.409.226,90	1.405.245	6.069.542	10.419.179	-2.875.885	-4.773.481	1.704.975

CREDITORS AND ACCRUALS	1995	1996	1997	1998	1999	2000	2001	2002	2003
(trade) debtors with credit balances			11.665.033			689.751	1.205.798	1.205.798	1.205.798
staff advance with credit balances						34.100	34.100	34.100	34.100
accruals	851.596	2.100.727	2.986.950	9.401.441	37.642.735	46.150.486	58.545.449	57.589.656	57.589.656
unidentified bank deposit (111)				192.500	192.500	192.500	282.000	282.000	282.000
unidentified bank deposit (8047)				157.860	157.860	157.860	157.860	157.860	157.860
other				13.167					
HIVOS deposit	53.367.644	7.378.889	8.135.319						
other deposits / others / customers deposit		3.130.000						165.000	3.798.500
sundry / business creditors	6.208.161	9.565.624	8.139.938	5.394.301	2.224.379	3.025.379	3.600.879	3.758.879	3.569.809
TOTAL	60.427.401	22.175.240	30.927.240	15.159.269	40.217.474	50.250.076	63.826.086	63.193.293	66.637.723

LONG TERM LIABILITIES	1995	1996	1997	1998	1999	2000	2001	2002	2003
hivos loan 3102/1884	21.083.092	5.070.799	5.070.799						
hivos loan 3102/1412	10.970.576	10.970.576	2.476.157						
hivos loan total	**32.053.668**	**16.041.375**	**7.546.956**						
C.R.D.B. material loan	31.770.757	40.399.402	68.656.358	98.008.513	98.008.513	98.008.513	98.008.513	137.221.948	137.221.948
Karadha company									
MEIDA									
SIDO	9.454.079	9.454.079	9.454.079	9.454.079	9.454.079	9.454.079	9.454.079	9.454.079	9.454.079
T.H.B. building loan	30.795.881	42.407.643	58.930.556	67.192.011	67.192.011	67.192.011	67.192.011	22.190.043	22.190.043
other									
TOTAL	**104.074.385**	**108.302.499**	**144.587.949**	**174.654.603**	**174.654.603**	**174.654.603**	**174.654.603**	**168.866.070**	**168.866.070**

CAPITAL RESERVES	1995	1996	1997	1998	1999	2000	2001	2002	2003
statutory reserve	4.051.164	4.051.164	4.051.164	4.051.164	4.051.164	4.051.164	4.051.164	4.051.164	4.051.164
share transfer fund	2.045	2.045	2.045	2.045	2.045	2.045	2.045	2.045	2.045
grants and donation of fixed assets									
TOTAL	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209	4.053.209

REVENUE RESERVE	1995	1996	1997	1998	1999	2000	2001	2002	2003
interest on share capital	1.848	1.848	1.848	1.848	1.848	1.848	1.848	1.848	1.848
deffered tax									
retained surplus/deficit	-61.112.352	-81.066.539	-146.748.032	-194.571.115	-134.592.186	-186.403.269	-238.957.062	-266.501.655	-297.231.290
TOTAL	-61.110.504	-81.064.691	-146.746.184	-194.569.267	-134.590.338	-186.401.421	-238.955.214	-266.499.807	-297.229.442

Appendix G. Income and Expenditure accounts of TAMECO

INCOME AND EXPENDITURE STATEMENT FOR 12 MONTHS ENDING ON 31/12									
INCOME FROM	1977	1978	1979	1980	1981	1982	1983	1984	1985
sales of knives		137.506	465.847	633.594	1.156.130	3.467.324	3.859.313	3.939.396	5.372.756
milling machine		224.247	285.042	407.923	354.205	314.823	244.860	223.107	371.701
consumer shop						164.007	195.094	236.884	276.809
transport									125.936
machine tools									
other income		5.363	9.438	16.687	204.729	311.658	124.914	69.970	103.447
TOTAL INCOME		367.117	760.327	1.058.204	1.715.064	4.257.811	4.424.181	4.469.357	6.250.649
COSTS FROM									
costs knife manufacturing		54.502	191.796	213.300	681.575	2.257.072	2.231.684	1.959.209	2.022.123
milling machine		0	0	0	0	149.642	274.199	216.396	329.179
consumer shop						169.193	184.761	236.758	282.453
transport									713.449
machine tools									
TOTAL COSTS CORE ACTIVITIES		54.502	191.796	213.300	681.575	2.575.907	2.690.644	2.412.363	3.347.203
NET INCOME CORE ACTIVITIES									
knives production/manufacturing		83.004,60	274.051,00	420.294,35	474.554,65	1.210.251,85	1.627.628,50	1.980.186,80	3.350.633,25
milling machine		224.247,40	285.042,00	407.923,05	354.204,50	165.181,35	-29.338,60	6.711,25	42.522,05
consumer shop						-5.186,05	10.332,90	126,80	-5.643,05
machine tools									-587.486,40
transport									
other income		5.363,00	9.438,00	16.686,70	204.729,30	311.657,65	124.914,00	69.970,20	103.446,60
NET INCOME TOTAL		312.615,00	568.531,00	844.904,10	1.033.488,45	1.681.904,80	1.733.536,80	2.056.995,05	2.903.472,45
OPERATIONAL EXPENSES									
personnel expenses		262.106,35	319.333,00	382.198,90	411.513,70	414.916,55	561.723,70	581.365,95	712.373,50
business & administrative expenses		41.546,40	58.992,00	61.400,50	83.302,35	209.045,70	196.976,85	223.753,10	406.320,35
office & general expenses		96.006,65	115.425,00	287.580,70	255.979,70	103.038,90	240.947,30	472.845,80	295.949,55
bank & finance expenses		2.409,90	39.250,00	31.116,00	46.101,35	61.721,05	56.130,35	44.832,40	18.423,25
production - transport & other expenses		175.470,80	142.982,00	372.232,50	387.489,05	228.822,15	454.406,95	535.179,95	469.149,90
TOTAL OPERATIONAL EXPENSES		577.540,10	675.982,00	1.134.528,60	1.184.386,15	1.017.544,35	1.510.185,15	1.857.977,20	1.902.216,55
NET SURPLUS/DEFICIT FOR PERIOD		**-264.925,10**	**-132.676,50**	**-289.624,50**	**-150.897,70**	**664.360,45**	**223.351,65**	**199.017,85**	**1.001.255,90**
LESS:									
provision for taxation							35.000,00	105.000,00	462.654,00
interest on share capital									
statutory reserve						132.872,00	37.670,00	18.803,00	107.720,00
staff houses scheme costs							213.350,00	108.500,00	117,00
share capital transfer fund						983,00			
ADD:									
acc. surplus/deficit brought forward		256.205,45	0,00	-132.676,50	-443.801,00	-548.361,30	32.400,65	-30.267,70	-63.552,85
prior year's adjustment		4.646,60		-21.500,00	46.337,40	50.256,50			3.728,10
ACC. SURPLUS CARRIED FORWARD		-4.073,05	-132.676,50	-443.801,00	-548.361,30	32.400,65	-30.267,70	-63.552,85	370.940,15

INCOME AND EXPENDITURE STATEMENT FOR 12 MONTHS ENDING ON 31/12									
INCOME FROM	1986	1987	1988	1989	1990	1991	1992	1993	1994
sales of knives	9.584.073	4.984.404	17.979.874	22.863.290	65.889.191	72.288.091	75.409.006	88.802.792	112.300.711
milling machine	759.085	1.275.361	1.654.311	1.946.072	2.511.483	2.322.448	2.995.282	3.585.234	3.422.938
consumer shop	285.286	239.355							
transport	371.387	292.834							
machine tools							105.700	1.327.780	12.230.360
other income	505.086	418.036	4.539.808	1.507.844	734.342	7.626.410	1.915.159	2.366.161	2.778.240
TOTAL INCOME	11.504.916	7.209.990	24.173.993	26.317.206	69.135.016	82.236.949	80.425.147	96.081.967	130.732.249
COSTS FROM									
costs knife manufacturing	4.924.450	3.181.088	10.300.051	7.180.818	30.035.686	29.217.528	41.698.676	44.776.776	53.193.328
milling machine	367.049	456.603	653.198	657.364	1.076.305	1.407.591	2.762.607	3.623.435	2.897.994
consumer shop	291.517	252.793							
transport	1.063.050	621.389							
machine tools							178.615	1.507.796	9.079.369
TOTAL COSTS CORE ACTIVITIES	6.646.067	4.511.873	10.953.249	7.838.182	31.111.991	30.625.119	44.639.898	49.908.007	65.170.691
NET INCOME CORE ACTIVITIES									
knives production/manufacturing	4.659.622,80	1.803.316,10	7.679.823,05	15.682.472	35.853.505	43.070.563	33.710.330	44.026.016	59.107.383
milling machine	392.035,90	818.758,50	1.001.112,80	1.288.708	1.435.178	914.857	232.675	-38.201	524.944
consumer shop	-6.231,80	-13.438,00							
machine tools							-72.915	-180.016	3.150.991
transport	-691.663,30	-328.555,15							
other income	505.085,90	418.036,05	4.539.808,00	1.507.844	734.342	7.626.410	1.915.159	2.366.161	2.778.240
NET INCOME TOTAL	4.858.849,50	2.698.117,50	13.220.743,85	18.479.024	38.023.025	51.611.830	35.785.249	46.173.960	65.561.558
OPERATIONAL EXPENSES									
personnel expenses	983.816,55	1.083.543,40	1.805.775,60	2.655.589	5.408.240	7.096.667	9.374.331	12.033.521	19.537.921
business & administrative expenses	1.090.833,25	1.199.575,30	1.524.054,65	3.930.435	5.743.398	14.423.836	7.892.110	10.617.187	13.559.553
office & general expenses	572.350,35	329.807,60	840.477,00	2.922.857	4.208.341	4.076.768	4.485.100	6.657.218	8.717.847
bank & finance expenses	15.615,25	170.691,80	1.569.702,25	9.603.970	8.911.245	11.932.181	17.544.623	11.215.398	13.655.295
production - transport & other expenses	1.041.367,85	1.681.384,90	2.105.246,90	1.704.301	5.876.710	8.147.100	9.634.149	8.714.044	13.190.001
TOTAL OPERATIONAL EXPENSES	3.703.983,25	4.465.003,00	7.845.256,40	20.817.152	30.147.934	45.676.552	48.930.313	49.237.368	68.660.617
NET SURPLUS/DEFICIT FOR PERIOD	**1.154.866,25**	**-1.766.885,50**	**5.375.487,45**	**-2.338.128**	**7.875.091**	**5.935.278**	**-13.145.064**	**-3.063.408**	**-3.099.059**
LESS:									
provision for taxation	427.516,00		1.350.000,00		687.957	390.996		153.107	
interest on share capital					825	1.023			
statutory reserve	145.470,00		805.097,45		1.437.426	1.386.071			
staff houses scheme costs	230,00								
share capital transfer fund			80,00		440	395		41.000	
ADD:									
acc. surplus/deficit brought forward	370.940,15	952.590,40	-814.295,10	2.409.227	71.099	5.819.542	9.976.335	-3.168.729	-4.775.329
prior year's adjustment			3.212,00					1.650.915	9.577.515
ACC. SURPLUS CARRIED FORWARD	952.590,40	814.295,10	2.409.226,90	71.099	5.819.542	9.976.335	-3.168.729	-4.775.329	1.703.127

INCOME AND EXPENDITURE STATEMENT FOR 12 MONTHS ENDING ON 31/12

INCOME FROM	1995	1996	1997	1998	1999	2000	2001	2002	2003
sales of knives	73.677.462	44.675.932	50.352.526	47.816.598	45.524.966	31.601.975	5.936.753	1.534.620	1.335.573
milling machine	5.166.285	5.275.020	3.708.926	2.866.837	2.501.452	2.206.218	868.559	970.630	2.993.323
consumer shop									
transport									
machine tools	0								
other income	5.468.394	6.413.379	5.168.949	3.056.401	9.981.151	4.542.614	5.739.165	6.080.304	3.882.789
TOTAL INCOME	84.312.141	56.364.331	59.230.401	53.739.836	58.007.569	38.350.807	12.544.477	8.585.554	8.211.685
COSTS FROM									
costs knife manufacturing	77.343.350	45.999.846	58.349.006	34.445.801	64.313.726	61.622.136	49.132.579	35.854.579	32.692.986
milling machine	2.371.154	2.304.157	1.951.987	2.397.401	2.993.430	2.056.682	1.144.432	1.275.967	1.273.867
consumer shop									
transport									
machine tools	1.800								
TOTAL COSTS CORE ACTIVITIES	79.716.304	48.304.003	60.300.993	36.843.202	67.307.156	63.678.818	50.277.011	37.130.546	33.966.853
NET INCOME CORE ACTIVITIES									
knives production/manufacturing	-3.665.888	-1.323.914	-7.996.480	13.370.797	-18.788.760	-30.020.161	-43.195.826	-34.319.959	-31.357.413
milling machine	2.795.131	2.970.863	1.756.939	469.436	-491.978	149.536	-275.873	-305.337	1.719.456
consumer shop									
machine tools	-1.800								
transport									
other income	5.468.394	6.413.379	5.168.949	3.056.401	9.981.151	4.542.614	5.739.165	6.080.304	3.882.789
NET INCOME TOTAL	4.595.837	8.060.328	1.070.592	16.896.634	-9.299.587	-25.326.011	-37.732.534	-28.544.992	-25.755.168
OPERATIONAL EXPENSES									
personnel expenses	16.678.128	12.302.920	10.562.875	9.192.991	13.460.356	11.424.043	9.317.316	206.150	288.473
business & administrative expenses	12.411.154	10.401.881	7.457.839	5.800.296	6.416.935	5.398.435	2.857.706	1.846.800	2.107.148
office & general expenses	7.730.182	8.984.399	3.818.455	2.883.197	6.471.565	4.126.136	636.424	614.243	761.591
bank & finance expenses	19.557.847	20.889.993	46.019.550	37.783.052	139.100	143.700	82.200	672.676	202.200
production - transport & other expenses	11.127.320	7.218.723	4.983.340	5.152.513	5.818.418	5.363.328	225.715	1.048.265	1.615.055
TOTAL OPERATIONAL EXPENSES	67.504.631	59.797.916	72.842.059	60.812.049	32.306.374	26.455.642	13.119.361	4.388.134	4.974.467
NET SURPLUS/DEFICIT FOR PERIOD	-62.908.794	-51.737.588	-73.912.651	-43.915.415	-41.605.961	-51.783.653	-50.851.895	-32.933.126	-30.729.635
LESS:									
provision for taxation					12.808.323				
interest on share capital									
statutory reserve									
staff houses scheme costs									
share transfer/share capital transfer fund									
ADD:									
accumulated surplus/deficit brought forward	1.703.127	-61.112.352	-81.066.539	-147.053.474	-194.571.115	-134.592.186	-186.403.269	-238.957.062	-266.501.655
prior year's adjustment	93.315	31.783.401	8.231.158	-3.602.226	114.393.213	-27.430	-1.701.898	5.388.533	
ACCUMULATED SURPLUS CARRIED FORWARD	-61.112.352	-81.066.539	-146.748.032	-194.571.115	-134.592.186	-186.403.269	-238.957.062	-266.501.655	-297.231.290

KNIFE MANUFACTURING STATEMENT	1977	1978	1979	1980	1981	1982	1983	1984	1985
INCOME SALES OF KNIVES		**137.506,15**	**465.847,00**	**633.594,00**	**1.156.130,00**	**3.467.323,65**	**3.859.312,65**	**3.939.395,55**	**5.372.755,95**
cost of raw materials		85.456,55	238.211,50	198.146,15	758.657,35	1.613.613,05	1.271.252,05	870.865,70	812.546,70
direct production costs						779.100,10	970.132,10	894.976,00	1.306.712,90
total production costs		**85.456,55**	**238.211,50**	**198.146,15**	**758.657,35**	**2.392.713,15**	**2.241.384,15**	**1.765.841,70**	**2.119.260,40**
add: opening stock of work in pr.		11.700,00	30.677,00	34.770,50	29.565,00	96.567,00	136.880,35	125.388,35	48.481,10
less: closing stock of work in pr.		30.677,00	34.770,50	29.565,00	96.567,00	136.880,35	125.388,35	48.481,10	141.926,00
add: opening stock of finished goods		0,00	11.978,00	54.300,00	44.352,00	54.432,00	149.760,00	170.952,00	54.492,00
less: closing stock of finished goods		11.978,00	54.300,00	44.352,00	54.432,00	149.760,00	170.952,00	54.492,00	58.185,00
TOTAL COST OF KNIVES SOLD		**54.501,55**	**191.796,00**	**213.299,65**	**681.575,35**	**2.257.071,80**	**2.231.684,15**	**1.959.208,95**	**2.022.122,50**
GROSS SURPLUS		83.004,60	274.051,00	420.294,35	474.554,65	1.210.251,85	1.627.628,50	1.980.186,60	3.350.633,45

DIRECT PRODUCTION COSTS	1977	1978	1979	1980	1981	1982	1983	1984	1985
salaries and wages						489.650,40	499.952,25	414.119,75	574.735,70
spares, maintenance and repair						60.024,00	137.417,65	83.361,50	257.863,45
depreciation - plant and machinery						122.034,45	122.025,35	134.388,05	138.087,00
other production costs						107.391,25	210.736,85	263.106,70	336.026,75
TOTAL DIRECT PROD. COSTS		0,00	0,00	0,00	0,00	779.100,10	970.132,10	894.976,00	1.306.712,90

BUSINESS AND ADMINISTRATIVE EXP.	1977	1978	1979	1980	1981	1982	1983	1984	1985
stationaries and printing		19.658,25	8.448,00	14.998,50	29.496,10	32.395,65	35.405,40	78.347,90	72.823,25
telephone, postage and telegrams		10.562,25	17.302,00	21,60	9.395,30	18.954,65	19.762,20	13.152,60	33.270,95
general meeting expenses				1.763,70	3.483,00	9.630,00	56.073,25	16.849,00	79.249,00
assets and revaluation expenses									
bad debts			13.265,00	250,00		6.098,50		4.126,00	2.500,00
audit and accountancy fees		3.000,00	3.000,00	3.700,00	3.000,00	20.000,00	15.000,00	20.000,00	40.000,00
advertisement and sales promotion							4.940,00	1.850,00	5.764,00
security and guarding services				3.000,00			5.400,00	2.400,00	5.100,00
donations and subscriptions		995,00	3.000,00	8.082,00	3.550,00	2.887,40	22.347,75	4.140,00	16.770,00
trading licenses and fees				5.005,00	675,00		1.375,00	7.695,00	5.000,00
import duty stamps and license				271,50				14.966,00	20.486,20
car benefit tax / property tax									
insurance premium and cover notes		2.506,75	7.620,00	17.622,85	22.417,90	104.079,50	16.673,25	29.551,20	65.192,90
consultancy expenses								25.675,40	32.900,00
business promotion marketing & p.r.									
entertainments		4.824,15	6.357,00	6.685,35	11.285,05	15.000,00	20.000,00	5.000,00	27.264,05
managing committee									
TOTAL BUSINESS & ADM. EXP.		41.546,40	58.992,00	61.400,50	83.302,35	209.045,70	196.976,85	223.753,10	406.320,35

KNIFE MANUFACTURING STATEMENT	1986	1987	1988	1989	1990	1991	1992	1993	1994
INCOME SALES OF KNIVES	**9.584.073,00**	**4.984.404,00**	**17.979.873,90**	**22.863.290**	**65.889.191**	**72.288.091**	**75.409.006**	**88.802.792**	**112.300.711**
cost of raw materials	3.781.027,75	1.229.433,65	8.481.123,80	8.452.473	19.317.432	20.168.898	27.464.092	19.385.946	29.216.065
direct production costs	1.725.936,20	1.514.981,00	2.717.497,75	5.068.614	6.775.374	9.361.299	16.559.993	22.269.623	28.271.357
total production costs	**5.506.963,95**	**2.744.414,65**	**11.198.621,55**	**13.521.087**	**26.092.806**	**29.530.197**	**44.024.085**	**41.655.569**	**57.487.422**
add: opening stock of work in pr.	141.926,00	781.082,35	325.262,40	614.188	3.210.043	1.777.367	3.310.484	4.000.000	1.884.886
less: closing stock of work in pr.	781.082,35	325.262,40	614.188,05	3.210.043	1.777.367	3.310.484	4.000.000	1.884.886	6.587.211
add: opening stock of finished goods	58.185,00	1.542,40	20.689,10	630.334	3.950.663	1.440.459	220.011	1.855.904	849.811
less: closing stock of finished goods	1.542,40	20.689,10	630.334,15	4.374.748	1.440.459	220.011	1.855.904	849.811	441.580
TOTAL COST OF KNIVES SOLD	**4.924.450,20**	**3.181.087,90**	**10.300.050,85**	**7.180.818**	**30.035.686**	**29.217.528**	**41.698.676**	**44.776.776**	**53.193.328**
GROSS SURPLUS	4.659.622,80	1.803.316,10	7.679.823,05	15.682.472	35.853.505	43.070.563	33.710.330	44.026.016	59.107.383

DIRECT PRODUCTION COSTS	1986	1987	1988	1989	1990	1991	1992	1993	1994
salaries and wages	758.086,50	769.207,85	1.177.524,85	859.785	1.328.750	1.915.686	2.652.576	2.490.383	5.249.928
spares, maintenance and repair	199.457,30	122.968,60	692.037,45	708.754	572.965	1.282.652	1.984.155	1.477.532	2.932.061
depreciation - plant and machinery	138.075,00	143.221,50	158.168,55	1.722.863	1.988.505	3.509.140	9.640.130	11.179.220	15.831.128
other production costs	630.317,40	479.583,05	689.766,90	1.777.212	2.885.154	2.653.821	2.283.132	7.122.488	4.258.240
TOTAL DIRECT PROD. COSTS	1.725.936,20	1.514.981,00	2.717.497,75	5.068.614	6.775.374	9.361.299	16.559.993	22.269.623	28.271.357

BUSINESS AND ADMINISTRATIVE EXP.	1986	1987	1988	1989	1990	1991	1992	1993	1994
stationaries and printing	113.658,95	101.989,00	187.770,00	214.574	420.319	496.503	554.645	360.790	486.290
telephone, postage and telegrams	46.650,05	31.743,80	92.487,85	258.414	356.819	282.425	162.665	327.300	710.320
general meeting expenses	182.577,40	29.894,00	44.272,20	100.720	278.040	600.820	1.790.580	2.179.620	2.397.920
assets and revaluation expenses							1.100.000	200.000	300.000
bad debts	35.735,00	225.665,05	13.335,60	21.297		9.721		850	710.178
audit and accountancy fees	60.000,00	60.000,00	70.000,00	150.000	200.000	300.000	400.000	400.000	500.000
advertisement and sales promotion	30.730,00	140.725,00	390.044,80	1.477.949	458.222	269.412	385.920	785.000	1.054.750
security and guarding services	5.400,00	600,00				1.439.700	1.330.000	1.464.500	1.512.140
donations and subscriptions	39.444,85	86.823,60	63.500,00	200.435	283.373	363.407	294.341	163.600	965.392
trading licenses and fees	5.087,50	13.025,00	11.300,00	7.300	15.900	74.540	19.100	26.300	280.400
import duty stamps and license	24.178,00		260.703,10	163.722	489.574	603.049	739.514	1.027.885	1.179.929
car benefit tax / property tax				100.000	25.000		101.400	84.000	25.000
insurance premium and cover notes	274.251,05	244.653,00	180.366,10	688.679	1.479.230	2.299.292	713.705	2.531.242	2.716.898
consultancy expenses	99.025,25	148.068,60	108.200,00	50.600	161.000	6.284.876			
business promotion marketing & p.r.				452.415	1.255.211	1.084.091	300.240	232.100	525.178
entertainments	174.095,20	116.388,25	102.075,00	44.330	320.710	316.000		834.000	195.158
managing committee									
TOTAL BUSINESS & ADM. EXP.	1.090.833,25	1.199.575,30	1.524.054,65	3.930.435	5.743.398	14.423.836	7.892.110	10.617.187	13.559.553

KNIFE MANUFACTURING STATEMENT	1995	1996	1997	1998	1999	2000	2001	2002	2003
INCOME SALES OF KNIVES	**73.677.462**	**44.675.932**	**50.352.526**	**47.816.598**	**45.524.966**	**31.601.975**	**5.936.753**	**1.534.620**	**1.335.573**
cost of raw materials	31.493.038	25.923.337	3.524.609	7.994.875	5.328.228	6.434.069	2.232.192	1.143.306	260.450
direct production costs	42.559.794	41.502.369	30.840.109	29.887.052	59.123.569	55.069.575	43.496.587	33.479.523	32.432.536
total production costs	**74.052.832**	**67.425.706**	**34.364.718**	**37.881.927**	**64.451.797**	**61.503.644**	**45.728.779**	**34.622.829**	**32.692.986**
add: opening stock of work in pr.	6.587.211	1.097.868	12.021.563	0	0	4.160.380	1.726.032	402.150	0
less: closing stock of work in pr.	1.097.868	12.021.563	0	0	4.160.380	1.726.032	402.150	0	0
add: opening stock of finished goods	441.580	2.640.405	13.142.570	1.179.845	4.615.971	593.662	2.909.518	829.600	0
less: closing stock of finished goods	2.640.405	13.142.570	1.179.845	4.615.971	593.662	2.909.518	829.600	0	0
TOTAL COST OF KNIVES SOLD	**77.343.350**	**45.999.846**	**58.349.006**	**34.445.801**	**64.313.726**	**61.622.136**	**49.132.579**	**35.854.579**	**32.692.986**
GROSS SURPLUS	-3.665.888	-1.323.914	-7.996.480	13.370.797	-18.788.760	-30.020.161	-43.195.826	-34.319.959	-31.357.413

DIRECT PRODUCTION COSTS	1995	1996	1997	1998	1999	2000	2001	2002	2003
salaries and wages	5.634.277	5.081.453	5.279.685	6.010.980	8.757.006	9.749.818	6.884.380	0	0
spares, maintenance and repair	3.304.052	6.279.755	2.065.335	3.779.286	3.722.383	4.114.117	1.003.879	1.337.524	291.743
depreciation - plant and machinery	15.822.957	14.462.382	14.087.967	12.790.352	33.075.283	33.001.783	32.428.339	31.605.283	31.605.283
other production costs	17.798.508	15.678.779	9.407.122	7.306.434	13.568.897	8.203.857	3.179.989	536.716	535.510
TOTAL DIRECT PROD. COSTS	42.559.794	41.502.369	30.840.109	29.887.052	59.123.569	55.069.575	43.496.587	33.479.523	32.432.536

BUSINESS AND ADMINISTRATIVE EXP.	1995	1996	1997	1998	1999	2000	2001	2002	2003
stationaries and printing	574.030	656.636	259.530	319.200	556.174	210.058	243.500	74.077	75.473
telephone, postage and telegrams	486.636	350.327	321.702	806.572	1.025.564	1.507.997	218.147	247.050	517.950
general meeting expenses	2.318.699	1.156.200	602.600						
assets and revaluation expenses	65.000								
bad debts						200.000			
audit and accountancy fees	500.000	550.000	600.000	600.000	700.000	500.000	500.000	150.000	150.000
advertisement and sales promotion	90.400	88.277	33.200	262.261		100.000	175.009	31.233	73.000
security and guarding services	2.386.620	2.557.880	1.700.910	783.670	850.820	684.430	713.750	632.300	631.100
donations and subscriptions	535.700	650.000	845.120	358.000	242.300	238.150		25.000	23.300
trading licenses and fees	198.313	18.000	50.000	34.000	74.800	193.000	95.000	10.000	100.000
import duty stamps and license	956.550	514.816	1.030.827	498.758					
car benefit tax / property tax	25.000	500.000			685.867	120.000	162.000		
insurance premium and cover notes	1.980.606	151.945							
consultancy expenses		1.920.800	1.899.750	1.139.650	287.000	1.330.000	693.000	600.000	10.000
business promotion marketing & p.r.	1.281.600	819.000	32.000	228.585	196.100				282.500
entertainments	1.012.000	468.000	82.200						
managing committee				769.600	1.798.310	314.800	57.300	77.140	243.825
TOTAL BUSINESS & ADM. EXP.	12.411.154	10.401.881	7.457.839	5.800.296	6.416.935	5.398.435	2.857.706	1.846.800	2.107.148

PERSONNEL EXPENSES	1977	1978	1979	1980	1981	1982	1983	1984	1985
salaries and wages		254.949,10	301.006,00	363.596,05	394.169,95	301.612,00	396.799,70	419.059,80	393.402,50
overtime			9.110,00	4.502,00	3.573,30		893,00	1.036,75	2.935,40
leave pay				588,00		32.421,40	12.103,20	27.928,60	58.538,00
payroll levy									
training, education and factory visits		7.157,25	9.217,00	2.690,00	5.690,00	43.449,45	60.243,80	46.081,10	75.900,00
condolance and funeral expenses				6.612,70	6.300,00	2.000,00	11.500,00	11.708,00	22.403,00
travelling allowance						19.382,55	36.016,25		
workers building expenses									
house rent allowance							18.061,35	14.860,90	39.700,25
workers uniforms									
pension and retirement contribution							5.000,00	45.666,50	117.285,00
medical expences				4.210,15	1.780,45	16.051,15	21.106,40	15.024,30	2.209,35
meal allowance									
TOTAL PERSONNEL EXPENSES	0,00	262.106,35	319.333,00	382.198,90	411.513,70	414.916,55	561.723,70	581.365,95	712.373,50

BANK / FINANCE EXPENSES	1977	1978	1979	1980	1981	1982	1983	1984	1985
bank charges		281,20		12.276,00	27.261,35	17.615,35	11.790,85	6.366,05	1.695,10
general interest payments		2.128,70	39.250,00	18.840,00	18.840,00			14.239,75	
interest on loan THB						22.491,70	22.365,50	16.226,60	16.728,15
interest on loan Hivos						21.614,00	21.974,00	8.000,00	
interest on CRDB materials loan									
TOTAL BANK / FINANCE EXPENSES	0,00	2.409,90	39.250,00	31.116,00	46.101,35	61.721,05	56.130,35	44.832,40	18.423,25

OFFICE AND GENERAL EXPENSES	1977	1978	1979	1980	1981	1982	1983	1984	1985
office and general expenses					2.707,10	6.322,70	122.700,25	14.543,00	114.643,30
land & office rent				5.250,00		7.634,40	5.096,90		1.093,75
depreciation of fixed assets		40.037,60	61.174,00	175.254,95	149.791,65	88.071,80	97.363,10	452.076,80	83.657,30
office building repairs				1.228,00					62.428,85
office cleaning and general sanitation									
electricity distribution and repairs				8.480,00	3.916,30				20.205,00
maintenance of office equipment						1.010,00	15.787,05	6.226,00	6.850,00
water charges / and electricity		55.969,05	54.251,00	97.367,75	99.564,65				7.071,35
TOTAL O&G EXPENSES	0,00	96.006,65	115.425,00	287.580,70	255.979,70	103.038,90	240.947,30	472.845,80	295.949,55

PROD., TRANSPORT AND OTHER EXP.	1977	1978	1979	1980	1981	1982	1983	1984	1985
fuel and oil / lubricant		40.145,80	47.736,00	53.304,45	73.964,00	88.748,75	176.587,15	169.476,95	151.717,50
scrap of fixed assets		24.381,70		193.709,80	3.001,95			16.875,00	
spare parts maintenance and repair		74.587,05	58.182,00	36.120,60	94.604,65	70.152,25	85.094,00	169.914,00	216.034,40
transport expenses		10.268,25	12.641,00	49.469,25	46.610,40	48.768,00	191.961,80	56.694,50	99.406,00
other expenses*		26.088,00	24.423,00	39.628,40	169.308,05	21.153,15	764,00	122.219,50	1.992,00
TOTAL PROD. TRANSP. & OTHER		175.470,80	142.982,00	372.232,50	387.489,05	228.822,15	454.406,95	535.179,95	469.149,90

PERSONNEL EXPENSES	1986	1987	1988	1989	1990	1991	1992	1993	1994
salaries and wages	519.188,90	453.033,35	663.753,00	718.761	1.898.895	1.945.143	2.867.332	4.069.010	4.991.860
overtime	13.702,35	18.586,10	41.293,85	66.711	208.386	180.347	286.710	290.189	
leave pay	87.271,00	166.265,05	157.511,00	256.327	572.598	779.285	1.132.510	90.124	3.076.884
payroll levy				66.848	139.633	172.400	214.627	277.836	624.741
training, education and factory visits	86.107,00	169.220,00	179.818,30	614.882	532.709	965.489	738.405	1.029.481	125.000
condolance and funeral expenses	6.785,00	14.125,75	147.287,20	78.702	303.691	410.957	335.343	1.044.101	340.480
travelling allowance				278.068	891.590	678.817	699.736	567.433	602.000
workers building expenses		55.019,80		150.517		371.756	350.000	1.705.092	1.580.000
house rent allowance	76.517,80	57.399,85	187.455,25	187.704	328.189	474.539	1.058.640	974.459	4.074.673
workers uniforms	63.150,00	14.890,00	241.055,00	5.980	197.960	335.696	374.600	50.000	
pension and retirement contribution	73.146,00	80.050,00	70.050,00	70.050	95.350	120.000	447.889	299.626	150.000
medical expences	57.948,50	54.953,50	117.552,00	161.039	239.239	662.238	868.539	662.217	1.935.559
meal allowance								973.953	2.036.724
TOTAL PERSONNEL EXPENSES	983.816,55	1.083.543,40	1.805.775,60	2.655.589	5.408.240	7.096.667	9.374.331	12.033.521	19.537.921

BANK / FINANCE EXPENSES	1986	1987	1988	1989	1990	1991	1992	1993	1994
bank charges	2.516,35	5.541,75	78.524,50	205.180	56.437	2.088	25.956	299.853	858.395
general interest payments		165.150,05	1.120.529,10	4.149.624	2.516.098				
interest on loan THB	13.098,90		68.290,60	431.055	830.704	3.048.378	8.373.786	3.881.587	3.776.500
interest on loan Hivos			302.358,05	1.353.550	1.319.109	4.596.144	3.688.860	5.339.695	
interest on CRDB materials loan				3.464.561	4.188.897	4.285.571	5.456.021	1.694.263	9.020.400
TOTAL BANK / FINANCE EXPENSES	15.615,25	170.691,80	1.569.702,25	9.603.970	8.911.245	11.932.181	17.544.623	11.215.398	13.655.295

OFFICE AND GENERAL EXPENSES	1986	1987	1988	1989	1990	1991	1992	1993	1994
office and general expenses	106.517,60	94.032,45	258.603,20	377.103	278.330	434.248	51.826	1.071.449	1.052.910
land & office rent		2.493,75	1.093,75		1.740	53.545	5.285	29.821	8.860
depreciation of fixed assets	130.193,20	150.062,60	237.618,70	2.343.135	3.185.423	3.136.128	2.244.400	2.750.380	2.735.681
office building repairs	140.743,60	21.340,00	78.600,20	57.012	386.531	212.871	1.810.965	81.336	1.287.630
office cleaning and general sanitation			182.201,25			54.200	277.540	1.340.900	2.725.590
electricity distribution and repairs	81.004,25	58.912,50		14.000	65.161	52.890		196.560	30.111
maintenance of office equipment	108.081,80		65.287,00	131.607	284.971	124.900	76.700	255.000	339.000
water charges / and electricity	5.809,90	2.966,30	17.072,90		6.185	7.986	18.384	931.772	538.065
TOTAL O&G EXPENSES	572.350,35	329.807,60	840.477,00	2.922.857	4.208.341	4.076.768	4.485.100	6.657.218	8.717.847

PROD., TRANSPORT AND OTHER EXP.	1986	1987	1988	1989	1990	1991	1992	1993	1994
fuel and oil / lubricant	246.249,45	592.127,90	752.280,70	991.524	2.021.781	3.432.324	3.627.880	2.621.894	1.648.789
scrap of fixed assets									
spare parts maintenance and repair	525.270,05	751.791,85	783.169,20	456.219	1.372.249	3.510.277	4.400.024	2.294.700	1.309.403
transport expenses	190.808,95	277.765,00	569.797,00	244.218	1.094.970	1.204.499	816.245	2.947.450	4.519.041
other expenses*	79.039,40	59.700,15		12.340	1.387.710		790.000	850.000	5.712.768
TOTAL PROD. TRANSP. & OTHER	1.041.367,85	1.681.384,90	2.105.246,90	1.704.301	5.876.710	8.147.100	9.634.149	8.714.044	13.190.001

PERSONNEL EXPENSES	1995	1996	1997	1998	1999	2000	2001	2002	2003
salaries and wages	5.388.715	6.637.709	4.636.740	6.184.069	7.777.290	7.213.844	5.297.168		
overtime									
leave pay	1.905.360	341.460	903.660	364.112	82.600		510.170		
payroll levy	632.920	105.378	550.588	562.815	759.596	724.276	538.399		
training, education and factory visits	80.000		214.160	1.000	100.000	165.000	3.000	41.500	9.500
condolance and funeral expenses	322.750	1.034.650	749.875	432.000	503.239	100.000	695.300	50.000	20.000
travelling allowance	482.000	151.000	190.000		691.585	997.807	952.890		
workers building expenses									
house rent allowance	3.773.815	2.232.352	1.682.575	1.354.725	1.815.006	1.676.496	961.639		
workers uniforms	338.000								
pension and retirement contribution	240.000	220.000	1.231.398		120.000	50.000			79.733
medical expences	1.667.033	974.627	403.879	294.270	1.611.040	496.620	358.750	114.650	179.240
meal allowance	1.847.535	605.744							
TOTAL PERSONNEL EXPENSES	16.678.128	12.302.920	10.562.875	9.192.991	13.460.356	11.424.043	9.317.316	206.150	288.473

BANK / FINANCE EXPENSES	1995	1996	1997	1998	1999	2000	2001	2002	2003
bank charges	91.469	149.586	144.482	169.442	139.100	143.700	82.200	672.676	202.200
general interest payments									
interest on loan THB	14.837.124	11.611.762	16.522.913	8.261.455					
interest on loan Hivos									
interest on CRDB materials loan	4.629.254	9.128.645	29.352.155	29.352.155					
TOTAL BANK / FINANCE EXPENSES	19.557.847	20.889.993	46.019.550	37.783.052	139.100	143.700	82.200	672.676	202.200

OFFICE AND GENERAL EXPENSES	1995	1996	1997	1998	1999	2000	2001	2002	2003
office and general expenses	361.350	391.535	261.985						
land & office rent	105.350	9.390	345.000	18.000	2.386.280	2.677.290			
depreciation of fixed assets	2.081.809	2.171.656	1.235.789	1.345.094	1.267.224	515.724	515.724	515.724	515.724
office building repairs	8.200	159.300	14.000	15.934	1.591.099	10.900	70.200	21.000	226.900
office cleaning and general sanitation	4.472.510	5.238.605	1.583.922	685.500	65.065	139.500	5.000	50.000	
electricity distribution and repairs	2.630	2.210	729	68.000	294.812	37.027	45.500	27.519	18.967
maintenance of office equipment	288.000	457.000	350.000	410.000	240.000	240.000			
water charges / and electricity	410.333	554.703	27.030	340.669	627.085	505.695			
TOTAL O&G EXPENSES	7.730.182	8.984.399	3.818.455	2.883.197	6.471.565	4.126.136	636.424	614.243	761.591

PROD., TRANSPORT AND OTHER EXP.	1995	1996	1997	1998	1999	2000	2001	2002	2003
fuel and oil / lubricant	1.825.075	1.451.743	663.010	436.950				12.000	
scrap of fixed assets									
spare parts maintenance and repair	2.426.185	1.375.500	255.000	190.833					
transport expenses	6.876.060	4.391.480	4.065.330	3.831.926	5.396.097	5.187.400	46.500	902.500	1.396.650
other expenses*				692.804	422.321	175.928	179.215	133.765	218.405
TOTAL PROD. TRANSP. & OTHER	11.127.320	7.218.723	4.983.340	5.152.513	5.818.418	5.363.328	225.715	1.048.265	1.615.055

Appendix H. List of Theses in Technology and Development Studies

M.Sc. Theses in Technology and Development Studies: 1996

96.1 Myriam Derks: Análisis e identificación de la problemática en el proceso de la ejecución de vivienda de interés social en Costa Rica.

96.2 Jan Willem Dijk: An appropriate Marketing Management Method that supports the Building Material Industrialization in Tanzania.

96.3 Annemarie van Iwaarden: The quality of locally produced wood-based panels in the relation to market demand in Tanzania: an explorative survey of customer satisfaction regarding the quality of wood-based panels for the Tanzanian construction sector.

96.4 Ivo Jongsma: Small scale cement production in Tanzania.

96.5 Saskia Rijkenberg: Adaptations to a cost control system: cost control as a tool to achieve productivity improvement on building sites of Skanska Jensen Int. in Tanzania.

96.6 Marten Treffers: The Informal Building Process in Dar es Salaam, Tanzania. A Contribution to the Upgrading of the Informal Construction Sector and to the Formulation of a Management Plan for Hazard Lands.

96.7 Arjen Veltman: Pre-feasibility study on the Establishment of a Furniture Factory. An assignment of FUNBAMBU San José, Costa Rica.

96.8 Anita van Dalen: Analysis of the provision of economic infrastructure related to industrialization, in large regional towns in Tanzania.

96.9 Raymond Duijsens: Metal Industry and Technical Education in Tanzania: model for matching demand and supply of knowledge and skills.

96.10 Donné van Engelen: Public policy making and the rise and fall of the Tanzanian manufacturing sector.

96.11 Wessel Schulte: Technology and quality of care in Muhimbili Medical Centre, Tanzania. Methodology to study the role of technology from the viewpoint of total quality. Factors marring total quality and possible management actions.

96.12 Gijs van Haastrecht: Training Courses for Logistic Improvement.

96.13 David Gonsalves: Energy conservation opportunities at Tanzania Bottlers Ltd. The position of the soft drinks industry in the Tanzanian industry: an exploration.

96.14 Yvonne van der Ven: Privatization at Tanzania Harbours Authority (THA). Case study: THA's grain terminal.

96.15 Hans Puttenstein: Quality of the telephone service of the Tanzania Telecommunications Company Limited TTCL).

96.16 Wim van Rooy: The dynamics of Kilombero Sugar Company (Tanzania) 1962-1992: an analysis of technology changes.

96.17 Pascal Hop: Information management aspects of ATS route planning, now and in the future: a case study in civil aviation in Tanzania.

96.18 Thom van der Veer: Productivity of a Tanzanian Battery Factory. The case of Matsushita Electric.

96.19 Fred van der Westerlaken: Feasibility study for a production facility for pipe fittings in Tanzania.

96.20 Jeroen Heggelman: Energy management system. Tanzania.

96.21 Annelies Balkema: Industrial Waste Water Treatment in Dar es Salaam, the Vingunguti Waste Stabilization Ponds.

96.22 Joost Raaphorst: The introduction of an environmental information system in Tanzania.

96.23 David van Horen: The eutrophication of Lake Victoria, East Africa.

96.24 Bart van Campen: Diffusion of solar water heating technology in Tanzania.

96.25 Jeroen van der Linden: A comparison of energy sources for the economically viable decentralized generation of electricity in rural areas.

96.26 Harro Zanting: A Systematic Assessment of Water Pollution in Lake Victoria.

96.27 Michel Gebbinck: Assessment of a sustainable process for the TOOLnet Access Point (an email service provider) in Peru.

96.28 Pieter Dijke: Future possibilities for Mini Hydro Power in Tanzania.

96.29 Hanneke van de Ven: Assessment of the sustainability of the small-scale brick-burning industry in Tanzania, with special attention to biomass energy use: an explorative study.

96.30 Jeroen Gelinck: A case study on the possibilities and constraints of GIS for urban planning and management in Dar es Salaam.

96.31 Erwin Mikkers: The use of photovoltaic technology in Benin: the problems with PV-systems and energy alternatives in a rural village.

96.32 Bianca de Wit: Possibilities for exploiting wind energy Identification of regions with potential markets for windpumps and/or wind turbines. Tanzania

M.Sc. Theses in Technology and Development Studies: 1997

97.1 John van Rijn; The implementation of building Techniques in Gedaref. The search for appropriate designs and building techniques for primary schools and health centres and their implementation in Gedaref (Sudan).

97.2 Marie Odile Zanders; An assessment of Domestic Waste Water Pollution for the Lake Victoria Region.

97.3 Marcel Cloo and Pjotr Ekelmans; The role of MIC Tanzania Ltd in the development of the Tanzanian telecommunication sector. Tanzania in search of an appropriate telecommunication technology.

97.4 Geert Bergman; Measuring Industrial Efficiency in Developing Countries. Theory and a case study: bottling of Coca-Cola in Dar es Salaam, Tanzania.

Geert Bergman en Marcel Alkemade; Ondernemen in Tanzania vruchteloos?. Een indicatie van de haalbaarheid van een vruchtensapfabriek, geschreven in het kader van de prijsvraag "Ondernemingsplan voor Afrika".

97.5 Francine Jansen; Analysis of the housing situation in Minsk (Belarus).

97.6 Bartelt Bongenaar; Part 1) Evaluation of the role of the Tanzania Industrial Research and Development Organisation; Part 2) The satellite receiver design.

97.7 Mark Pantus; Implementation of a total quality assurance system in electronics. A study of total quality in a Philippine electronics company.

97.8 Jan Buis; Productivity measurement in the Costa Rican low-income housing projects. The search for an adequate methodology.

97.9 Casper Esmeijer; Production and application of lime in Tanzania; with special reference to the construction sector.'

97.10 Warner Werkhoven; Mapping the effects and impacts of refugees sites. The case of the 1994-1996 influx in the Kagera region, Tanzania.

97.11 Otto Bos; Energy Conservation in Tanzanian Industry. Manual Energy Conservation for Tanzanian Metal Industry.

97.12 Bas Sturkenboom: Analysis Aeronautical Navigation Service Organisation in Tanzania. Technology audit Aeronautical Fixed Service provision via low-speed Aeronautical Fixed Telecommunication Network.

97.13 Gertrude Zijl and Robbert Lassche: Testing a Technology Audit Methodology. A rapid assessment of six small and medium scale enterprises in Tanzania.

97.14 Jurgen Busink and Sander Wilson: Testing a Technology Audit Methodology. A rapid assessment of eleven enterprises in Costa Rica.

97.15 Rick van der Kamp: Technology and Human Resources in the Indonesian Textile Industry - The role of technological progress, education and Human Resource Development in economic performance.

97.16 Menno Prins: Manufacturing Statistics. Reconstructing Tanzanian Manufacturing Value Added 1965-1995.

97.17 Hans de Klerk: Telecommunication Network Planning in Developing Regions. The Technological Possibilities Applied to North-Kivu (Zaïre).

97.18 Wendy Schellens-Haans: Attitudes and behavioural change with respect to the environment. Design and implementation of a training course for secondary schools in the Republic of Belarus.

97.19 Jeroen Thielemans: Estudio Comparativo de Impacto Ecológico en Estructuras "Bloques de Concreto vs. Paneles con Bambú". Un enfoque de Análisis de Ciclo de Vida.

M.Sc. Theses in Technology and Development Studies: 1998

98.01 Arwin Hoekstra: ADOBE WASI: Difusión y Transferencia de la Tecnología Constructiva Mejorada. Un Estudio de los Problemas y Opertunidades en los Asentamientos Urbano Marginales de la Ciudad del Cusco, Perú.

98.02 Suzanne Jacobs: Changing Commuter Traffic of Car Owners from San Ramon.

98.03 Marcel Radstake: The Search for an Adequate Strategy for the Development of Telecommunication in North Kivu (Zaire). Based on Experiences of the East Asian Newly Industrialised Countries (NICs).

98.04 Pascal Schreur: Analysis of the construction process of low-income housing in Costa Rica. A search for opportunities to improve the performance of the construction process and the applicability of technology-based research methodology.

98.05 Jeroen van den Brink: Scrap and Scrap Recycling in the Tanzanian Industry.

98.06 Mohini Keunen: Present and future electricity generation: possibilities and restraints of large and small scale hydro power plants, case of the State of Kerala, India.

98.07 Elma Kloosterman: The commuter traffic of Grecia, Costa Rica: Towards a more sustainable commuter traffic system programma de investigacón en Dessarollo Urbano Sostenible.

98.08 Mischa Kok: The development of an instrument to evaluate the sustainability of urban development projects.

98.09 Bert van der Plas: Energy efficiency improvement in the brown sugar industry of Costa Rica. A case study of energy conservation opportunities in small brown sugar mills in Bajo la Paz.

98.10 Jan Cloin: PV on Thatch. A search for opportunities of sustainable implementation of PV in Manicaland, Zimbabwe.

98.11 Frans Hermans: Waste load assessment of wastewater sources in and around Bais City, the Philipines.

98.12 Sander Knirim: Pre-feasibility study on bamboo matboard production in Tanzania.

98.13 Corné Spreij: Prerequisites for automation processes in developing countries.

98.14 Esther de Vreede: Transfer of Manual Pit Emptying Technology (MAPET) in Southern Africa to unplanned urban areas.

98.15 Michel Krott: Computerized automation of the metal industry of Costa Rica and its effects on employment and eduction.

M.Sc. Theses in Technology and Development Studies: 1999

99.01 Daan Kers: Industrialisation and electrcity supply: Mbagala, Tanzania as a case.

99.02 Barbara Simaeys: Electrificacion de baja escala en el bosque nublado del Ecuador: La elaboración de dos casos en la provincia del Carchi.

99.03 Ame Kraus: Housing finance in Tanzania, a survey on the demand of the low-income households for a more applicable housing finance system and how it can facilitate the introduction of new bamboo construction technologies.

99.04 Renilde Becque: The sustainability of ferrocement stairs (production) in a social housing project in Nova Friburgo, Brazil, aimed at lower-income groups.

99.05 Bas Lebbing: Energy use in small-scale brick making industries in Northeast Thailand.

99.06 Maike van Rooy: Optimisation of purchasing process for state oil company Suriname in Saramacca.

99.07 Dennis van Hunen: Technologies for municipal solid waste management in Masaya Nicaragua. A study on compost systems.

99.08 Ronald Warmerdam:Opportunities for improving solid waste management in Kanpur, India. The increase of private sector involvement.

99.09 Arjan van Bergeijk: An appropriate school for Tanzania. Evaluation of the involvement of PLAN International Tanzania in school constructions in Dar es Salaam, Coastal region, Morogor region and Mwanza municipality.

99.10 Joris van Iersel: Assessment of an appropriate drying technology for the drying of coffee by small rural producers in the south of Lempira, Honduras.

99.11 Felix Tillie: Terms of Reference for a Training Programme for Roof Tilers in Urban Tanzania.

99.12 Nathalie van Hoeven: Assessment of opportunities to improve the capacity of the Kejetia Public Transport Terminal in Kumasi, Ghana.

M.Sc. Theses in Technology and Development Studies: 2000

00.01 Eric Lakerveld: Information and Performance. The role of Quality Information Systems in a multinational electronics company.

00.02 Martijn Vis: Assessment of the Possibilities to Utilize Large Solar Water Heaters for Industrial and Commercial Sectors in Thailand.

00.03 Amber Beernink: Vehicle/Pedestrian Traffic Conflicts. Appropriate Construction Technology for a Pedestrian Crossing at Kejetia, Kumasi, Ghana.

00.04 Pascal Vlieghe: Lake Pollution and Vulnerability of Fishing Communities. Mwanza Gulf of Lake Victoria, Tanzania.

00.05 Bart Frederiks: Assessment of Sustainable Means of Private Electricity Production. A case study at Katani Ltd., Tanzania.

00.06 Rolf Verlaan: Identification of the Opportunities for Sustainable Production of Energy from Biomass Residues in Swaziland.

00.07 Anne van Hoof: Maintenance and Utilisation of physical capacity at Ghana Textile Printing Co. Ltd.

00.08 Rob van der Werff: The Value of Technical Education. A Cost/Benefit Analysis of Technical education and other Subjects of Education in Tanzania.

00.09 John Brenters: Design and financial assessment of small scale sisal decortication technology in Tanzania.

M.Sc. Theses in Technology and Development Studies: 2001

01.01 Piet Hein Breeuwsma: The Demand-led Approach to Vocational Skill Training: The Cosdec Programme Namibia.

01.02 Eduard J. Boonstra: Establishment of a Calcium-silicate unit Industry in Indonesia.

01.03 Arjan van Dal: Assessment of a more Sustainable Sanitation Technology System for a Harijan Community in India.

01.04 Benoit Chamuleau: Energy Efficient Low Cost Housing in South Africa.

01.05 Arnoud van Bemmelen: Energy Conservation Opportunities in Hotels in Costa Rica.

01.06 Herwich Hobbelen: Assessment of Domestic Liquid Waste Runoff, Dar es Salaam, Tanzania.

01.07 Sander Gelsing: Solar Home Systems in the Caprivi. Evaluation of the Technology Choice and the Implementation of Small-scale Electricity Technologies in rural Namibia.

01.08 Ilse Oosterlaken: Industry Study: Thai Building Material Industry (1960 - 2000) - "Opportunities for SMEs Producing Building Materials: Case of Northeast Thailand.

01.09 Joost Ossevoort: Systematic Assessment of Water Pollution in Ebrié Lagoon, Ivory Coast. Modelling eutrophication, followed by an inquiry into the causes and impacts of this phenomenon.

01.10 Jeroen Steman: Pre-feasibility Study on Centrifugal Pump Manufacturing in Zambia. An identification of feasible production technologies.

01.11 Krista Jansen: Future Supply and Demand for Petroleum Products in Indonesia; Challenges and Options for the Refining Sector.

01.12 Marieke de Ruijter de Wildt: The Searching Enterprise. Information Usage of Small Enterprises and Business Development Services.El Salvador.

M.Sc. Theses in Technology and Development Studies: 2002

02.01 Jeannette Klein: Water Pollution in the Accra-Tema Metropolitan Area. Sources and Impacts. Ghana.

02.02 Shila de Vries: Bamboo Construction Technology for Housing in Bangladesh. Opportunities and constraints of applying Latin American bamboo construction technologies for housing in selected rural villages of the Chittagong Hill Tracts, Bangladesh.

02.03 An Nguyen: The Introduction of Digital Terrestrial Television in Vietnam. An opportunity study.

02.04 Martijn Jonker: Building Technological Capabilities to Improve Performance. A case study of the paper industry in West Java, Indonesia.

02.05 Jeroen Nuijten: Sustaining the Basic Research Program of the International School of Photonics. Cochin, Kerala. India.

02.06 Brecht Mommen: Changes in the Basic Needs Situation due to Hydro-projects in Nepal. A case study of Kali Gandaki project.

02.07 Roy Vink: Assessment of Impacts of Hydro-project Balsa Superior on Economic Activities in the Canton San Ramón de Alajuela, Costa Rica.

02.08 Svend Minderhoud: Technological Performance in Indonesian Paper Industry. A case study.

02.09 Mirjam Pronk: Sustainable Building Systems for Low-cost Housing in Guayaquil, Ecuador.

02.10 Thijs Gilde: "Save Water"- An assessment of the major causes of non-revenue water in the drinking water distribution system of SEMAPA in Cochabamba, Bolivia.

02.11 Mark van Stiphout: What are the costs of wetland pollution? Integrating the environmental effect chain and the total economic value for a coastal wetland in Ghana.

02.12 Rick Boellaard: Op weg naar ontwikkeling.CFAR-Kasangulu, Zaïre.

02.13 Petra Hofman: The effects of the Formalization of Urban Informal Property on the Quality of low-Income Housing in Lima, Perú. Problems and Solutions.

02.14 Issmaïl Nnafie: Internet cafés in Dar es Salaam: Problems and Opportunities. Recommendations for e Think Tank Tanzania.

02.15 Loek Daemen: The Socio-Economic Effects of Road Maintenance in Iringa Rural and Mufindi Districts, Tanzania. An explorative case study into the input-functions for the calculation of maintainable core-networks.

02.16 Christian Rademaker: Anti-Seismic Information Transfer. Assessment of a more appropiate information transfer method for implementing anti-seismic construction solutions in El Salvador.

M.Sc. Theses in Technology and Development Studies: 2003

03.01 Maartje van Dalen: Role and Performance of the Indonesian Construction Sector.

03.02 Wouter Zegwaard: Distance Learning Solutions to Bottlenecks in Indonesian Education.

03.03 Dennis Bours: The dissemination of amorphous solar PV panels for rural households in the Manaus region, Amazonas, Brasil.

03.04 Henri Heine: Cleaner Production in Industry: Measurement of the total energy saving potential and cost saving potential of small and medium enterprises in the plastic industry in Santiago, Chile.

03.05 Ursula Kirchholtes: The important Crops of Andalusia in relation to Super Absorbent Polymers. Spain.

03.06 Carin Bouwman: Wrestling with Development: "Arriving where we started?" A structured overview and analysis of 177 TDS MSc research projects in developing countries: their characteristics, goals and development relevance.

03.07 Ellen Geurts: South African development plans and the performance of South African construction industry: Constraints of small emerging contractors in the city of Tshwane.

03.08 Bram Saeijs: Science Parks in South Africa: Characteristics and Analysis of Success Factors. A preliminary method for potential success ranking of science parks.

03.09 Saskia Dalman: Measurement of sustainability of primary schools in rural areas in South Africa. Development of a tool to measure the sustainability of the Thulani Primary school, Limpopo Provine, South Africa.

03.10 Bernadette Huizinga: A roof over your head. A Quatitative Housing Need Assessment for Tanzania.

03.11 Marloes Kerklaan: Possibilities for development co-operation between developing countries and the Eindhoven University of Technology. An instrument for project appraisal and an analysis of development co-operation projects.

03.12 Mark Vlok: Flood Risk Reduction Strategies: Recommendations for flood risk reduction in the Limoncito watershed in Puerto Limón, Costa Rica.

03.13 Jimmy Murli: Diffusion of Technology from University to Manufacturing Firms in Kerala, India.

03.14 Tijs den Uijl: Values of Cultural Heritage: Identification of a Cultural Heritage Building Rehabilitation Methodology applied in the Case of the Convent Santa Catalina of Collpaciaco, Bolivia.

M. Sc. Theses In Technology and Development Studies: 2004

04.01 Saskia Ruijsink: Urban upgrading needs in an informal settlement in Dar es Salaam, Tanzania. An analysis based upon the interaction between urban space and the people's livelihood strategy, the case of Keko Magurumbasi A.

04.02 Moniek Vulink: Technology Transfer in the Construction industry of Ghana. Human resource development through international collaboration between foreign and local contractors in the Greater Accra region.

04.03 Jaap Bosch: Improvement Possibilities for refugee Shelters; a case study in Mtendeli Refugee Camp, Northwest Tanzania.

04.04 Maarten van Oosterhout: Adoption and Diffusion of Natural Gas in the Small-scale Rural Industry of Bolivia. The cases of the Stucco Sector and the Chicha Sector in Cochabamba.

04.05 Marieke Pluk: Economic growth and the environment in developing countries. The case of cement consumption and related carbon dioxide emissions in the construction industry in Chile.

04.06 Anja Kuijsters: Environmental response of the Chilean building Sector. Efforts and constraints towards environmental building practices in the Santiago Metropolitan Region.

04.07 Tom Siebeling: A Novel Approach to Innovation Processes in Community Driven Projects: How an extended Learning Selection model explains the success of SEIDET, an educational community development project in rural South Africa.

04.08 Matsen Jorritsma/Koen van Noorden: Sustainable implementation of wind pump projects in TASAF supported villages. Preconditions and major policy guidelines for Tanzania Social Action Fund.

04.09 Rudy Honings: The Improvement of Wheelchair Provision for People with a disability in Northern Thailand. A study on constraints in assistive technology services.

04.10 Jessica Curta: Renovation in developing countries. The development of a decision support tool to stimulate renovation. A case study to characteristics, constraints and solutions to renovation projects in Paramaribo. Surinam.

04.11 Marloes Reinink: Sustainable School Design Tool. Integrating sustainability into the design and design process of primary and secondary schools in poverty-stricken areas of South Africa.

04.12 Jouke Boorsma: Analysis and Improvement of (Domestic) Liquid Waste Systems and their Impacts in the Region of Bais City, Philippines.

04.13 Wouter Houët: Facilitation of Social Housing Delivery in Urban South Africa. Investigation into the role and power of local government regarding the formulation and implementation of social housing policies in case studies Tshwane and Ekurhuleni.

04.14 Pieter Habets: Social Rental Housing in Costa Rica. The possibilities and constraints for the adoption and implementation of social rental housing for low-to-middle income groups, within the institutional framework of Costa Rica.

M. Sc. Theses In Technology and Development Studies: 2005

05.01 Mara Wijnker: Design of a methodology to determine ex-ante the sustainability of rural electricity systems. Based on a case study in Oruro, Bolivia.

05.02 Michèle Koper: Decentral, Renewable Energy System in Rural Bolivia. Evaluation of case studies and a framework for effective project design.

05.03 Irene Vloerbergh: Implementation & Diffusion of a Foreign Innovative Technology in the Residential Construction Industry. Case study on the diffusion of the HBB-system (Heysterum Bouw & Beheer) in the large scale low-income housing sector on Java, Indonesia.

05.04 Jeroen Matthijs: Access to spatial geographic information on mountainous areas. Building Spatial Data Infrastructure in Tanzania.

05.06 Diane van Herpen: Onbenut potentieel aan vastgoed in Paramaribo – Suriname. Exploratief onderzoek naar onbenut potentieel aan vastgoed in Paramaribo in bezit van in Nederland wonende eigenaren en ideeontwikkeling voor de inzet daarvan ten behoeve van woningbouw en stadsherstel.

05.07 Saskia Benda: Capacity Building in the Tanzanian Construction Industry. Identifying conditions for foreign-domestic collaborations to lead to technology transfer.

05.08 Herjan Siegers: Designing an Appropiate Drinking Water Facility: Iris, an island in the Nile, Sudan.

05.09 Joris de Groot: Technological trajectories and diffusion of photovoltaic technology. South Africa.

M. Sc. Theses In Technology and Development Studies: 2006

06.01 Rik Luiten: Power Supply Performance: Tanzanian Manufacturing Sector Aim.

06.02 Janske van Eijck: Transition towards Jatropha Biofuels in Tanzania? An Analysis with Strategic Niche Management.

06.03 Arend Driest: The role of entrepreneurs in the innovation process in Ghana's timber exporting sector.

06.04 Martine Teeselink: The Vietnamese Software Industry: Export Success or Domestic Strenght?

06.05 Jeanet Eggengoor: Exploring the feasibility of minimizing the waste product. Fly ash from the Indonesian Textile Industry by co-processing in the Indonesian Cement Industry.

M. Sc. Theses In Technology and Development Studies: 2007

07.01 Hans van Dijkhuizen: Overcoming bottlenecks with implementation of new technologies. African aviation system.

07.02 Ina de Visser: Design and implementation of biomass energy systems in rural India.

If you would like to receive a copy of one of the above indicated M.Sc. theses, please contact:

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