ACQUISITION of CAPABILITIES through INTERNATIONAL TECHNOLOGY TRANSFER

The Case of Small Scale Industrialization in Tanzania

SVERKER ALÄNGE

Chalmers University of Technology, Sweden

ACQUISITION OF CAPABILITIES THROUGH INTERNATIONAL TECHNOLOGY TRANSFER. The Case of Small Scale Industrialization in Tanzania.

ISBN 91-7032-281-3

Published and distributed by Department of Industrial Management, Chalmers University of Technology, S-412 96 Göteborg, Sweden

Printed in Sweden
Goterna - Göteborg
1987

ACQUISITION OF CAPABILITIES THROUGH INTERNATIONAL TECHNOLOGY TRANSFER

The Case of Small Scale Industrialization in Tanzania

Sverker Alänge
Department of Industrial Management
Chalmers University of Technology
Göteborg, Sweden, 1987

ISBN 91-7032-281-3

ABSTRACT

The focus of this thesis is on the acquisition of static and dynamic capabilities in LDC industry. This has been studied in small scale industries in Tanzania, which were started through international technology transfer, in which small producing firms from Sweden acted as technology suppliers (The Sister Industry Programme).

The data has been collected during an eight-year period, beginning from the start of the first projects in Tanzania in 1978. In total, interviews have been conducted in 22 Tanzanian firms and 18 Swedish firms, supplemented with interviews with authorities and consultants. An in-depth study of acquired capabilities was carried out in 1983, forming the basis for an assessment of the technology transfer programme. An analytical scheme was made for the analysis of static and dynamic technological and managerial capabilities. These include production/administrative and inventive/entrepreneurial capabilities. Furthermore, during the course of the research, a method was developed for estimating the dynamic long-term effects in terms of magnitude of the capability contribution from the international technology transfer project.

It was found that capability acquisition is a complex and long-term process, of which an international technology transfer project is only one step. Previous industrial experience is essential in order to benefit from an overseas training programme. While small scale industries were shown to be excellent in transferring production capabilities, they were less successful in the transfer of adminstrative and dynamic capabilities. This was primarily due to their inherent weakness of having a shortage of qualified personnel for training activities. However, through long-term cooperation, initially based on a contract later developing in to a business relationship, and recurrent training periods in Sweden, it has been shown that several of the small Tanzanian firms have been able to acquire substantial stocks of dynamic capability. The Swedish firm has thus supplied the Tanzanian firms with new information and knowledge, having the double function of compensating for weaknesses in the local Tanzanian network and sometimes serving as a link to an international market. Based on these findings, the present study also makes some additons to the conceptualization of the infant industry process. Lastly, recommendations are provided for improving a sister industry type of technology transfer.

KEYWORDS: Developing countries, Diffusion, Entrepreneurship, Industrial economics, Industrialization, Infant industry, Innovation, Motivation, Network, Technology transfer.

ACKNOWLEDGEMENTS

During my work on this thesis, I have been assisted by many people, both in Tanzania and in Sweden.

I would like to express my gratitude to the members of my dissertation committee at the Department of Industrial Management at Chalmers University of Technology Holger Bohlin, Ove Granstrand and Christer Karlsson, especially for their guidance and patience. Thanks also to Martin Bell, very knowledgeable in the area of LDC industrialization, who was my special advisor on research design, Jan Theman who assisted in developing the method for investigating capabilities and with whom I collaborated on a scientific report, and Per Brandström who gave me a broader understanding of Africa.

Åke Holmberg, Ilmar Roostal and Sven Söderberg were helpful in the early period of this project, and in the final stages I was assisted by Lars-Erik Gadde, a source of good advice and helpful comments, and Staffan Jacobsson, an invaluable discussion partner with profound knowledge of the field.

Of my many research colleagues, I have worked most closely with Tommy Löwbäck, who struggled together with me to formulate the research design and concepts and who helped compile data in Sweden and Tanzania. Magnus Hult and Harald Niklasson have collaborated with me in scientific reports. I am also indebted to my Tanzanian colleagues Andrew Fatukubonye, Cashmir Nyoni and especially Epaphrah Mushi who made valuable comments on the manuscript for this thesis and helped interpret compiled data. My colleagues Hans Gustafsson, Ulf Karlsson, Jon Sigurdsson, Sören Sjölander, Per Svensson and especially Janne Linder all gave me a kick now and then.

I was most impressed by Basil P. Mramba and Sten Sporre, practical minded visionaries who also helped me identify the focus of my research and come into contact with firms and Tanzanian research colleagues. SIDA officials Agneta Danielsson, Lars Ekengren, Rolf Eriksson in Sweden and Gunilla von Arbin, Monica Brodén, Alf Karlsson and Gunnar Lindgren in Tanzania were most kind, as were Mike Laiser, Japhet S. Mlagala, Charles L. Sabali, Raymond Sabuni, Epaineto B. Toroka, and the entire organization of SIDO. Olle Arefalk, Jerker Carlsson, Inga Christenssen, Carl-Gunnar Karlsson of Fide contributed to the data collection. I am, of course, also grateful to all industrialists in Sweden and Tanzania, and to Carl-Gustaf Svensson, one of the earliest initiators of the SI programme.

There is a nitty-gritty side to academic research and I especially thank Mats Alänge, who helped me during the data compilation in Tanzania and was a troubleshooter during the main study. Åke Boberg, Göran and Louise Molin, Christina and Hans Pettersson who helped me find my way around Mzumbe, Torbjörn Andersson and Bo Nilsson in Arusha, Thomas Nordin in Mafinga and Kurt Norrgård and Urban Särenfors who put me up and served as discussion partners.

The research for this thesis was financed by SAREC (main study) represented by Olle Edqvist who also provided valuable advice, MTC (motives study in Sweden), Scandinavian Institute of African Studies (inital funds) and Chalmers University of Technology (initial funds).

I have received a colossal amount of assistance from the Chalmers University Library, and am especially grateful to Inga-Lill Hult, Sickan Johansson and Per Thernqvist for their service-mindedness, suggestions and ability to find literature from all over the world, including very peripheral articles. Thanks also to Gullvi Nilsson, Sari Scheinberg, Laura Sharp-McQueen for checking my English as I wrote and to Joy Ellis for correcting the worst mistakes and editing at the last moment. This thesis was proofread in parts by Olle Alexanderson, Mats Alänge, Simona Andersson, Lennart Bångens, Karl Liander and Stefan Norrfjärd. Heli Johansson, Lotta Johansson, Ulla Martinsson and Gun Åkerman helped type the early version. Ola C. Maltesson has been helpful in many ways throughout the years and Cinna Andersson did the graphics work on the cover. Ulla Larsson has my undying gratitude for the amazing amount of work she put into typing the final manuscript with all the last-minute changes, and for cheering me up when needed.

Many thanks to one and all.

Sverker Alänge

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter Eight

Chapter Nine

ABBREVIATIONS

A capability	=	Administrative capability
A.D.	=	Assembly director
CFW	=	Common facility workshop
CTH	=	Chalmers University of Technology
DDC	=	District Development Corporation
DSM	=	Dar es Salaam
E capability	=	Entrepreneurial capability
EO	=	Export orientation
FIDE	=	Swedish firm of consultants
G.A.	=	General adviser
GNP	=	Gross national product
GT	=	General Tyre East Africa, Ltd.
I capability	=	Inventive capability
IC	=	Industrialized country
I.D.	=	Industrial installation director
ILO	=	International Labor Office
IS	=	Import substitution
ITT	=	International technology transfer
Junior sister	=	Tanzanian technology recieving company
LDC	=	Less developed country = developing country
M.D.	=	Managing director
Ma.D.	=	Marketing director
MEIDA	=	Metal Engineering Industries Development Association
MNC	=	Multinational company
Mradi	=	An activity on the side of ordinary work which brings in a little extra money
M SEK	=	Million SEK
n.a.	=	not available
n Ach	=	Need for achievement
NDC	=	National Development Corporation
NIC	=	Newly industrialized country
OECD	=	Organisation for Economic Co-operation and Development
P capability	=	Production capability
P.D.	=	production director
P.F.	=	production foreman
R&D	=	Research and development
RM	=	Raw material
SCB	=	Social cost-benefit
SEK	=	Swedish currency (krona)
Senior sister	=	Swedish technology supplying company
Shs	=	Tanzanian currency (shillings)
SI	=	Sister Industry

SIDA	=	Swedish International Development Authority (foreign-aid agency)
SIDO	=	Small Industries Development Organization
SME	=	Small and medium-sized enterprise
SWEDFUND	=	Swedish Fund for Industrial Cooperation with Developing Countries
TANU	=	Tanganyika African National Union
TISCO	=	Tanzania Industrial Studies and Consulting Organisation
UN	=	United Nations
UNCTAD	=	United Nations Conference on Trade and Development
UNDP	=	United Nations Development Programme
UNIDO	=	United Nations Industrial Development Organization
US	=	United States of America

Junior sister firms in Tanzania

AMI	=	Arusha Metal Industries
FAWIPMA	=	Fabrication and Wire Products Manufacturers
KIMESHA	=	Kilimanjaro Metal Shapers
NEM	=	Northern Electrical Manufacturers
UHANDISI	=	Uhandisi Cooperative Society (1974), Industrial Fasteners Project
MAFOTCO	=	Mawenzi Forging & Tool Company
PEMACCO	=	Pioneer Electric Machines and Consulting Company
TANLOCKS	=	Tanzania Locks and Metal Products Company

Exchange rates Source: OECD 1986

1977	100 US$	=	448 SEK	
1978	100 US$	=	452 SEK	
1979	100 US$	=	429 SEK	
1980	100 US$	=	423 SEK	
1981	100 US$	=	506 SEK	100 Shs = 71 SEK
1982	100 US$	=	628 SEK	100 Shs = 80 SEK
1983	100 US$	=	767 SEK	100 Shs = 79 SEK
1984	100 US$	=	827 SEK	100 Shs = 52 SEK

Consumer price index (Sweden) Source: OECD 1986

	Price index	Percentage changes from previous year
1977	100	
1978	110	10.0
1979	117.9	7.2
1980	134.1	13.7
1981	150.3	12.1
1982	163.2	8.6
1983	177.6	8.9
1984	192.0	8.0

Source: When otherwise not indicated the source for tables and figures is the author's own interview data.

CHAPTER ONE

INTRODUCTION

1.1 Problem background

One essential aim of most, if not all, less developed countries (LDCs) is to develop a national industrial capacity. This includes establishing a certain capacity to produce desired products, but also developing technological and managerial knowledge for the further indigenous development of industry; that is, to be able to adapt and develop new products, to improve production processes and to create new business areas. One potential means of developing these capabilities is international technology transfer projects.

1.1.1 LDCs need dynamic capabilities

Economic historians and some economists have pin-pointed the important role of innovation and diffusion in industrial development (Schumpeter 1934, David 1975, Rosenberg 1976). Most literature in the industrialized world has been concerned with radical or major breakthrough type of innovations, which are almost non-existent in developing countries. Some researchers have, however, emphasized the considerable importance of incremental change (Lundberg 1961, Marquis 1969, Cole 1979, Sahal 1981a) in industrialized countries. There are few studies of innovation and its origin in developing countries. However, Cooper and Hoffman (1978) argue that incremental innovations are substantial in developing countries. According to Vaitsos and Lall (1978), research on innovation in LDCs is one of the most urgent areas in the whole field of technology, and is one of the least studied at present. Recently, some studies have shown evidence of innovation in LDCs (Katz and Ablin 1978, Lall 1979, Mytelka 1979, Dahlman et al. 1985).

Recent literature on international technology transfer to LDCs has distinguished between transfer of capacity 'to produce' and 'to develop'. (Lall 1978, Farrell 1979b, Bell and Hoffman 1981, OECD 1981, Dore 1984, Ranis 1984). The importance of transferring capabilities needed for innovation has been emphasized. Here, Bell and Hoffman (1981) make the distinction between production/technological capacities while Farrell (1979b) uses the terms static/dynamic technology. OECD (1981) underlines the importance of this distinction as well. A very important part of technological capability that has previously been neglected is the problem-sensing or diagnosing capability (Farrell 1979b, Wallender 1979) that supplements the more well-recognized problem-solving capability. To describe a similar but somewhat wider capability, Nelson and Winter (1982) use the concept "search" that they define as "all those organizational activities which are associated with the evaluation of current routines and which may lead to their modification, to more drastic change, or to their replacement" (p. 400). However, while recognizing the importance of dynamic capabilities, some authors do not distinguish between managerial and technological capabilities (1:1)*. This distinction was clear to Schumpeter (1934) and the demands of and differences in ways of developing entrepreneurial and technological capabilities indicate a need for preserving it. Some authors do discuss entrepreneurial capabilities under specific labels, often referring to specific investment decisions. For example, Bell and Hoffman (1981) use the term 'techno-managerial capabilities' and Dahlman et al. (1985) distinguish between production, investment and innovative capability. 'Production capability' is needed to operate production, 'investment capability' is needed to establish new or expanding existing facilities, and 'innovation capability' is needed to create new technology (p. 9). Hence, in both of these studies a need has been found to make a more distinctive anlaysis of capabilities, including investment capability, which can be seen as a part of Schumpeter's entrepreneurship concept, i.e. there is a reference to combining resources to achieve something new. Developing countries "... usually reverse the sequence and use production capability as the foundation for developing capabilities in investment and innovation." In comparison with industrialized countries where the sequence normally is innovation---investment---production (Dahlman et al. 1985, p. 18). This is because the developing countries can often purchase technology that already exists on the international market.

Sahal (1981b) has formulated a hypothesis of learning, i.e. that technological innovation originates in accumulated experience of a practical nature. Lall (1979) claims that several types of change occur which can be represented by various types of 'learning' processes, emphasizing that learning and change take place at different levels of development. He creates a scale: simple learning by doing, learning via adapting, learning by design, learning by improved design, learning by setting up complete production systems and, finally, the last and highest level, learning by innovation. However, there are very few studies which include qualified empirical evidence regarding if, how and under what conditions transfer actually contributes to the development of capabilities needed for product, process and business area development. Two detailed case studies: the successful example of acquiring technological mastery at the Usiminas Steel Plant in Brazil by Dahlman and Fonseca (1978), and the less successful case of "permanently infant enterprises" in Thailand by Bell et al. (1980). According to Dahlman et al. (1985), acquisition of technological capabilities does not come automatically, merely from experience, though experience is important; it requires conscious efforts by the recipient.

1.1.2 Capability acquisition

An extensive amount of literature has been concerned with different aspects of 'learning' in connection with technology transfer projects (Strassman 1968, Maton 1969, Kilby 1973, Lall 1979, Stewart 1979, Vitelli 1979, Bell 1984). In particular, the involvement of local personnel in different phases of technology transfer projects in order to obtain learning opportunities has been emphasized. The empirical base is nevertheless limited. "Despite considerable speculation on the significance of 'learning' as a potential output from transfer projects, we are aware of no data about whether and how it arises" (Bell and Hoffman 1981, p. 225).

---

* all notes are referred to in this form, i.e. (n:n)

"The accumulation of technological capacity is not a simple, easily described activity." (Stewart 1979). Attempts have been made to study local skill development through indirect methods such as analysing license statistics (Vitelli 1979) or to study 'spillover efficiency' through the analysis of productivity levels in different local industries in relation to share of foreign plants in the same industry (Blomström 1983) (1:2). Katz (1984) has made a large number of case studies in Latin American industry, including different kinds of industrial processes and firm size, to obtain more detailed and direct information of an economic and engineering nature on the phenomenon of learning. These studies make efforts to develop a deeper understanding of capability acquisition for different types of plants. However, there are few LDC studies which make a direct effort to reveal the detailed content of the black box, i.e. technological and managerial capabilities. One exception is Lester (1980), who made a very detailed study of Malaysian free trade zone managers' jobs content, in order to investigate what is diffused from MNCs (multinational companies) to local industries. There are some studies from industrialized countries which go deeper into the understanding of capability (Theman 1976, Almgren and Söderberg 1980).

Several authors have argued that the accumulation of technology takes place in cumulative stages (Stewart 1979, Wallender 1979, Kim 1980, Katz 1984). Kim (1980) draws on experiences from the development of the Korean electronics industry and identifies three different developmental stages: implementation, assimilation and improvement of foreign technology. According to Kim, this sequence can also be found in other countries, e.g. Japan, and in other industries, e.g. automobile industry. Stewart (1979) also sees the development of local technological capabilities as a three stage process which is gone through sequentially; i) the capacity for independent search and choice, ii) minor technical changes generated locally, and iii) indigenously developed new technology (p. 41). Wallender (1979) identifies eight different stages which can be synthesized into the following four; i) organization development, ii) search and acquisition iii) maintenance and modification and iv) research, development and export (p. 48). Katz (1984) argues, based on a large number of Latin American cases, that product design efforts generally develop early in company history, while other types of process engineering capabilities are developed at a later stage. This is in accordance with the dynamic model of company and technology development by Abernathy and Utterback (1978), and the perception of the accumulation of technological capabilities as a dynamic process has important policy implications for how to adjust transfer projects in order to fit the precise development level of the receiver. Interest in the specific situation in the receiver country has previously been limited, and the LDCs have been treated as a uniform group. However, a growing concern has arisen regarding the substantial differences between countries (Odle 1979, Wallender 1979). The result of a transfer project might be totally dependent on the project corresponding to the stage of development of the specific recipient in question (Wallender 1979).

The above studies indicate that the development of technological capabilities is a gradual process that can be described as step-wise. However, these studies do not provide guidelines on the firm level, e.g. on how to design training programmes, etc. With a few exceptions, an understanding of technology and capability need in relation to type and size of plant is also missing.

It has been suggested that the complementary use of foreign technological elements with local technological capabilities speeds up the development of internationally competitive industries (Dahlman and Sercovich 1984). To get the balance right between local and foreign technology (skills), and to promote indigenous change activities, the policy of 'unpackaging' has been presented (Cooper and Maxwell 1975, Cooper and Hoffman 1978). A complementary policy is the strategy of alternative sourcing of inputs in order to increase the bargaining capacity of the receivers. However, it has been argued that the practical efficiency of these kinds of policy might be quite limited because of the homogeneity of the suppliers and their strong bargaining position (Odle 1979). Furthermore, other research has shown the advantages of establishing stable buyer-seller relationships on industrial markets (Håkansson and Johansson 1982), which further limits the benefits of an alternative sourcing strategy. There is another limitation to the policy of unpackaging, as the benefits in terms of increased possibilities for learning through increased local involvement do not fully benefit the receiving firm, but rather someone else in the environment (externalities). For this reason, and because of other imperfections in the technology market, propositions have been made for different kinds of international actions (Lall 1979) or for state intervention (Corden 1974, Katz 1984, Lall 1984, Jacobsson 1985).

In technological transfer for industrial development, the importance of transferring a technology that will fit into the local environment and establish functioning linkages with other industry and institutions has been emphasized (Rweyemamu 1975). In some developing countries, the successful first steps toward this kind of links have been made (Sigurdson 1974). On the other hand, literature reveals examples of newly established industries which function like islands with very few transactions and linkages with the local society. However, few empirically based studies have penetrated the form, determinants, and effects of linkages in developing countries in detail (Jansson 1981).

Most of the existing literature about technology transfer and capability acquisition simply assumes that significant benefits will arise as a result of increased technological and managerial capabilities in the new firms. In addition, in connection with the discussions of "learning", it has been assumed that the cost of acquiring knowledge and experience will be low or zero. Thus, with costs assumed to be low and benefits assumed to be high, analysis of any failure of transfer projects has tended to consider the issue as one of politics and morality rather than economics. Hence, there is a need to base an analysis on firm empirical data on benefits as well as costs.

1.1.3 Small scale industries as technology suppliers

Most policy oriented literature on international technology transfer has examined transfer from and to relatively large companies. Recently, however, there has been a growing interest in the small scale industry as a supplier of technology to LDC firms. There are some suggestions within the literature that small scale supplier firms would behave differently from large scale firms with respect to key aspects of the transfer process.

In most literature concerning technology transfer to developing countries, multinational corporations (MNCs) are involved as suppliers of technology (1:3). Here, an implicit assumption is that the MNC really transfers technology. However, this assumption has been questioned by various authors, like Peno (1975), Coulson (1976), Shivji (1976), Zahlan (1978), and Farrell (1979a). The view of 'technology-free transfer', has also been integrated into the general theory of dependent underdevelopment (Girvan 1973, Odle 1979). Other authors (e.g. Rosenblatt 1979, Poznanski 1984) have another opinion, and claim that technology-free transfer stems from internal factors in LDCs rather than MNCs' unequal and exploitative nature.

One reason for the overwhelming dominance of MNCs in the literature might be that the small scale industry is involved in technology export to a much lesser extent than are MNCs. For example, statistics on Swedish technology export in 1977 show that small firms (less than 100 employees) only account for two percent of the total value. Even if medium-sized firms (less than 500 employees) are included, the share of total technology export does not exceed 17 percent. The vast majority of technology export is attributable to the large MNCs (Granstrand 1980).

Small and medium-sized enterprises (SME) might operate differently than large MNCs in the role of suppliers of technology (1:4). As MNCs have a more or less overall international strategy for their business, they are assumed to have other effects on host country firms than do small scale suppliers with a more limited local market (Cooper and Sercovitch 1970, p. 19). Empirical evidence for this hypothesis is limited (Stout and Bradbury 1979), although UNCTAD has recently promoted some research that supports it (White and Feldman 1980 and 1982, Ahmed 1982, UNCTAD 1984, Onida et al. 1985, Ozawa 1985, UNCTAD 1986). Also, it has been argued that as the small-scale industries' experience of the developed countries is likely to be more relevant to the factor endowments of the developing countries, the small industry is a better instrument of technology transfer (Bhalla 1974). However, recent experiences from Kenya indicate that SMEs and MNCs satisfy different types of technological requirements in LDCs and that, therefore, policies should be sensitive to these differences (UNCTAD 1986). It is therefore not a question of choice between SMEs and MNCs but rather a choice of projects.

Dahlman et al. (1985) point out that the 'maneuvering' possible within each mode (e.g. MNC or SME) is more important than the differences between the modes, i.e. "... the technological benefits to be gained from foreign technology depend less on the method (mode) selected for the transfer, more on how the method is implemented." (p. 33). In this context, they argue for the need to discuss not only how but also to focus on what technological elements are transferred. Dahlman et al. distinguish between the following elements of technology: information, means and understanding. Often transfer projects only concern the means of technology, leaving out the information and understanding elements that are necessary for developing an indigenous technological capability for adaptation and innovation.

1.1.4 The sister industry programme

The above-mentioned problem areas will be dealt with in the present study, which has as its primary object of study a programme for international technology transfer involving Swedish and Tanzanian small scale industries, i.e. 'the sister industry programme'.

The SI programme (SI = sister industry) is a foreign aid-financed programme for establishing Tanzanian small scale industries through international technology transfer by Swedish small or medium-sized enterprises. It was started in 1977 and 30 new small industries had been started by the end of 1986. The total number of employees in these industries at that time was about 700. A contractual agreement stipulating a long-term cooperation (5-10 years) has been established between each Swedish industry (senior sister) and the parastatal SIDO (Small Industries Development Organization) in Tanzania, SIDO acting as the negotiator and party of agreement for the Tanzanian side during the early phases. Normally, the senior sister produces the same type of products as the new Tanzanian industry (junior sister) will start to make. This facilitates the training that takes place in-plant in Sweden. This training is considered as an important component in the SI programme. Some 100 Tanzanians have been trained in Sweden, for periods varying from a few weeks up to almost two years. The junior sisters produce a great variety of products, mainly metalware, e.g. locks, valves, hand tools, electrical motors, clogs, rivets, metal nets, etc. (see Appendix One for a short description of the 30 sister industry projects started in Tanzania).

1.2 A framework for capability acquisition and capability stocks

The following figure presents an overall framework for the study. The focus is on the process of capability acquisition and its effect on the stocks of capabilities during different time periods. The capability stock refers primarily to the managerial and technical knowledge and skills of those individuals that were selected to become SI entrepreneurs. The development of the capability stock is studied over three time periods, with the time when the international technology transfer (ITT) project was initiated as the point of departure (time = t). The end of the training and start-up phase with transition into a 'going concern' run by the SI entrepreneurs themselves, is indicated by time = t+1. Finally, the capability stock at the start of the ITT project is partly the result of individuals' prior education and experiences, which were acquired at time = t-1, i.e. before the ITT project was started.

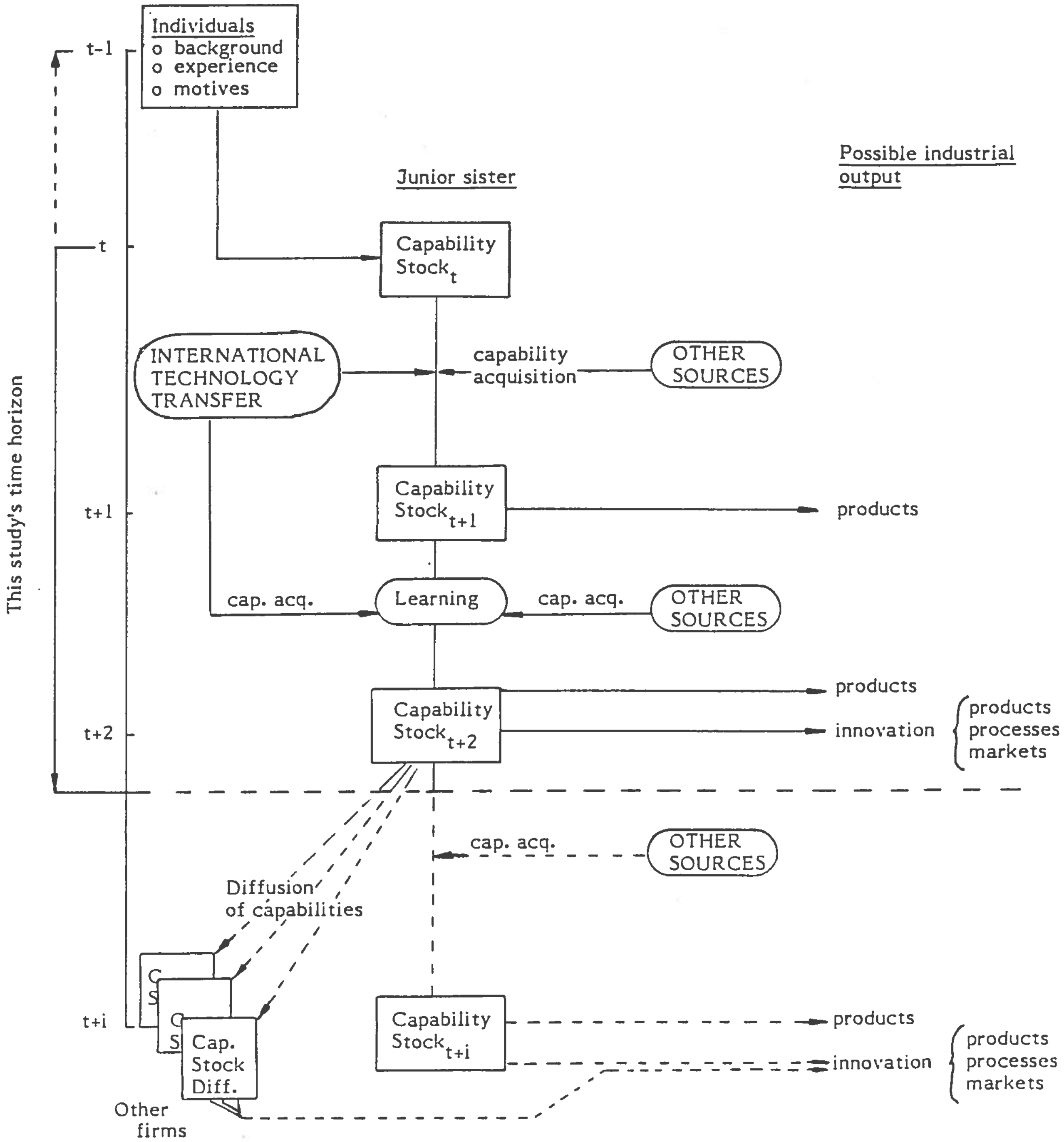


Figure 1.1 A time model of capability acquisition and capability stocks

The framework is centred around the development of the junior sisters' capability stock as obtained through the international technology transfer project (ITT). The impact of other sources on the junior sisters' capability stock is also considered as far as it has been possible to distinguish their contribution from that of the ITT's. Furthermore, output measurements, e.g. production and innovation, are used to provide a picture of the relation between stocks of capability and the resulting industrial outputs. Finally, a possible diffusion of capabilities from the junior sister to other firms is indicated.

Below, a summary is provided of the concepts and main variables in a time perspective.

t-1: Individuals with a certain background, education, previous experience and motives for becoming entrepreneurs are selected to become SI entrepreneurs. They have acquired their capabilities at time = t-1 or previously.

t: Start of the junior sister firm. The SI entrepreneurs have a capability stock ($Stock_t$), formed by their background knowledge and experiences.

t--t+1: Influence of an international technology transfer project (ITT) on the SI entrepreneurs' capability acquisition and other sources.

t+1: The capability stock at the time t+1 ($Stock_{t+1}$) as a result of the ITT.

t+1--t+2: Learning-by-running the company in combination with the continued influence from the ITT and other sources of information and knowledge. This results in the acquisition of further capabilities.

t+2: The resulting capability stock ($Stock_{t+2}$) is the one considered for the present study's final analysis of the ITT project's contribution to the capability acquisition. This capability stock is composed of managerial as well as technological capabilities. The possible industrial output is products and different types of innovations (e.g. product, process and market innovations).

t+i: The capability accumulation continues over time, resulting in new capability stocks, e.g. $Stock_{t+i}$ at time = i. However, the time period after t+2 is not covered in this study.

1.3 Objectives of the study

The primary objective is to study the effects and the importance of a specific form of international technology transfer in the process of acquiring various forms of capabilities. A supplementary aim is to analyse the nature and level of the acquired stock of capabilities and the impact of this stock on indigenous product, process and market development. The emphasis is more on empirical exploration than on testing hypotheses. An attempt is also made to specify the content of the learning process in infant industries.

Furthermore, the study aims at analysing the costs and benefits of this particular form of technology transfer. This includes an estimation of the diffusion of capabilities within and from the firms that initially acquired the capabilities.

The final aim is to draw conclusions concerning the sister industry programme and to make practical suggestions for improvement of this programme. The study will also provide a set of data which can be used for future evaluation of the long-term effectiveness of the sister industry programme.

1.4 Concepts

Concepts of general importance to this study are presented in this section. Other concept definitions can be found in the chapters concerned.

1.4.1 Technology and management

The word technology is derived from the Greek words 'techne' (technique) and 'logos' (knowledge), and thus means 'the knowledge of technique'. We define technique as machinery, products, and methods of production. Thus, we make a distinction between knowledge and the production procedures that have been developed using knowledge.

In the literature, however, a variety of other definitions or uses without definitions can be found. Even when in agreement about the basic definition of technology as knowledge, scholars use the concept with differing contents (1:5). In a recent dissertation, Mattsson (1983) defines technology as knowledge of how to use, manage, and change technique (pp. 18-19) (our translation of the Swedish words 'bruka', 'styra' and 'förändra'). 'To manage the technique' means 'planning and managing production' (our transl.), which limits managing to a specific field. 'To change technique' is defined as 'to shape/construct the production process as a system and its components' (our transl.) (1:6). In our opinion, there is also a need, in an industrial firm, to plan and manage innovative activities; i.e., to use the concept 'manage' in a broader way. Other authors regard 'technology' and 'management' as two separate concepts, e.g. Granstrand (1979),

> "Technology ... refers to knowledge of industrial products and processes and ... includes, for example, knowledge from medical and agricultural fields but not knowledge about management" (pp. 4-5).

In accordance with the above author, the present study will, for the purpose of analysis, keep the two concepts separate.

The words manage and management derive from the Latin word 'manus' (hand), and have "... a ring of doing, or influencing others to do ..." (Granstrand 1979, p. 6). A definition is given by Drucker (1977), p. 349:

> "Manage: in an organizational setting, to mobilize resources for the achievement of a human purpose."
>
> "Management: the group of persons who manage an organization. Also the discipline concerned with understanding and improving the knowledge of how to manage."

An important feature of 'managing' is that it is a purpose-oriented activity. According to Bohlin (1981), this means that: i) the purpose is of fundamental importance but also that ii) 'managing' can never be described in mechanistic causality terms, as the concept itself is influenced by the participants' perceptions of the need for actions as well as by their perceptions of the possibilities to act in the way they regard as necessary to fulfil the purpose. Furthermore, iii) other participants are also involved in purpose-oriented activities, which influences the possibility of fulfilling the purpose. Finally, iv) 'managing' is influenced by expectations of the future.

The definition above also includes the phrase 'to mobilize resources'. 'Resources' means everything needed to fulfil the purpose, of a human or material nature. 'Mobilizing' means the whole or parts of the following chain of activities (Bohlin 1981):

- to define which resources are needed
- to procure the resources
- to make the resources cooperate
- to maintain the resources
- to develop the resources
- to renew the resources
- to liquidate the resources

The above list points in the direction of participation in innovative activities, business development, etc., in the industrial firm. It should, however, be emphasized that the definition of management as the group of people who manage should not be viewed in a narrow sense, as synonymous with the top management. Instead, management should be viewed in a broader way, normally containing several hierarchical levels in an industrial firm. To supplement the above definition, the following list of so-called managerial functions is given, a list that can be found in a typical textbook in the field: planning, decision-making, directing, organizing, coordinating, controlling, staffing, motivating, evaluating, communicating, goal-setting, and initiating.

A common distinction is made between manager and entrepreneur. For example, Schumpeter (1934, p. 75) used a narrow concept of manager, referring it to the organization and administration of running operations, while he reserved the term 'entrepreneur' for an individual who carries out an innovation. Schumpeter (1976) described the entrepreneurial function as "It consists in getting things done." (p. 132). In this study, the 'management' concepts include entrepreneurship, even though the term 'entrepreneur' is used in a Schumpeterian way, normally referring to an individual starting a new business, or line of business. The term 'SI entrepreneur' is used in this study to characterize the individuals that were selected to run the industries within the sister industry programme.

1.4.2 Transfer and acquisition of technology and management

Transfer is defined as "to convey (or remove) from one place, person, etc., to another" or "to cause to pass from one person to another, as thought, qualities, power, etc." (The Random House Dictionary of the English Language, 1968 ed.) This can be described by a simple model involving a supplier, a receiver and a linking mechanism in a socio-economic/cultural environment (e.g. Schlie 1976).

We view transfer of technology and transfer of management (as knowledge) separately in our analysis, although they often are interwoven. In accordance with a common use of the concept 'technology transfer' in the literature, it is sometimes used in a more general way in this study. However, when there is a need to separate the two concepts 'technology transfer' and 'management transfer', this is done explicitly.

A successful transfer of technology means that a recipient acquires the knowledge of techniques, i.e. masters the technique. On the other hand, a successful transfer of technique does not involve the knowledge component 'to master', but might include the transfer of machinery, products and methods of production required 'to use' the technique, i.e. to produce the originally agreed upon products.

Acquisition of technology or management relates to the actual build-up of knowledge. Acquisition of technology can be accomplished through technology transfer, but it can also take place through one's own efforts to develop technology, e.g. through development work and testing in one's own facilities. This is in accordance with the general meaning of the word 'acquire' i.e. "to gain by one's own efforts" or "to get as one's own" (Webster's New World Dictionary 1974). Hence, we include intention in the concept 'acquisition', using it somewhat like Brodén (1983), although we do not make the same distinction as regards technology transfer, restricting it to occasions when multinational companies take the initiative (1:7).

1.5 Relation to other studies

This study is one of the final reports in a Swedish-Tanzanian research project with the SI programme as the primary object of study. The researchers have come from the Institute of Development Studies in Mzumbe, Tanzania and from Chalmers University of Technology and Växjö University, both in Sweden.

This research project has resulted in several reports covering different aspects and phases of the SI programme, based on different methodological approaches and with researchers from different disciplines. Early publications included a descriptive report on the initial phase of the SI programme (Alänge, Hult and Löwbäck 1979) and a somewhat more comprehensive analysis of the situation a few years later (Alänge, Fatukubonye, Löwbäck, Mushi, Niklasson and Nyoni 1981). The research project's final reports cover some different issues. Alänge and Löwbäck (1981a) provide an analysis of Swedish small scale industries' motives and the environmental conditions for involvement in technology transfer projects in LDCs. (Alänge and Löwbäck 1986 is a slightly revised English version of that report). Niklasson (1983) makes a cost-benefit analysis of four SI projects in Arusha from the point of view of Tanzania's national economy. Alänge (1986b) is an analysis of the SI entrepreneurs' motives for becoming entrepreneurs. Alänge and Granstrand (1986) provide a comparative analysis of different kinds of entrepreneurship in an international perspective. Referring to the three basic forms (autonomous, corporate and state entrepreneurship), it is claimed that the SI programme is a form of 'early stages' state entrepreneurship. Alänge (1986a) presents eight case studies of SI projects, which are used for the analyses in the present study.

The present study is primarily related to a study by Löwbäck. His research interest is divided into three different levels. First, the small scale industry policy level which concerns the policy's relation to and effects on the SI programme. Second, the SI programme level, with special focus on the public small industry support organization SIDO's role, learning, capability acquisition and performance. On the third level a comparative analysis of sister industries with other Tanzanian industries started through different modes of capability transfer is made. Here, the specific focus is on the potential for capability acquisition, incidence of technical change and performance on the firm level (Löwbäck 1987a and 1987b).

The focus of the present study is on the acquisition of technological and managerial capabilities on the level of the individual. The capability acquisition process, the stocks of capabilities and the development of African entrepreneurship is given special consideration.

1.6 Structure of the report

The following is a short description of the report's structure and content. See also figure 1.2.

Chapter Two is a summary of the most relevant literature which, in combination with the literature sections in Chapter One, provides a frame of reference for the study. In Chapter Three, the different methodological phases are presented, i.e. the pilot study and the subsequent main study design. Some methodological problems and solutions are also discussed.

Chapter Four presents the firms studied in the broader context of Tanzanian industrial policy, economy, infrastructure and industrial structure. Furthermore, a description of the SI programme is provided.

Other empirical data are presented in a summarized form or in tables in Chapters 5-9. Each chapter has its specific focus. Chapter Five concerns individuals' backgrounds and motives for becoming entrepreneurs. Chapter Six analyses the stock of static or dynamic capabilities which the entrepreneurs have acquired. Chapter Seven is about the capability acquisition process and different factors that influence this process. Chapter Eight is on the diffusion of capabilities, Chapter Nine about the costs of the SI programme and the contribution of capabilities to Tanzania.

Chapter Ten on technology transfer, entrepreneurship networks and infant industries draws on all the preceeding chapters and has the character of a general discussion chapter. Specifically, the conceptualization of the infant industry process is discussed.

Finally, Chapter Eleven provides a summary of conclusions and suggestions for further research. It also includes a section on recommendations for the improvement of the SI type of international technology transfer.

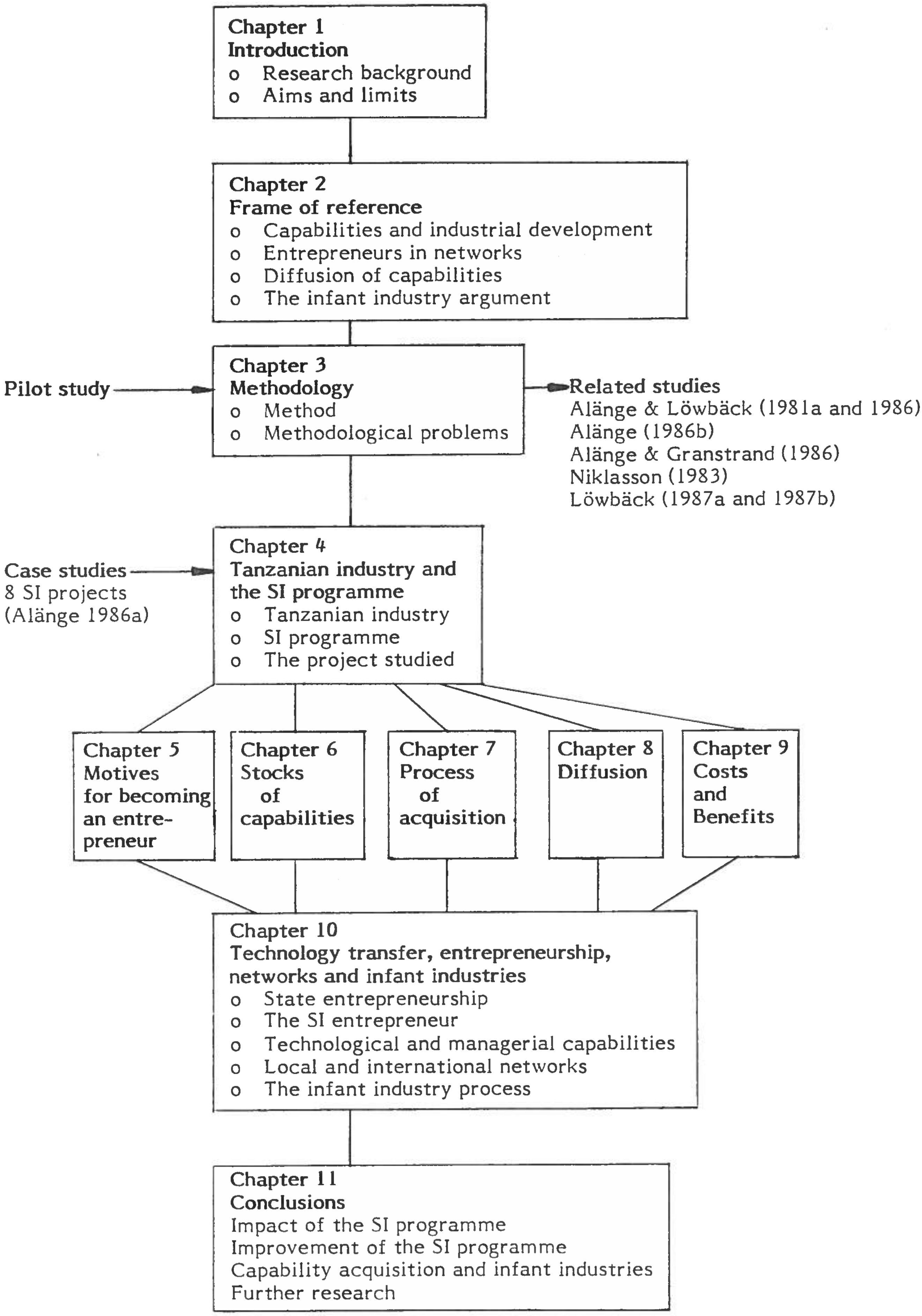


Figure 1.2 Structure of the report

CHAPTER TWO

FRAME OF REFERENCE

In this chapter a presentation of selected literature is provided in five different areas, all with a bearing on development of industry in LDCs. They are; capabilities and industrial development, entrepreneurship research, entrepreneurs in networks, diffusion of capabilities and the 'infant industry argument'.

The infant industry argument, concerning the possible need for protection to foster the development of infant industry during a limited period of time, is discussed to some extent, but not in depth, in the context of capabilities and industrial development. Sometimes it is not discussed at all. We believe, therefore, that there might be a need for qualifying some aspects of the infant industry argument in the light of knowledge about the different types of capabilities needed for industrial development and the perspective that the development of an infant industry also requires the development of linkages, i.e. the development of a network. In the discussion, Chapter Ten, a more thorough discussion of the infant industry argument and its conceptualization is provided.

2.1 Capabilities and industrial development

The inability of the neo-classical school to explain the influence of the residual factor on economic development, in combination with the rise of the newly industrialized countries that makes the dependency school out of date, has left us in a situation where no school of thought has a unique position in a paradigmatic sense (Hettne 1982) (note 2:1). Especially the phenomenon of technology and technical change has been poorly understood. According to Nelson (1981), "... the theoretical model underlying most research by economists on productivity growth over time, and across countries, is superficial and to some degree even misleading ..." (p. 1029). In the '80s we have witnessed a renewed interest in technology and in understanding what is happening within 'the black box'. This has called for more dynamic points of departure, one of which is orthodox Marxism, another the work of Schumpeter. Especially work on developing Schumpeter's thoughts of entrepreneurship and innovation, also including the importance of incremental change, has had a considerable impact on development economists in recent years. According to Fransman (1985), "... in the area of the study of technology there is an increasing convergence of perspective between those working, on both industralised and Third World countries, under what has been referred to ... as a neo-Schumpeterian banner." (p. 638). The importance of technology, technical change and the capabilities needed for the accomplishment of these is clear, but the 'residual' in most analyses is still treated in an aggregated way. In the concept technology (technical knowledge) a variety of capabilities is often included (see also section 1.1.1).

In policy-related literature there has been an extensive concern with the type of technology that is needed for the development of a viable and innovative industrial sector in LDCs. References have been made to Rosenberg (1976) and others who have pointed to the importance of the machine-making sector in the development of local industrial capability in industrialized countries. Cooper (1980) argues that the advantage for LDCs lies mostly in "... adapting, copying, and fabricating simpler machinery components." and then primarily in "... industries based on mechanical technologies, not on electrical, chemical, and electronic technologies, which are more complex." (p. 40). Furthermore, Cooper makes a distinction between the large-scale (formal) and small-scale (informal) LDC firms, on the customer side as well as on the supply side (machine makers). While these studies make a number of important observations, one shortcoming is that they do not come down to the root of what precise type of technologies and capabilities are really needed within developing countries. Instead it is expressed in more general terms such as; design engineering, technical skills in machine fabrication and so forth. We agree on the importance of a machinery making industry for the development of industry, but we doubt that it is always wise to create this type of industry without analysing the priority needs for capabilities and services.

There might also be differences between countries with different markets (size, structure) and resources. As an example, Frej (1981) made a study of the essential technologies for the development of small scale metal-working industries in Sweden. For Sweden's most small-scale-intensive community, Gnosjö, it was found that it was not the machine-making capability as such that had been of importance, but the tool-making capability. This included a need for both experienced tool makers and facilities for hardening the tools (Frej 1981). Also today the tool-making capability is an essential competitive strength for many small scale industries in this community working primarily as subcontractors on an international market. The machines as such, presses, etc., are bought on the international market from machinery producers that enjoy economies of scale in the production of machines. We believe that a comparative situation might exist for many LDCs in certain industries. Hence, it might be that the essential capabilities are in the area of tool-making, surface treatment, maintenance and some spare parts fabrication, rather than in the mastery of making whole machines.

Dahlman and Westphal (1982), Lall (1984) and Fransman (1985) have found that developing countries do not need to have full technological mastery to be competitive on the world market. They referred to the example of South Korea, which 'knew how' to produce but did not 'know why', i.e. did not fully understand the underlying principles of product and process development, but still has made an impressive break through on the international market. According to our view, there is a need of making a further break down of the concepts to fully grasp what is needed for a single firm to be competitive. The distinction between technological capability and managerial capability is helpful. A single firm can be competitive on the world market as the example above shows, by efficiently using technology developed elsewhere. Above we argued that in some cases it is not really necessary to have the capability to make the machines; instead it might be that the tool-making is the essential technological capability. However, we could consider the example where a firm that has bought its machine also decides to buy the tools needed, and it could still be successful on the world market. This is quite a common procedure even in industrialized countries. What are then the essential capabilities involved? A certain amount of technological capability is needed to be able to order, to negotiate about the price and to make the buy-decision. However, it may well be that the most essential capability is the ability to estimate the market potential, to procure the resources, which might even involve buying the basic design of the new product, i.e. these activities are essentially entrepreneurial.

2.2 Entrepreneurship research

What we have labelled 'entrepreneurship research' is another line of research that is concerned with some of those issues found in development economics, i.e. those of developing firms. According to Vesper (1982), "The overall field of entrepreneurship is loosely defined as the creation of new business enterprises by individuals or small groups." (p. xxxi). However, as entrepreneurship research starts off primarily from other traditions, it is carried out with very few connections to development economics, one reason naturally being that the primary focus of research has been on entrepreneurship in ICs. However, there exists a tradition of studies of African entrepreneurship (Kilby 1969, Marris and Somerset 1971, Nafziger 1977). Entrepreneurship research concentrates primarily on the start-up of new businesses and on the entrepreneurs. This character is seen from a variety of perspectives, including those of finance, psychology and sociology, but in general the connections to development economics are few. Schumpeter forms a linkage though, as there is at present a trend of neo-Schumpeterianism in development economics (Fransman 1985), and an increased interest in studying what is happening within the 'black box' and how these ocurrences are influencing the growth of capabilities and outputs.

There exists a certain amount of literature concerning entrepreneurship, although "... the balance of forces to date has left entrepreneurship with a very minor overall representation in academic research." Furthermore, much of what has been written "... are not research works at all but expositions," and "... much of what is called the literature of entrepreneurship is either anecdotal or else judgemental without clear reference to basis in fact." (Vesper 1982, pp. xxxiii). However, some fields of entrepreneurship are better studied among which are the psychology and the sociology of entrepreneurship (2:2).

Entrepreneurship research suffers, with a few exceptions, from an ethnocentric drawback. This holds true also for those studies and action programmes in the psychological tradition, carried out in different LDCs by McClelland and others (Hofstede 1980). Nevertheless, there are reasons to believe, with consideration of the above mentioned limitations, that the findings from this line of research might be of value for the understanding of LDCs' industrial development. However, a more thourough analysis of the cultural differences influencing entrepreneurship in different countries is needed.

A concept that recently has been spread to entrepreneurship research is that of 'networks', i.e. the need of seeing the entrepreneur and his capabilities in the light of his economic and social linkages to other individuals, firms and institutions (2:3). This perspective has been shown to have great explanatory power in the study of entrepreneurship in ICs (e.g. see Johannisson 1985, Aldrich et al. 1986). We believe that a variant of this perspective also has something to offer in the study of LDCs' technological change and capability development.

2.3 Entrepreneurs in networks

The network approach has been used to an increasing extent in studies of organizations, business relations and community development. This approach has been used to analyse industrial markets and the competitive position of firms (Håkansson and Johanson 1982), and the way to structure networks to obtain efficient use of R&D resources (Håkansson and Laage-Hellman 1984). The importance of networks and the individuals, gate keepers, who transmit information into firms for the benefit of research and development, is well documented (e.g. Allen 1984). Social networks, e.g. membership in a local association, have importance for communication in social settings, such as the introduction of an innovation (Rogers and Kincaid 1981). Interest in using the network concept in the area of entrepreneurship research is, however, of a more recent date (Aldrich et al. 1986).

Through the network approach the perspective is changed from the individual entrepreneur to "... entrepreneurship as embedded in a social context, channeled and facilitated or constrained and inhibited by people's positions in social networks." (Aldrich and Zimmer 1986, p. 4). However, the empirical evidence, according to Aldrich et al. (1986), is limited.

MacMillan (1983) argues for the importance of the entrepreneur developing contacts and networks in order to break down reluctance by stake holders during the initial phase of launching a new venture. His analysis is illustrated by some cases where the development of an 'influence network' had been influential in breaking down the resistance to being the first party to commit itself to a business start-up. MacMillan stresses three ways to enforce networks; 1) stressing commonality, 2) seeking advice and 3) providing help. Birley (1985) reports from a study of business start-ups in a declining US region, that the entrepreneurs relied heavily on the informal network prior to start up. The entrepreneurs approached formal sources, e.g. banks, "only when the elements of the firm were set, and the extent of finance determined." (p. 325). According to Birley this behaviour is inefficient and she proposes ways to make the formal system more accessible for potential entrepreneurs.

Aldrich et al. (1986) provides an empirical report of a research project concerning entrepreneurs' social networks. They report on the characteristics of the network for entrepreneurs during early phases in terms of network activity and network multiplicity. They also presented some findings concerning the importance of 'weak ties' during start-up phases, i.e. having a network in which relative strangers also participate. In other studies the importance of weak ties or low 'communication proximity' has been shown to be of considerable importance in obtaining valuable information that goes beyond what the individual already has (Granovetter 1973, Rogers 1983). However, in referring to the above mentioned theory (Granovetter's) of the advantage of 'weak ties' and a test of the theory in Mexico, Rogers and Kincaid (1981), point out that "... Cross-cultural tests of 'made in the US' behavior science theories are needed to determine the degree to which they are culture-bound." (p. 247). They continue:

> "In both the United States and Mexico, we conclude that networks are important influences on human behavior, but the function played by network links may be somewhat different in each country. Further, the fundamental basis of network links may be different in Mexico than in the United States. North Americans tend to respond

to their network links with social friends and work associates in making many decisions. In Mexico, kinship ties are much more important in effecting many life decisions, and the quality of these links tends to be more stable and multiplex. Perhaps through future study of this fundamental quality of network links in various cultures, network analysis can better understand the role of cultural factors in human behavior." (p. 247)

Johannisson (1985) has made studies in Swedish communities of the importance of social networks for entrepreneurship. Referring to the most industrialized municipality in Sweden, with the highest frequency of business start-ups paired with the lowest unemployment, he points out that the main factor behind this successful development is the favourable local business climate. It is based on a mutual interest in a viable community, kinship relations and widespread membership in local associations. The local business people are hence highly interconnected in personal networks. First, there are the local social networks that tie the local entrepreneurs together and form the basis for success for each individual firm. However, participation in global social networks is also of importance for success. "Success then depends on the ability to balance and manage global and local linkages." (p. 8). Johannisson also emphasizes the importance of local arenas, i.e. meeting places where the relationships can be created and maintained. He argues that "Generally the number of local associations and social clubs indicates the networking potential of a community." (p. 8). The importance of these local arenas for information exchange and business development has also been emphasized in other studies (Alänge et al. 1979, p. 101; Frej 1981, pp. 56-57).

In communities where a favourable local business climate does not exist, Johannisson (1985) shows empirical evidence for the importance of the 'social entrepreneur' in the process of developing the business climate, the social network and the local arenas. The social entrepreneur is an individual with a vision of the future who stimulates the local people to start their own businesses.

The Utterback and Reitberger (1982) study of Swedish technology-based start-up firms included a section concerned with the personal networks of the entrepreneurs. To focus the inquiry they related the use of information-sources to: 1) key decisions for the companies, such as the decision to start-up and, 2) critical events, e.g. meeting key people or discovering the solution to a problem. For comparison, data was collected also among "Route 128" companies in Boston. Based on this data, Leonard-Barton (1983) found that accesss to information through experience in the industry, contacts with outside consultants, and extensive travel, were characteristics of the more successful Swedish entrepreneurs. Although the data did not permit firm conclusions, she reported that the interviewers "felt they saw subjective evidence that the real 'net-workers' were among the more successful entrepreneurs ..." (p. 559). She also commented that "Swedish entrepreneurs appear to use personal contacts as a source of relevance for business information less than their American counterparts." (p. 538). However, in Sweden the regional and industry differences are considerable. For example, the Gnosjö region, mentioned in Frej (1981) and Johannisson (1985), shows very well developed local personal networks among the entrepreneurs, although the same does not exist for the Östersund region. The same regional differences, where some regions have more extensive networks, can also be found elsewhere, e.g. in the Silicon Valley in the US which "is a system interconnected by a ganglia of interpersonal networks" (Rogers 1981, p. 36). In this area there is a large number of local 'arenas', i.e. bars, restaurants and 'hang-outs' where information is exchanged 'cost-free' and personal networks are developed and maintained. Reitberger (1984) adds that the development of supplementary networks is of importance for the diffusion of innovations into firms. One of these is a global technical network involving the local pioneering firms and their national and international counterparts. The other is a personal local network in which the local pioneering firm acts as a 'change agent' and helps to establish the credibility of the innovation for the other local firms.

The 'relation content' of various types of networks is almost unlimited according to Knoke and Kuklinski (1982). They list the following; transaction relations, communication relations, boundary penetration relations, instrumental relations, sentiment relations, authority/power relations and kinship/descent relations (pp. 15-16). The social networks for entrepreneurs are mostly based on several types of relational content. According to Johannisson (1985) the local social networks in his study were based on both instrumental and moral commitment, but they "... also carry information and exchange processes between owner-managers and other community members ..." (p. 8).

2.4 Diffusion of capabilities

There is an extensive number of diffusion studies of innovation. A share of these studies concern the diffusion of industrial capabilities and processes (2:4). Some studies of capabilities concern diffusion from one firm to another, but there are also some on diffusion within firms.

The diffusion of industrial processes has been studied in an international perspective (Mansfield 1968, Tilton 1971, Nabset and Ray 1974, Kling 1981). It has been found that the technology is spread according to an S-shaped curve, indicating the rate of adoption. This curve shows the initial slow diffusion in the innovator category, the increasingly more rapid spread via the early adopters and early majority, the decline in rate of adoption beginning with the late majority and finally the slow adoption by laggards (Rogers 1983, p. 247). However, it cannot be taken for granted that the diffusion pattern will always look like this on the producer market and that the same type of categorization is meaningful for the diffusion of e.g. specialized machines (Hammarkvist 1978). According to Nabseth and Ray (1974) factors influencing the diffusion rate of new process technology are; first information, profitability, access to investment capital, international contacts, size of firm, institutional circumstances and management attitudes (pp. 299-310). However, Kling (1981), partly drawing on the same data, comments that it is not the profitability that motivates firms to adopt new process technology, rather it is the competitive pressure. Also, he adds that the diffusion is more rapid when a firm has its own R&D, when it has a high export share and between firms of equal size. Furthermore, he did not find any relation between size of investment and the rate of diffusion. Finally, he concludes that it is doubtful if more rapid information diffusion will influence the rate of adoption, rather it is dependent on the existence of demonstration examples.

There are not many studies on the diffusion of industrial processes in developing countries (Vaitsos and Lall 1978). However, Vernon (1966) has presented a general theory for the gradual spread of innovations internationally, the international product cycle theory. It has been examined empirically and been questioned in several areas by e.g. Cortes (1976) in her empirical study of the transfer of technology to the petrochemical industry in Latin America.

Cooper (1970) studied start-up of new ventures that are spin-offs from existing firms (incubators). This as well can be seen as a form of diffusion. Cooper (1984) makes a review of prior research on the role of incubator organizations for new start-ups. The location of spin-offs is mostly in the same regional area as the incubator organization and in a closely related business. Hence "... regional entrepreneurship is largely dependent on the pool of people already living in the area." (p. 160). A substantial number of founders left the incubator organization because of strong negative 'push'. Furthermore, small firms tend to have higher spin-off rates than large firms, among other things due to opportunities of developing broad experiences and of getting a perspective wiew on what is involved in managing a small firm. Finally, Cooper points out that the incubator organizations "... provide the setting within which founding teams can be formed." (p. 163). Some aspects of incubator organizations have also been touched upon by Vedin (1980) and Rogers and Larsen (1984) who both studied the development of the semi-conductor industry in the Silicon Valley. Vedin (1980) used the expression 'Fairchildren' to characterize the culture where "... there are low economic and mental barriers to gifted people leaving one corporation and starting a new one on their own." (p. 7). (Fairchild was one of the first electronics companies that can be seen as a starting point in the spin-off tree of descent). Also spin-offs from universities have been studied (Olofsson and Wahlbin 1984, Rogers and Larsen 1984, McQueen and Wallmark 1985).

Few studies have a direct focus on the spread of capabilities. Lester (1980) has studied the diffusion of different kinds of capabilities from MNCs in free trade zones in Malaysia. His preliminary findings of the diffusion of managerial and technical skills indicate that "... a surprisingly wide diversity of jobs has been created within the electronic assembly industry in free trade zones in Malaysia. Moreover, these jobs are virtually all of a kind to be found in any modern manufacturing industrial sector, leading us to concur with Helleiner's observations about the learning effect of export manufacturing." (pp. 31 and 33). However, there are also a number of studies indicating that the diffusion of capabilities from MNCs is limited (Peno 1975, Farrell 1979a).

The diffusion of knowledge and skills within organizations has been on the agenda when new forms of work organization have been introduced in production systems (Matejko 1979). It has been shown that initially training one small group in its work tasks and then moving the experienced individuals to newly formed work groups has given good total results in the start-up of work group organizations. The use of work rotation, to increase the general level and flexibility of a work force, has been practised in several countries. Especially, Japan is known to have a well developed system, where also newly employed engineers at first start working at the shop floor, then rotate to different occupations for a time before taking up their originally assigned job, e.g. in the R&D department. (Cole 1979). These methods indicate the importance of learning-by-doing and of getting the opportunity of an overview of a unit, i.e. a holistic approach to learning.

2.5 The infant industry argument

The debate about whether the state should intervene to foster the development of infant industry has been going on for more than a century. John Stuart Mill's endorsement of the infant industry argument in the mid-19th century made it acceptable in wider circles. The question concerns whether the state, during a limited time period, should protect local infant industry from foreign competition, so that the local industry can develop and become strong enough to stand international competition (2:5).

According to Corden (1974), "The essence of the infant industry argument is that it is an argument for temporary protection. Hence (a) time must enter the argument in some essential way; it cannot rest solely on static economies of scale, whether internal or external. Furthermore, (b) it is an argument for intervention to alter the pattern of production, and so will require some kind of distortion, imperfection or externality in the system somewhere." (p. 249).

Corden (1974), distinguishes between internal dynamic economies and external dynamic economies as a basis for an infant industry argument. In-house learning provides internal dynamic economies through the creation of human capital, but if there are no specific distortions, there is no case for intervention. According to Corden, the argument can mainly be motivated in two possible ways; by imperfection of private information and by imperfection in the capital market (2:6). According to Corden, the case for imperfection of private information is not very strong, but at least for indigenous LDC firms there might be a need to spread information, e.g. market information. The most serious argument for fostering infant industries is imperfections in the capital market. This depends primarily on the individual's and the state's different time preferences, but also on different perceptions of risks. For the state it could be preferential to invest in a certain technology that is supposed to gain importance in coming decades, while this time and risk perspective is far too long for an individual entrepreneur. Corden (1974) points out that, "... in spite of many qualifications, a valid, practically relevant infant industry argument for subsidizing of new manufacturing industries resting on capital market imperfections can be made for many less-developed countries." (p. 255). However, Corden (1980) stresses that the two above arguments do not provide a case for infant industry protection of subsidiaries of transnational companies. The reason is that these companies usually have information, can raise internal funds and take a long term view.

By external dynamic economies are meant those benefits in human capital and experience that other firms/organizations will enjoy as a result of the first firm's investment. These accrue, for example, when a firm decides to use a local supplier/consultant, although the use of a foreign firm would result in a higher quality job done in less time and more cost effectively. Hence, for the buying firm it is a loss while the supplier/consultant benefits in terms of learning opportunities which provide experience that can be used in commissions for other customers, who then benefit from the learning paid for by the first buying firm. The training of workers might also result in externalities; in the first place it is the workers who benefit, which can be reflected in their wages (2:7), and in the second place, other firms might benefit if the workers leave for other jobs. Another example of externalities is knowledge that is not possible to keep secret or to protect by patent, etc. A more general form of dynamic externality is the creation of a general atmosphere that is conducive to industrial activity and factory work. "Here the training and experience of workers in firm X may affect the quality of other workers; thus new attitudes and knowledge leap from worker to worker, the gains will then go in the main to the workers but will no doubt also spill over to firms." (Corden 1974, p. 264). According to Corden (1980), the creation of a general atmosphere that is conducive to manufacturing and organized economic activity "... may be the most important basis for the infant industry argument ..." (p. 60).

Mill's original argument concerned the protection of an infant that then should become internationally competitive and be able to remain in the technological forefront through its own investments. However, radical innovations on the international scene might make competitive technology outmoded once again, which could call for the society to reconsider: "... to protect a second, or even a third, round of indigenous learning in order to prevent the technological gap from widening once again ..." (Katz 1984, p. 132). This might be the case at present, since the introduction of micro-electronics might well mean that previously competitive firms will fall behind. Kaplinsky (1984) even suggests that "... the gap between DC (developed countries) and LDC technology is reopening, but at the same time DC technology is becoming increasingly inappropriate for LDCs." (p. 158).

A wider application of the infant industry argument is possible as well. Corden (1974) provides the specific case of 'infant marketing protection'.

> "Many industries and countries have experimented in exporting new products. Indeed, there is a special learning problem in breaking for the first time into foreign markets, so that there could be an infant marketing argument additional to the usual infant industry argument concerned with production. Here again, an argument for protection must rest additionally on capital market imperfection, inadequacy of private information or judgement, or externalities." (p. 269)

Corden (1974) argues that "... a policy that is applied as close as possible to the point of the relevant divergence is always first-best.", i.e. that it is best to use a policy that as closely as possible influences the problem that it should deal with. From this follows, Corden argues, that in general, subsidies are preferred before tariffs, and both of these are preferred before quantitative restrictions like import quotas. This view has recently been questioned partly on the basis of empirical findings. It has been shown that the use of import quotas, that according to the standard view would always be a third-best alternative, has been related to successful infant industrializtion (Westphal 1981). According to Fransman (1984a), an important factor that might provide at least a part of an explanation is 'uncertainty'. Referring to practices in South Korea, Fransman points out; "... one of the main advantages of using quantitative restrictions is that they provide the firms concerned with a greater degree of certainty regarding market size and hence sales and profitability than do tariffs (unless prohibitive) or subsidies." (p. 54). However, Jacobsson (1985) argues that the use of quotas in South Korea was inefficient and detrimental and that other measures accounted for the relative success.

Even when agreeing on the need for infant industry protection the opinions have been different concerning the advantages of general versus selective state intervention and concerning what kind of policy instrument to use. Balassa (1975) and Corden (1980) are in favour of a uniform protection in order to let the market decide on the pattern of industry. Balassa recommends a 'two tier system', where industry in general should have a low (10-15%) uniform protection and for certain selected infant industries the protection should be slightly higher (20-30%), but still uniform within these industries. As far as the choice of instrument is concerned, Baldwin (1969), argues against the case for always using tariffs for protection. He points out that "What is required ... is a much more direct and selective policy measure than non-discriminatory import duties." (p. 304). Other authors, referring especially to practices in successful NICs, are also in favour of the use of more selective measures, both as regards selectivity between industries (Westphal 1981, Katz 1984) and choice of instrument to be used (Jacobsson 1985).

Westphal (1981) means that it is more important to select the right firms, than to establish certain levels of protection. He is in favour of the Balassa 'two tier system', providing a uniform low protection to all industries except a small number of industries, which should receive absolute protection. By absolute is meant "whatever is necessary to secure an adequate market for the industry's output as well as a satisfactory rate of return on investment". He continues that "... the level of absolute protection is something that can only be determined 'endogenously', for example by basing protection on import quotas." (p. 19). Regarding the low uniform protection to all other industries, Westphal points out that it is "critically important, because it both avoids capricious discrimination among these activities and benefits export activity." (p. 20).

Jacobsson (1985) argues that the "... main criticism of the Corden-Balassa view of uniform effective protection ... is that they apply principles derived from static allocation theory to questions relating to infant industry problems. These are by definition not a matter of static analysis, but of the growth of resources over time." (p. 271). Based on comparative studies of lathe manufacturers in Argentina, South Korea and Taiwan, Jacobsson (1985) argues for the use of product, firm and function specific policies. On the other hand, general measures, like trade restrictions, have been shown to be inefficient, costly and of marginal use to most firms. In contrast to firm-specific policies, 'neutral' protection is only relevant "... when one is justified in assuming a homogeneity among firms, i.e. that one can analyse on the basis of a 'representative' firm ...", on account of minimizing the social cost of transition (p. 290).

Jacobsson (1985) also provides a practical reason for selective intervention; "Indeed, given that infants can take a decade to mature, a practical reason for selective intervention is simply that the society cannot find the means, or is not ready, to pay for the learning period involved in having a large number of infants simultaneously." (p. 247). This is in accordance with Westphal (1981), who comments in his postscript concerning the industrialization of South Korea; "... substantial difficulty has been encountered in developing its most recent set of infant industries ..." and he continues, "... the difficulty stems from the Korean government's initial decision to promote too many infant industries at once and from its subsequent -- and newly acquired -- reluctance to abandon or radically revise its plans on the basis of information and experience accumulated over time. Thus, Korea's recent problems may provide additional evidence to support the need for selectivety in the promotion of infant industry." (p. 35).

Katz (1984) makes a division of different production organizations on a relatively aggregated level; continous flow in-line large scale plants, individual order production and small-lot production. Katz also argues, based on empirical data from Latin America, that "... no general statement concerning public policy in the field of protection can be made on the basis of simplistic specification of the production function. 'Tailor-made' policy actions appear to be needed that would closely reflect the specificity of the learning situation of each particular form of production organisation." (pp. 134-135).

Besides the impact of support and protection, the state's orientation internationally (export oriented or import substitution strategy) seems to influence the infancy period of its industrial firms. Based on the experiences of the rapidly industrializing NICs' export oriented strategies (EO), it has been suggested that an infant which exports at an early stage would mature more rapidly than those infants who sell on the local market only. Jacobsson (1985) identifies some technological and competitive factors that support this suggestion. He starts out from the notion that firms operating in industries with large economies of scale necessarily face problems if they are confronted with small markets (2:8). If an export orientation implies larger volumes and the accumulation of production experience is a measure of the infancy period, then the infant will mature more rapidly. Other technological factors were; EO gives the firm access to virtually free technical information from the world market; and scarce entrepreneurial ability and other capabilities of the firm can be better utilized if the firm finds it economical to export. Finally, for an infant to mature more rapidly it can be beneficial to be more exposed to international competition. The evidence from Jacobsson's empirical study provides support for the relevance of the above mentioned factors and for the impact of an export orientation on the duration of the infancy period (2:9).

The above mentioned studies are based on firm level data from Latin America and Asia. Our study provides further empirical data from a specific case involving small scale industries started under protection, financed by foreign aid, in Africa. In comparison to the above studies, our data on capability needs is on a more detailed level, providing a basis for a more detailed anlaysis of needs for support and protection.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The focus of the present thesis is on the acquisition of capabilities in LDC firms, specifically on capabilities needed for innovation. The purpose of this chapter is to present the research design and the way of presenting the empirical data. Specific methodological problems and solutions will also be discussed. Initially, some comments are made on the research programme, of which the research for this thesis was an integrated part.

3.1.1 The research programme

The basic goal of the research programme has been "to make an active contribution to the efforts of the developing countries to themselves create and shape their industrialisation process" (Alänge and Löwbäck 1978). This goal has influenced the research design, including the main study's, in different ways. First, technology transfer has been seen in the perspective of not only aiming at installing production capacity in African industries but also at developing indigenous capabilities needed for product and process development. Second, from the very start of the research programme, the aim has been to bring about a joint project with Tanzanian institutions and in this way to stimulate further domestic Tanzanian research. Third, as a research programme set up in parallel with the development of a new programme for technology transfer (the SI programme), the research has had a certain action orientation, i.e. to serve as an input for ideas of adjustment and development of the SI programme. This has been an influence on different levels, on SI programme level as well as on the level of specific SI projects.

3.1.2 The different stages of the research programme

The early explorative period of the research programme resulted in a number of reports covering different aspects and forming a ground for the CTH study design. Among these reports were descriptive reports of the SI programme at specific points in time (Alänge et al. 1979, Löwbäck 1979, Alänge et al. 1981). These reports serve as a data base for our study of the development of the SI programme over time in the main study. To a certain extent these reports also had an aim of serving as a direct formative evaluation input in the SI programme's continuous development process. Other reports analysed specific research questions that it was possible to study separately from the main study (Alänge and Löwbäck 1981a). Finally, some reports discussed methodological issues and reported on tests of methods, especially they considered the problem of measuring capability acquisition (Alänge, Löwbäck and Theman 1981).

The CTH study was designed on the basis of the above-mentioned exploratory findings (Alänge and Löwbäck 1982). Owing to financial constraints, the participation of our Tanzanian colleagues has from then on been limited to them giving us assistance in our research. This assistance has been very valuable for our data collection and analysis, but the basic aim of having an integrated Swedish/Tanzanian research programme and indigenous Tanzanian research has not been fulfilled.

The CTH study's focus is on the acquisition of technological and managerial capabilities in Tanzanian firms and the effects thereof in terms of product innovation and economic results. The CTH study was divided into two separate parts, one primarily dealing with data on the firm level including a comparison with other mechanisms for the transfer of small scale industry technology (Löwbäck 1987a and 1987b). The other part, i.e. the present study (called the 'main study'), focuses on the individuals and the processes of capability acquisition, the resulting stock of capabilities and the effects in terms of product innovation. From here on, only this second part of the CTH study will be dealt with.

3.1.3 Comparative case studies

Our scientific field is not developed to such extent that hypothesis testing is the natural research method; instead, a search for relevant factors and subsequent hypothesis generation seems appropriate. Hence, a survey testing a few variables for a large number of units of analysis is less useful as a research design. Instead, we have an interest in a large number of variables, and this limits our study to the investigation of a limited number of units. The concept case study refers to studies where a limited number of units are studied in more detail, providing comprehensive descriptions of the units (firms, negotiation-processes, etc.).

> "Thus case studies are suitable for certain kinds of explorative investigations, where the purpose is to get a detailed understanding of what is taking place within, for example, a firm and where it is not possible to tell in advance what is important and what is unimportant to investigate." (Lekvall and Wahlbin 1979, p. 38, translation from Swedish in Svensson 1984)

The case study approach has frequently been utilized in the study of technology transfer (e.g. Chadha 1981, Brodén 1983). The early studies in the research programme were used to explore the phenomenon of technology transfer through small scale industries and to generate research questions for the subsequent main study. These studies also served as a means to establish a relation based on mutual confidence with the people in the industries studied. (See also section 3.6). This is in line with the comment by Lekvall and Wahlbin (1979, p. 38). "The researcher then establishes such contacts with the cases that he later can return to obtain supplementary data and go deeper into interesting issues" (our translation from Swedish).

Svensson (1984) claims that "In my opinion, the fact that social reality is turbulent and dynamic is better paid attention to in a longitudinal-processual case study than in any kind of experiment" (p. 65). Kjellén and Söderman (1980) are of the opinion that case studies can be used as an aid for generating new theory who in line with Glaser and Strauss (1969) claim that via "the constant comparative method of qualitative analyses", it is possible gradually to develop theory.

> "Since accurate evidence is not so crucial for generating theory, the kind of evidence, as well as the number of cases is also not so crucial. A single case can indicate a general conceptual category of property; a few more cases can confirm the indication." (Glaser and Strauss 1967, p. 30)

The value of the case study method is increased by making comparisons between the cases and something else. According to Normann (1976, p. 75) a number of possibilities for comparison are available: other cases, formal theories, ideal states and ideal types, and 'traditional norms and perceptions'. However, there are some limitations in the possibility of using even comparative case studies for generalizations.

> "It is very dangerous to generalize the insights from a single case to any other situation. ... However, with multiple cases a comparison can be made, identifying the factors and events, varying and in common. ... only reliable findings can be generalized to other situations, and then, only tentatively and to situations which have sufficient commonality." (Alloway 1977, pp. 2-3)

In line with Svensson (1984), we agree that the case study method is complicated and makes great demands on its user. The following quotation from Hedlund and Hägg (1978) illustrates this.

> "In order to conduct and make sense out of a case study you need to be a skillful question-asker and interpreter of information, a confidence builder, a paradigm-shifter, at the same time a scholar of many disciplines and knowledgeable of the practical aspects of what goes on in the situation, etc. And, as has been said, you have few rules and procedures to stick to." (Hedlund and Hägg 1978, p. 13)

3.1.4 Measurement of technological and managerial capability

What are the methods employed to measure technological change, i.e. change in the capability stock? Technological change is inherently difficult to measure and has therefore usually been measured indirectly. One way is to measure different kinds of output of technological change. One method used in ICs is patent data as indicator of technological change, but apart from general drawbacks such as the fact that some firms in order to keep their knowledge secret do not patent their inventions, the relevance of patent data for LDCs is nevertheless lower. One reason for this is that the majority of LDC innovations are incremental and hence, by definition, not patentable. Another output measure is productivity growth, but used in isolation it only captures one part of capability development, as it does not take quality changes into consideration. A further drawback might be that in some African countries environmental constraints, such as foreign exchange shortage and thereof depending raw material shortages, make industries stand idle for certain periods. This makes ordinary productivity data less reliable as indicators of the capabilities a firm possesses.

Through case studies there is a possibility of studying the outcome of technological change in more detail, e.g. new or improved products and production processes. A further output measure has been export, as it can be seen as an indicator of a firm's technological capability on an international level. Instead of measuring output it is also possible to measure inputs of different kinds. One measure has been total R&D

spending, another the number of technicians or R&D personnel. However, according to Fransman (1985), "they may be misleading as they bear no necessary relation to output." (p. 589). Instead, Fransman suggests that it will usually be necessary to use a combination of different measures of technological change. Some studies (e.g. Kilby 1971 and Wallender 1979) have identified areas where the capability shortcomings are most serious. This could as well be used as an indicator of missing capabilities.

The above-mentioned measures are all indirect methods of measuring technological change. The output methods all have a drawback in that the output is influenced by other factors, some even beyond the control of the individual firms. This calls for surveying the methods for direct measurement of capability change. We are only aware of one study in LDCs, Lester (1980), that more directly tries to study what is in 'the black box' on a detailed level. Lester studied to what extent electronic assembly operations in free trade zones in Malaysia transfer significant managerial and technological skills (capabilities) to their local employees. Lester's emphasis was on "learning effects" in the form of "generalizable managerial and technical skills" rather than the transfer of proprietary technological knowledge (from the electronic assembly industries studied). Lester utilized a combination of instruments; one was a skills questionnaire where the respondents were asked to break down their jobs into major components, called job tasks, and then to identify those technical and managerial skills needed to perform these tasks. The respondents were also asked to evaluate how important each of eight different possible sources of learning were for each of the skills that they had identified. To obtain a measure of the importance of these specific skills, interviews were conducted with employees concerning the skills that they had acquired (which they used most and what skills they would list in a job application to a local company), as well as with managers in order to have the company point of view on the value of these skills. Finally, ex-employees were asked to identify skills acquired while working at the electronics companies, and also to comment on the extent to which they use those skills in their current jobs in local industries. In this way Lester obtained a very detailed description of the work tasks for managers, supervisors and technicians, i.e. an overview of the potential for learning. The interview concerning the use of acquired skills in local industries also provided a hint on the value of this learning, but Lester did not put forward any measure of the quality or level of the capabilities acquried.

Barker et al. (1976) made a survey of the impact of technology transfer on the build-up of technical skills in 28 large-scale Tanzanian firms. This study uses a detailed analytical framework, where the firms studied were classified within the following variables: organization of manufacture, automation of manufacture and skills in industrial manufacture. They centred their analysis around some important areas: repair work and design of equipment, modification and design of products, and co-ordination of work. Barker et al. also make an analysis of the relation between production and the educational institutions in Tanzania and of future manpower needs and deficiencies. This study provides information concerning the kind of capabilities that are built-up in Tanzanian industry (mainly in maintenance and repair work) and also concerning those areas that in general show weaknesses (production and design). The data is on a relatively detailed level and provides some insight into the general skill level and the dependency of foreign sources for innovative activities, including minor modifications of products and processes.

The above studies were all conducted in LDCs. In industry in ICs, we have found some methods for analysing the capability level and development over time. Almgren and Söderberg (1980) used an instrument for measuring the capability development in work groups for the assembly of trucks. This instrument measures goal satisfaction of simple behaviouristic criteria expressed in the form of simple sentences. The capability development is checked in relation to a number of phases, each defined by simple sentences covering those capability areas that are to be analysed. The principle outline of the instrument is provided below (here with 7 goal areas and 4 development phases).

Goal areas	Development phases			
	Phase I	Phase II	Phase III	Phase IV
1. Technical skills				
2. Group efficiency				
3. The group's ability to reach goals and to formulate new goals	"Short sentences which describes the demands on the group for each goal area and development phase"			
4. Problem solution during work				
5. Project work, planning and implementation				
6. Administration				
7. Evaluation and feed-back of information				

Figure 3.1 The principle outline of an instrument for measuring capability development
Source: Almgren and Söderberg 1980

An advantage with this instrument is the practical applicability. The capability areas are defined by operational sentences, i.e. the goals are possible to measure in an industrial environment. In this way the 'relation-problem' between goal and result is avoided, because the goals are defined in terms of their results. Another strength is that the emphasis on behaviouristic criteria also means a focus on such things that directly influences the firm's operations. Individuals might think in different ways but still reach the same goal, i.e. satisfy the behaviouristic criteria. On the other hand, there is also a weakness in only studying the manifest, since the possibilities of correcting wrong performances are limited as far as the instrument does not map the road leading to the incorrect behavior. Furthermore, it is difficult to make a suitable division of capability areas and development phases. According to Almgren and Söderberg, a "reasonable" division "... got to be tried out in the individual case". (our transl.). They recommend broad behaviouristic criteria to increase the validity in relation to the total work task. There is also a reliability problem in respect of the need for a decision concerning how the number of a criterion should be satisfied before a certain level of capability should be considered to be fulfilled. This method demands some form of continuous data collection, by the researcher or by reports from the research object, if it shall be possible to check the capability development over time according to the method's intentions. If applied less frequently during short measurement periods, many situations might not occur, which implies that only very common criteria can be put down, or that some criteria will never be satisfied. Furthermore, assuming that innovation presupposes understanding of the technology, the method has further disadvantages. As behaviours are measured and we know that these might accrue in a number of ways which the method does not take into account, the possibilities of making an estimation of future innovation potential are limited, in comparison with methods analysing understanding instead of behaviour.

A way of analysing understanding of different phenomena and the influence of learning processes has been developed by e.g. Marton (1976), Svensson (1976) and Säljö (1982). In general the knowledge areas covered have not concerned industrial activity. Theman (1976) is an exception. The method applied is an in-depth interview technique developed within a phenomenological school of thought. This method opens up possibilities of analysing technological and managerial capabilities. It is further described in sections 3.2.2 and 3.4.3.

3.2 The pilot study

3.2.1 Exploratory phases

Influenced by the early explorative studies, we concentrated our interest on "the effects on the growth of technological knowledge (know-how)" (Alänge and Löwbäck 1979). In this report we used a model of the knowledge growth process, being influenced by technology transfer and other factors. Here we claimed that it was not appropriate for our purpose to measure the individual's knowledge growth directly. Instead our main interest was "in measuring the company's total knowledge growth". See figure 3.2.

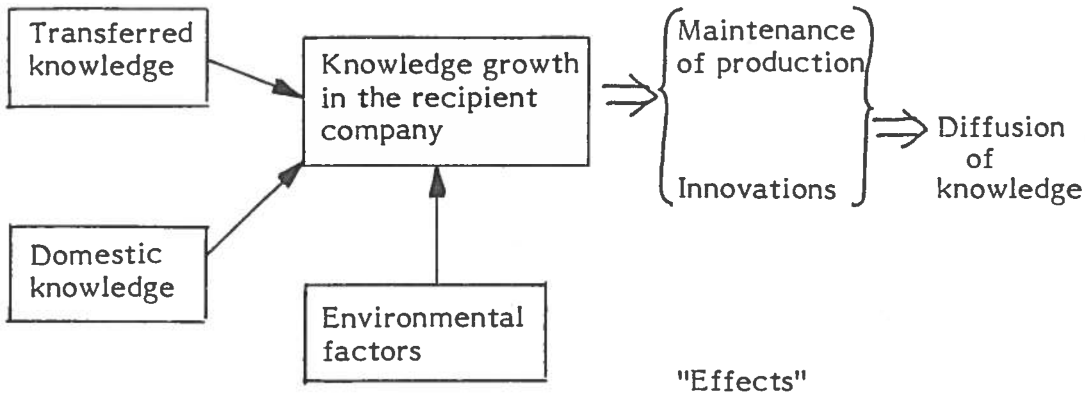


Figure 3.2 Growth of knowledge
Source: Alänge and Löwbäck 1979

Hence, we planned to measure 'effects of the knowledge growth', i.e.: maintenance of production (production capability), innovations (inventive capability), diffusion of capabilities through the assistance of indicators on potential diffusion, and 'knowledge about creating an industry' (entrepreneurial capabilities in our present terminology, see section 6.1.3 for definitions of the concepts).

To describe capability we used an established model where it was seen as consisting of: knowledge, skill and attitude. A similar model of four components was also considered, i.e. capability = motor skills, perceptual skills, intellectual skills, and social skills (Welford 1976).

However, this traditional way of classifying capability in one theoretical, one practical and one attitudinal component was found to be both hard to manage and less relevant for the study of the transfer and growth of industrial capability in an international setting. The assumed influence of the cultural factors was hard to identify by using the traditional approach (Alänge, Löwbäck and Theman 1981). Our earlier plans (Alänge and Löwbäck 1979) to measure only effects of knowledge growth combined with inductive discussions were considered to be insufficient when the aim was to identify the acquisition of capabilities in a trans-cultural perspective. Hence, we turned to the department of education at the University of Göteborg and received some assistance in developing a methodology suitable for analysing capability acquisition and the content of acquired knowledge.

3.2.2 Measurement of trans-cultural knowledge

To be able to measure industrial "capability" it is essential to explain what we mean by this concept. At first, however, we will provide a brief description of the traditional way of measuring learning.

The traditional way of measuring learning has been developed to fulfill the need of the school system, and naturally is a reflection of this. It is a preoccupation with quantitative measurements rather than the content of learning. This also implies that no routines of measuring actual skills (capabilities) have been developed. Furthermore, an assumption was made that human behaviour is similar to the laws of nature as described in the disciplines of physics and biology. This led to an underestimation of how important the other areas such as thoughts, feelings and under standing of phenomena are. However, in this study these areas are considered to be of considerable importance for the understanding of learning.

One way to study the effects of learning is to observe the behaviour of individuals. According to Ryle (1949), it is not sufficient to define capability only in terms of intelligent behaviour. Instead it is necessary to "describe the ways in which those people conduct parts of their predominantly public behaviour" (p. 51). The reason for this is, according to Ryle, that it is never possible to measure what has happened in the brain of the individual observed. Ryle provided the example of two chess players, one skilled player and one without understanding. Both were able to learn to move the chessmen in the same way according to a studied game of chess. However, these moves had very different meanings for the two players and very different effects on their capabilities as chess players. Hence, it is not sufficient only to observe Ryle's chess players, there is also a need to consider the content of the observation and its design (Alänge, Löwbäck and Theman 1981).

This line of thought has been developed by, among others, Marton (1976, 1978, 1982) and Svensson (1976). Their basic assumption is that all human actions emanate from a mental conception of these actions. They claim that it is not possible to act without the action being formulated in to thoughts, i.e. what you can do you can express. In this way the prime measurements would not concern the amount of knowledge (quantitative focus), but the content and structure of the knowledge that results in actions. Thus, this knowledge could be practically expressed in terms of concrete categories of thought (descriptive categories of conceptions).

> "A conception exists in the real world only in terms of a mental act and is exhibited by someone who does something in a certain setting." (Marton 1981, p. 196)

The last line emphasizes Marton's view of the importance of the context for learning. Marton and Svensson also see learning in a 2nd order perspective, i.e. as it is perceived by the learner and not from the 1st order perspective, i.e. as it is experienced in traditionally defined results.

> "The idea is here to describe learning from the learner's own perspective, to outline the structure of the learner's experience. There is, however, an interplay between our own preconceived ideas of learning and what we observe and discern about other's experience of learning. We understand what we see in terms of our ideas but, on the other hand, our ideas are shaped and modified by our understanding of what we see. The way we characterize the learner's experience of learning has thus to be understood in terms of our conception of learning, which in turn is a result of our anlaysis of the learner's experience of learning." (Marton 1982, pp. 5-6)

This has implications for the selection of method for data collection and analysis and has led to the development of in-depth interview techniques (see Svensson and Theman 1983a, Theman 1983b).

The methodology for our study of the stock of capabilities in the Tanzanian industries has been influenced by the work of Marton, Svensson and Theman. We view capabilities in the context of specific industrial work tasks and our data collection as well as our analysis starts out from the perspective of the interviewee's perceived capabilities. However, there were some basic differences between our objects of study and phenomena of interest and those in the studies by Marton and his group of researchers. In Alänge, Löwbäck and Theman (1981) the first test of the in-depth interview technique in the Tanzanian cultural setting was made. We chose to study two different phenomena; one was the design of work places for assembly operations, the other concerned work at a spot welding machine. The interviews were technically somewhat limited but they showed some of the advantages and limitations of the method. Our design has hence been modified so as to collect data on the stock of capabilities in different complementary ways and to analyse the stock from different points of departure. A more detailed description of the method used in our study is provided in section 3.4.

3.3 The main study - introduction

This study's most central areas concern the capability acquisition process and the individuals' stocks of capabilities. A comprehensive description of a number of individuals' capability acquisition processes has been used as an input for a discussion about the influence and significance of technology transfer projects as a means of capability build-up.

Other sections of this study are based partly on these descriptions but also on a broader data base, involving data from a larger number of companies within the SI programme.

3.3.1 Case study structure

The empirical findings are presented as case descriptions of the capability acquisition process and of the prevalent stocks of capability. The case studies have the same broad structure, but differ on the level of detail. The focus is primarily on five first-generation SI projects: AMI, FAWIPMA, KIMESHA, NEM and UHANDISI. The other case studies: three second-generation SI projects, MAFOTCO, PEMACCO and TANLOCKS, are on a less detailed level. 'First generation' refers to junior sister companies started in 1978-80, and included in 'second generation' are those companies that were started between 1981 and 1983.

The case studies of the capability accumulation process in the junior industries have a basic structure which focuses on one or a few selected individuals who have participated in training programmes in Sweden. At present, these individuals primarily hold the positions of managing directors and/or production managers. The aim is to illustrate the technology transfer process of each junior industry, in the context of previous experience of individuals involved and of other sources of capability acquisition besides the SI programme. In this way, a few cases, showing in detail the capability accumulation process and resulting capability stock for some individuals, are used as a basis for discussion.

Among the total population of 25 SI projects at the time of our data collection, the SI firms selected for our study were chosen to obtain variation in the following two parameters: i) incidents of change; and ii) length of training programme. 'Incidents of change' mean all those activities that result in some form of innovation (product, production process or market). Furthermore, in order to analyse the SI programme's development over time the projects were divided into two groups according to iii) the year of implementation.

Firm	Incidents of change	Length of training	Technology complexity	Year of implement-tation	
AMI	low	long	high	1979	First generation
FAWIPMA	high	long	medium	1979	
KIMESHA	high	short	low	1978	
NEM	high	short	medium	1979	
UHANDISI	low	short	low	1978	
MAFOTCO	-	long	medium	1981	Second generation
PEMACCO	-	long	high	1981	
TANLOCKS	-	long	high	1981	

Table 3.1 Firms studied for capability acquisition

The structure for each case description, includes eleven sections, as follows:

1. Introduction - description of the firm
2. Background of the individual
3. SI programme - phase I
4. SI programme - phase II
5. Other sources of capability acquisition
6. The process of capability acquisition
7. Stocks of capability
8. Static versus dynamic capabilities
9. Management composition
10. Strengths and weaknesses of the firm
11. The contribution of capabilities to Tanzania

Each case study is introduced by a short description of the firm and its products, production process, etc. The cases are then structured in a longitudinal order, i.e. starting with background training and experience, followed by the content of the first phase of the SI programme and concluding with the continuation, or second phase, of the SI programme. Phase I is considered as the start of the first organized training or learning opportunities for an individual in an SI project. This phase ends with a successful performance test or, in the case of foreign instructors remaining in Tanzania after this date, with the return of these instructors. If the instructors return to Tanzania at a later point, this is considered to be in phase II, i.e. the continuation of the SI programme. The same classification is used concerning recurrent visits by Tanzanians to Sweden for further training. Section 6 summaries the capability acquisition process described in the preceding sections.

Section 7 gives a detailed description of the stocks of capability within certain known 'trouble areas' within African industry: ordering of raw material, maintenance, product development, production planning, quality control, marketing and cost calculation. Section 8 provides a description of the general character of the capability stock, whether it is static or dynamic. Section 9 concerns the capability composition of the whole management group, i.e. not only the individuals figuring in the previous detailed sections. The aim is to identify whether the firm as a whole lacks essential capabilities or if the management team is well composed, i.e. has a management depth. Section 10 is a summary of the strenghts and weaknesses of the firm's capabilities. Section 11 lifts the analysis to another level, as it is concerned with the contribution of capabilities to Tanzania at the time the sister industry programme was started. The eight case studies are presented in full length in Alänge (1986a). Excerpts from the case studies are provided in Chapters 4, 6, 7 and 8.

3.3.2 The broader data base

The case studies form the most important part of our analysis of the process of capability acquisition and of the stock of capabilities. However, these case studies primarily focus on a limited number of individuals in eight different firms. Especially the study of stocks of capability is limited to one point in time, whereas capabilities are changing all the time. The stock of capabilities is different now from what is was when our in-depth interviews were made in 1983. To develop the longitudinal component of the study as well as to broaden the number of cases, data from previous exploratory studies has also been used. In this way also the historical perspective has been considered.

The study of motives for individuals to become entrepreneurs serves two different purposes. First, it is used as a background chapter for the analysis of factors influencing the capability acquisition process. Second, it has a value in itself in providing empirical data about the conditions and motives for African entrepreneurship in the light of theoretical contributions by Shapero (1980).

The motives of the Swedish small scale industries to enter into international technology transfer projects were analysed in a report published earlier (Alänge and Löwbäck 1981a, now available in a slightly revised English version; Alänge and Löwbäck 1986).

3.3.3 The time model of capability acquisition and capability stocks

In chapter one a time model of capability acquisition and capability stocks was presented (see figure 1.1). The focus in this model is on the process of capability acquisition and its effect on the stocks of capabilities during different time periods. In figure 3.3, we have used a slightly modified version of this model to illustrate our data collection. Some additions have been made in order to make possible a comparison between the Tanzanian national stock of capabilities and the addition of capabilities through the SI project.

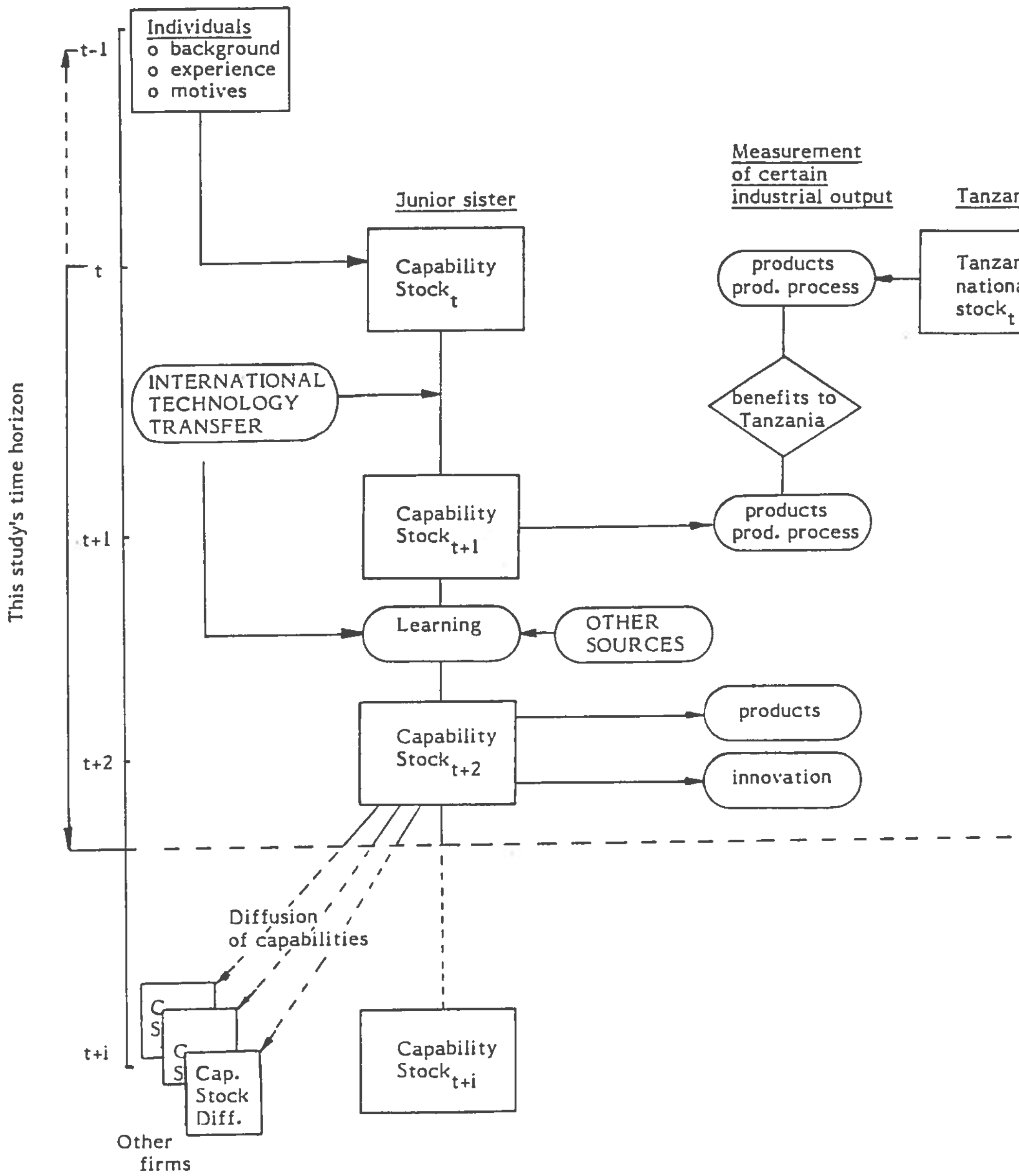


Figure 3.3 The time model of capability acquisition and capability stocks and this study's outline

The framework is centred around the development of the SI entrepreneurs' capability stock as obtained through the international technology transfer project (ITT). The impact of other sources on the SI entrepreneurs' capability stock is also considered. In addition, a comparison is made with the national Tanzanian capability stock prevalent at the start of the SI project (see figure 3.3).

Below a summary is provided of the concepts and main variables in a time perspective, including the main measurements of industrial output in this study.

t-1: Historical analysis of the SI entrepreneurs' background, education, previous experience and motives for becoming entrepreneurs. The primary means of data collection has been interviews with the SI entrepreneurs.
(Chapter 4, 5 and case studies)

t: Start of the SI firm. The SI entrepreneurs have a capability stock ($Stock_t$), formed by their background knowledge and experience. This stock has been estimated by using the historical analysis and supplementary interviews with the Swedish instructors.

t->t+1: Influence of an international technology transfer project (ITT), including training, etc. This process has been observed in a longitudinal study involving several visits to Tanzania and to Swedish senior sisters during the period 1978-83. Interviews have been the method of primary data collection, but observation and secondary data have also been used. The secondary data includes training programmes and evaluation reports by senior sisters and consultants.
(Chapter 7)

t+1: The capability stock at the time t+1 ($Stock_{t+1}$) as a result of the ITT. The measured output is products and a production process.

t+1->t+2: Learning-by-running the company in combination with the continued influence from the ITT and other sources of information and knowledge. Interviews have been conducted with the SI entrepreneurs and with Swedish instructors.
(Chapter 7)

t+2: The resulting capability stock ($Stock_{t+2}$) is measured for the final analysis of the ITT project's contribution to capability acquisition in terms of managerial as well as technological capabilities. An in-depth interview technique was used to measure these capabilities (see section 3.4). Furthermore, the output was, to some extent, measured in terms of production of the products introduced by the ITT project. Originally, the plans were to measure production and productivity development over time. However, due to environmented constraints (shortage of raw material), production was totally dependent on Swedish import support allocations for raw material. Hence, the production volume did not reflect any capability accumulation and was, thus not useful for our purpose. Lastly, the output was measured in terms of innovations (product, process and market innovations). This data collection was carried out through interviews and observation.
(Chapter 6)

t+i: The capability accumulation continues resulting in new capability stocks, e.g. $Stock_{t+i}$ at time = i. However, the time period after t+2 is not covered in this study.

As shown above, the main emphasis in this study is on the process of capability acquisition (Chapter 7) as well as on the capability stocks and its impact on innovation (Chapter 6). The study also aims at providing some insight into the influence of an international technology transfer project on the development of African entrepreneurship in a broader sense. Hence, some supplementary areas are covered in this study. These areas include the diffusion of capabilities within and from the initially formed industries (Chapter 8), and a study of benefits and costs of the SI projects (Chapter 9). In the latter chapter a comparison is made between the output of the SI project at time = t+1 with the existing output on a national level at time = t, i.e. when the SI project was initiated. Finally, in Chapter 10, "Technology transfer, entrepreneurship net works and infant industries", a synthesis is made of the preceding chapters, relating the impact of international technology transfer on capability formation to other sources' influence on the capability formation.

In the following sections (3.4-3.7), a more detailed description of the specific methods used to study different factors is given.

3.4 Methodology - Stocks of capability

In order to identify the stock of capability, the data collection has been carried out in three complementary ways. First, a general explorative overview was conducted of the different capabilities needed to run an industrial firm. Second, this overview has supplemented by an analysis of identified weaknesses in the stock of capabilities. Third, in-depth interviews covering selected areas have been conducted.

The data was collected during a 6-year period (1978-83) and the in-depth interviews and weakness analysis were primarily concentrated to the two last years (82-83), i.e. when the industrial firms studied had some years of production experience. Interviews concerning the stock of capabilities have been conducted with a total of 18 SI entrepreneurs from 8 different junior firms.

3.4.1 General overview

The explorative phase of the data collection has had a broad approach, covering most SI projects and most areas of importance for running an industrial firm. However, the focus has been on the management group, i.e. primarily on the individuals who were trained in Sweden.

The primary means of data collection has been interviews. Questionnaires with open-ended questions were used, covering functional knowledge areas such as: plant management, production, materials management, maintenance, quality, accounting, personnel, and marketing. These interviews have been supplemented by interviews with Swedish instructors as well as by relevant documents and reports. Finally, our own observations of different activities and planning procedures have provided a more complete picture of the stocks of capabilities.

A general aim has been to connect the issues raised during the interviews, to reality. For example, when discussing capacity in product calculation, this includes the examination of cost calculations completed. In this way, validity was improved and some interview effects were avoided.

3.4.2 Weakness analysis

Literature (Welford, 1980) reveals the importance for an individual to have a complete register of abilities needed, especially concerning high order skills, i.e. management capabilities etc. If, for example, four specific kinds of skills are needed, extreme competence in three of them do not outweigh a low level in the fourth. Similarly, in studies concerning entrepreneurship and the success of new firms, the importance of forming a management group with capabilities covering all necessary areas has been elucidated (Utterback and Reitberger 1982, Karlsson and Gadde 1983). This leads us to the strategy of studying the weakness in the present capability stock of the individuals and the group of managers, in order to identify missing parts in the process of capability development.

Weaknesses might be identified through observations, but the primary sources for the weakness analysis were the general overview and documents such as production and marketing statistics, statistics of incidents of change and statistics of failures or general problems.

Direct interview questions concerning change failures, general problems, etc., also served as starting points for the data collection. The aim was to give an answer to the following questions: What sort of weakness seems to be prevalent in the stock of capabilities? In what area of capability development is the weakness most serious and hence most urgent to correct? Is there any inherent weakness in the SI mechanism? If so, is it possible to correct this weakness within the existing SI programme structure?

3.4.3 In-depth studies

A number of problem areas were selected for in-depth studies of the capabilities within these areas.

While this study's aim was to analyse capability build-up and stocks of capability, it was found that an explorative approach covering a broad range of capabilities sometimes only provided a surface understanding of the phenomena studied. Hence, a need was felt to refine the methods of data collection and data analysis in order to obtain a better understanding of capabilities (Alänge, Löwbäck and Theman 1981). Direct test methods in respect of abilities were found to be undesirable because of the necessity of access but also because of prevalent cultural bias, i.e. methods developed for use in one society might not be suitable in another society.

Quite recently, an interesting research approach to studying the effects of training/learning in terms of understanding, has been developed at the department of education at the University of Göteborg. A group of researchers, under the supervision of Professor Marton, have developed an in-depth interview technique as an instrument in analysing interviewees' understanding of certain phenomena. This group works with a phenomenological approach which aims at grasping the interviewee's understanding of the phenomena studied, expressed in his own words (for a review, see Gibbs et al. 1980). The approach has primarily been used in different studies of students' understanding, for example Johansson's (1981) study of the students' understanding of "Forces in motion" at the department of Mechanics at Chalmers University of Technology. That study will serve as a basis for modification of the present teaching method which has shown severe limitations. However, the method has also been applied in studies at industrial sites (Theman 1976). For a recent methodologically-oriented dissertation from this group of researchers, see Theman (1983b). The above methodological developments have inspired this study's design, but there are some important differences that influence the direct transferability of methodology. The following has been characteristic of the majority of the studies made by Professor Marton's group of researchers:

- One or a few phenomena (concepts) have been studied in each study. For example, in Theman's study (1983b) the phenomenon was 'politisk makt' (= political power) and in Johansson (1981) the phenomena were mechanical forces influencing objects in motion.

- Each interview has been very 'deep', in that there has been plenty of time for each phenomenon and it has been possible to discuss it in detail (as the total number of phenomena was very low). As the aim is to get the interviewee to express his understanding in his own words, this has required special training in interviewing, in order to avoid influencing the interview through 'leading questions'.

- The studies have all been made within the same culture, using the mother tongue of the interviewee as well as of the interviewer.

This study's design has primarily been influenced by the above-mentioned methodological research developments. However, the in-depth interview as an instrument for acquiring one's own understanding of complex relations has frequently been used in studies with a qualitative methodological design (see Lund 1969, Granstrand 1979).

However, as mentioned above, this study's purpose and location in Tanzanian industry make the research situation somewhat different as compared to that of the Marton group. The following dissimilarities distinguish this study from the above description.

a) Technological capabilities as well as managerial capabilities consist of a large number of phenomena. Hence, the potential and perhaps also necessary capability area to study is very wide. This is also the case in the depth study, although the number of phenomena (problem areas) studied here has been heavily restricted.

b) The data collection was carried out by interviewers from one culture with interviewees from another quite different culture, in a language (English) that was not the mother tongue of either party.

c) The in-depth interview approach requires that a relationship of mutual trust is established between the interviewee and interviewer (Theman 1983a). This is especially so in this study, as the aspects and phenomena asked about are often the ones where the weakness of the individual's stock of capability becomes evident. This is, of course, a natural outcome of the manner of selecting phenomena in this study. Nevertheless, this makes the interview more complicated, especially as it was sometimes hard to establish the proper relationship because of the limited time to cover several areas together with managers with a full schedule in their firm. There were examples of the interviewee feeling threatened by the manner of questioning, and developing suspicions that the interviews had other aims than pure research. However, most interviews were made with individuals already acquainted with the researchers and their previously published research reports, and thus the desirable relationship was easier to establish.

d) A certain bias was introduced by this study's design, with recurrent interviews covering broadly the same areas. This has further been influenced by other researchers, consultants or journalists studying the same SI firms. This questioning might have influenced the interviewees' ability to answer the questions as well as contributed to the learning process. One of the SI entrepreneurs said, when asked if he felt all these interviews to be trying and disturbing (rendered freely):

"No, not really as I learn all the time from the questions you ask. If there is something I can't answer, I can go back and investigate it, and next time I get the question I will be better prepared to answer it."

e) The data collection in Tanzania has been carried out primarily by one Swedish researcher interviewing one single interviewee. A considerable part of the data collection has also been carried out by Tanzanian researchers in the same type of face-to-face situations. However, starting in 1980 some interviews were also carried out by a team of one Tanzanian and one Swedish researcher. An observation from these three types of situations was that they yielded different results in answer to the same type of questions (open-ended questions). The Swedish researchers received more comprehensive answers in certain areas, primarily where the Swedes might be supposed to have a certain influence, whereas the Tanzanian researchers did not obtain this kind of data, but on the other hand received answers richer in other fields. The Tanzanian/Swedish teams obtained relatively meager results, primarily data of a more neutral nature.

However, this situation was in conflict with another methodological aim, namely to avoid cultural bias through joint data collection and data analysis. The result was that most interviews were carried out by Swedes or Tanzanians individually. The co-operation was also limited by financial constraints for the Tanzanian party. However, in 1983, some interviews were again conducted by a Tanzanian/Swedish pair of researchers. This time, the previously experienced negative effects on the comprehensiveness of the data, were very limited. The main reason was probably that this time the Tanzanian researcher was well-known from earlier visits and research reports and hence, an interviewing relationship of great trust was established.

This cross-cultural team of interviewers had several advantages in the interviewing situation, especially as compared to a European researcher conducting interviews in Africa. Firstly, some mistakes owing language or culture were avoided in questions as well as answers. Secondly, follow-up questions of a more valuable character might come up. Thirdly, the validity is further increased if a preliminary analysis of the data is carried out in direct connection with the interview. Fourthly, draft research reports might receive cross-cultural comment.

However, especially for cross-sectional studies (surveys etc.), the above-mentioned restrictive effects of cross cultural interviewer teams must be considered, in the design and evaluation of the study.

3.4.4 The design of the in-depth study

The characteristics described above of the research objects/situation provided the framework for the design of the in-depth study. A limited number of problem areas were selected, and each of these was studied according to a three-step research design: i) limitations, ii) conception and iii) action.

i) Limitations
To obtain a picture of the interviewee's frame of reference, questions were asked about how the interviewee experienced his present function and what limitations he was facing both socially and in terms of competence. This facilitated the continued analysis of the individual's capability. The questions were related directly to reality to avoid general and diffuse answers.

ii) Conception
Here, we adopt the viewpoint that one can describe with one's own words anything one can do, i.e. describing the world, "as it is experienced" rather than describing the world "as it is" (see Svensson 1976 and Marton 1978). In contrast to behaviouristic tradition, which only measures effects, we can obtain a description of the apprehension of the object behind the observable action. This provides the opportunity, in a cross-cultural process (international technology transfer), to analyse apparently irrational actions, which might be interpreted by traditional methods as being due to an unsuccessful education, etc., leaving the essential reason for the action unidentified. For the in-depth interviews tape-recorders were used in order to record the exact wording used by our interviewees. In cases where tape-recording turned out to be a disturbing factor, normal interview techniques or conversation was used as a substitute.

iii) Action
The third step involved an investigation of how various activities in each problem area were carried out in practice. This information has been collected by direct observation, various documents and by interviews with the Swedish instructors who had made another visit to Tanzania, some years after the start-up phase.

3.4.5 A problem-solving model of change capability

Of specific interest for this study is the development of inventive and entrepreneurial capabilities, i.e. change capabilities. Hence, for all the problem areas concerned, the specific perspective of change capability has been emphasized. To make the concept of change capability operational, we have used a problem-solving model. This model of change capability, involving technology as well as management, consists of four different components:

1. Capability to diagnose problems and opportunities
2. Capability to generate change propositions
3. Capability to evaluate and to make decisions
4. Capability to implement the change propositions

These four capability components constitute the essence of abilities needed to accomplish change activities. However, the change activity steps do not usually follow a simple one-way process. Instead, there are frequent feed-back loops as the model below shows.

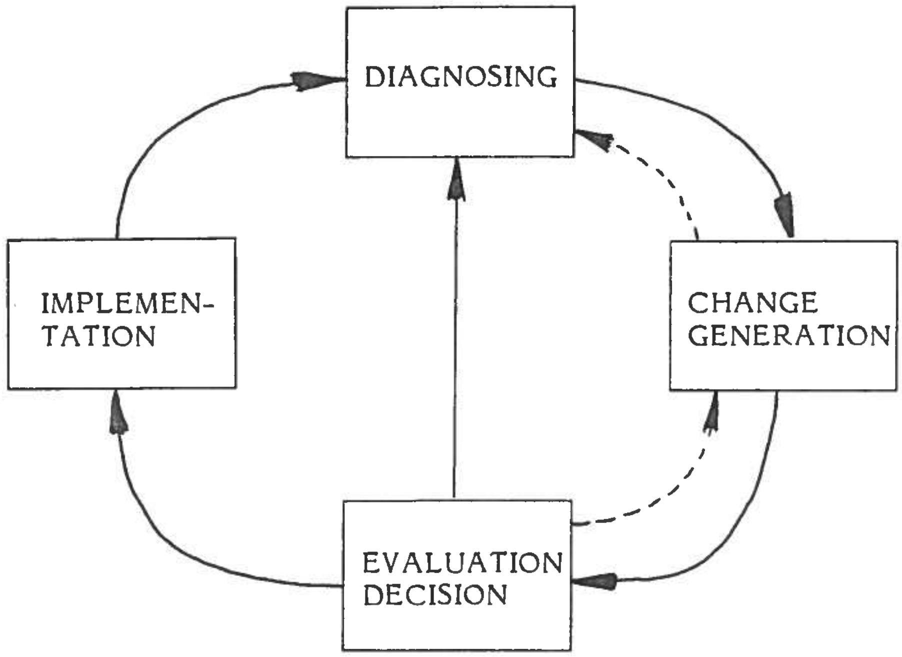


Figure 3.4 A problem-solving model of change capability

Either the process starts with the diagnosing (including spotting) of a need (problem/opportunity) (pull-effect) or stems from technical knowledge in the form of a technical solution 'searching for' an application (push-effect). Mostly, however, it is a circular process working in the direction towards the more specific, by the repeated defining of needs and technical solutions. As an industrial firm works in order to carry out profitable projects, the third component, the capacity to evaluate and to make benefit calculations of change propositions, is of essential importance. The change should only be introduced if it provides returns in profit or in some other unit of measurement used within the firm. Finally, the question concerning implementation remains. If we look at the decision-making process from a managerial point of view, one essential question, during all four phases, is to what extent the tasks should be carried out inside the firm and what should be bought from the outside in terms of machinery, components as well as services. In this context, bargaining capability might be essential.

(I) Capability to diagnose problems and opportunities

The ability to diagnose a problem or an opportunity is fundamental to any activity directed towards change. When talking about product development, identification of the needs (opportunities) of the market is of basic importance. Furthermore, the ability to diagnose problems in the production process, product design, market performance, etc., is crucial for process and organizational innovations as well as for product improvements. Here, the first step in the development is the diagnosing, followed by the search for solutions and the eventual perception of a possible technical solution, a phase demanding capability of the next type, technical knowledge. Recently, studies (Farrell 1979b, Wallender 1979 and Bell and Hoffman 1981) concerned with the development process of industries in developing countries have stressed the importance of a diagnosing ability or "problem sensing capability" in the terminology of Farrell (1979b). Especially when parts of the technology are acquired externally, the capability to formulate the diagnosed problem or oppor tunity in terms of a specification of demands is essential.

This diagnostic capability is needed at several levels in the firm. One of the most important is the need for a top management that can look ahead and use its "imagination" (the word used by a general manager for an inventive firm).

However, certain shortcomings in this area have become evident in developing countries' industries. Wallender (1979) says: "The major problems confronting user firms in developing countries are ... building a basic management structure and developing the internal capability to diagnose problems and identify the types of technologies that will be of greatest value in improving the capabilities of the firm." (p. 49).

This study's main emphasis concerning change capabilities was to analyse the capability to diagnose problems and opportunities within the problem areas selected. According to the original research design, the problems for analysis should be of two different types: actual and hypothetical problems.

Naturally, actual problems are dependent on the type of company investigated and will hence differ between companies. The advantage of hypothetical problems is that the same problem and same questions could be used for all objects of study, facilitating a direct comparison. Furthermore, when dealing with hypothetical problems, we approach one of the most important management components: planning. "Hypothetical thinking is the essence of planning." (Dahlgren 1981).

However, it was found that within the problem areas chosen (raw material planning, maintenance, product development, etc.), the actual problems that could be used as points of departure were quite general for all firms. For instance, all companies suffered raw material shortages. Furthermore, the need to establish and maintain the interviewing relationship was found to be greater when approaching hypothetical problems. This, in combination with our limited time resources was a further reason for using actual problems as a point of departure. Finally, the potentially increased validity, when using a problem familiar to the interviewee, influenced our decision primarily to use actual problems as our points of departure. To some extent, even the general problem area was used without basing the interview on an actual specific problem. However, if time and resources had been available, we believe that it would have been valuable to develop a study of diagnosing capabilities with the approach of using hypothetical problems as a point of departure for the interviews.

The questions to be answered were: What is the capability for diagnosing problems and opportunities? Has this capability been augmented by the SI projects? If not, from what source does the accumulation of diagnosing capability stem? Did the SI projects have as a purpose to develop this kind of capability?

(II) Capability to generate change propositions

What is needed is a certain minimum stock of knowledge that provides the basis for identifying the possible technical solutions as well as the knowledge of what may be needed to effect the change. For example, knowledge of material may be a very important factor in several product change situations, as it provides the possibility of altering the source of raw material supply, including the possible use of local raw material. It also sets the functional limits for product designs and production processes, etc. Other areas of technical knowledge are: methods of production, strength of materials, mechanical, electrical and electronic knowledge, drawings, toolmaking and test procedures.

Furthermore, certain innovative and systematic techniques might be of considerable importance. This group includes: information seeking capability, functional thinking, group work, etc. For example, the information-seeking capability requires particular consideration as development work never proceeds in a vacuum. Literature gives numerous examples of the importance of a wide network of contacts and information channels. Information channels commonly used are: technical magazines which provide insights into technical novelties as well as machine and trade exhibitions. The opportunity to discuss technical solutions with people from related industries provides a great deal of input for new solutions, as has been shown by studies in a high-technology environment, the micro-electronic industry in the Silicon Valley in the US (Rogers 1981) as well as in a low-technology environment, the Gnosjö-area in the Småland county of Sweden (Frej 1981).

Another capability is also needed for development work. It could be described as the ability to think in terms of functions, rather than in terms of parts making up a product. This is very essential in order to be able to create new solutions to well-known problems. There are several methodologies for obtaining this capability (for example value analysis, see Miles 1961), and in all cases their thinking is in terms of functions as a common denominator.

(III) Capability to evaluate and make decisions

The changes undertaken in industrial firms must show some benefits, normally in terms of profit, such as less man-hours per unit, lower unit cost, etc. but might also be evident by other parameters such as improved working conditions, etc. The capability to make a cost estimate is central. Of course, the type of calculations needed will vary from situation to situation, on some occasions only consisting of a rapid rough mental estimation, other times requiring a considerable amount of investigational and analysing work.

However, for an entrepreneur in a new firm considering changes in product or anything else, some basic understanding of cost calculations, liquidity budgeting and investment calculations is needed. These abilities are so central that it is not sufficient that a consultant, whether foreign or local, makes the economic calculations; instead this type of capability is needed in-plant. Furthermore, a close understanding of the technology is, in general, needed to make proper calculations. Even though a hired consultant has considerable experience in calculation technique, the lack of knowledge of the process may result in inferior cost estimates. A cost-calculating system introduced in the grey-iron foundry (GIFCO) by a local firm of consultants is an example. The foundry's activity is service casting, which means that the customers come to the foundry to ask for a very wide variety of products to be cast, varying greatly in complexity and weight. However, this firm of consultants distributed the costs according to the weight of the final product, which resulted in heavy simple products like manhole covers being overpriced in relation to small, light and perhaps complicated items, which were underpriced. Knowledge of the following was missing: the technique and the products, the complexity variation and the work amount needed for each type of product. However, if the raw material shortage was so severe that it motivated pricing solely according to raw material use, the pricing motivation should have been clearly spelled out.

The capacity to evaluate and make decisions is as important if the firm itself decides to carry out the work as if some one else is contracted and ready-made solutions are bought.

(IV) Capability to implement change propositions

Certain kinds of change propositions are possible to implement without considerable investments, e.g.: minor product modifications, re-organization of production flow and finding a new source of raw material supply, while other change propositions demand heavy investments in R&D, laboratories, machinery, etc. Thus, in most cases, investments in hardware and knowledge are necessary for a firm to have the capability to implement change propositions.

All four steps constituting change capabilities were used as a background frame for the interviews in all different problem areas. However, as mentioned above, emphasis was put on analysing the capability to diagnose problems and opportunities.

3.4.6 The problem areas selected

To a large extent, the problem areas selected were the same for all objects of study. However, to be able to elucidate certain capability areas of specific interest, some problem areas were selected only for one or a few companies.

The problem areas studied were selected on the basis of problem areas indicated by previous research (Gabriel 1967, Kilby 1973, Stewart 1979) and on the basis of the results of previous exploratory studies (Alänge et al. 1979, Löwbäck 1979, Alänge 1980) as well as of our pilot study (Alänge and Löwbäck 1981b).

The problem areas that were studied in detail were the following:

(i) raw material planning
(ii) production planning and management
(iii) maintenance
(iv) product development

(i) raw material planning

A common problem among our study objects, and a well-known problem in countless industrial projects in developing countries, is frequently re curring interruptions in the supply of raw material, resulting in a sub-optimal utilization of capacity (Wangwe 1976). This is partly due to factors beyond the control of the individual company. For instance, in Tanzania, a large deficit in the trade balance has led to the country's industries not having access to sufficient foreign currency to be able to import raw material enough to permit full utilization of capacity. However, the external factors are not the only ones, as the problems are augmented and/or caused by shortcomings in internal raw material planning and ordering as well. The question is: "How should one proceed, and what must be kept in mind when ordering raw material?".

The focus is on the time/quantity relationship. This brings up the question of planning for future use and of finding an order level which will prevent shortages from occuring. It is interesting to note, in this context, that traditionally, there are no absolute times in Africa, as the 'life-cycle' has had very few 'must-get-things-done periods'. This is in contrast to Sweden, where the summer/winter variations have limited activities (Brandström 1981). In Tanzania, the only set period has been the hoeing period at the beginning of the rainy season, when everyone is intensively involved in getting as much planted as possible. Otherwise, everything can be postponed till the next day, an attitude reflected in a multitude of proverbs, such as; "Hurrying, hurrying brings no blessing", "The one who walks slowly doesn't stub his toe", and "Pissing quickly will not make the journey go faster". The people interviewed by us generally have some experience of industrial work (up to 10 years) with set working hours, etc. but they are, however, the first generation of industrially trained people in Tanzania.

One way of handling the problem of raw material shortages is to conduct all planning/ordering, etc. in the best possible way within the given structure. Another way is to change the conditions of raw material need and sources, i.e. to influence those factors that are within the control of the individual company. Examples of this kind of solution could be to develop alternative products using local raw material or to increase local content in the present products.

ii) Production planning and management

The internal planning, scheduling and control of production has been a problem area for African industry (Kilby 1971). Also here our focus is on time/quantity relationships. The task is: Describe how you proceed with the planning and organization of production.

Here we are also concerned with the implementation, modification and use of various management information systems. A further subject is the organization and use of incentive systems in production.

(iii) Maintenance

Maintenance of machines and equipment is necessary in order to maintain a production system. Maintenance activity can be divided into preventive and corrective types. Developing country industries have traditionally concentrated almost exclusively on the corrective type, i.e. repair of broken components.

Thus, industrial activity in developing countries has often been characterized by completely broken-down machinery or long waiting periods for spare parts. This is due to untrained labour, but also to the financing situation (especially when aid money has been involved), which often makes it easier to purchase new machines than to repair the old ones. It can be especially difficult to justify such efforts when there are no clear signs of breakdown. Therefore, traditional maintenance ability has been almost entirely of the corrective type; when something has broken down, it has been repaired.

In the cases of our objects of study, the Swedish sisters have mostly prepared detailed plans for preventive maintenance, with written lists of how maintenance is to be carried out daily, weekly, etc. ending with extensive overhauls every other year. What do these plans mean in practice for the people who are to run the industries in Tanzania? Do they carry out these maintenance programmes mechanically, or do they have enough understanding to be able to design a maintenance programme on their own, for instance, for newly-purchased machinery? In this context, the time aspect is important, as are costs, wear, etc.

(iv) Product development

The most important reason for importing technology, other than to obtain access to products, is to develop inventive capability for use in change activity. According to earlier models, this is regarded as a step-by-step process. Above, we pointed out the need to analyse the diagnostic capacity. In our study objects, some changes had already taken place. The pilot study showed innovations in products, production techniques and in organization.

Actual observed changes (innovations) are interesting to study, as is the thinking leading to, or interrupting, innovative activity. During the pilot study (Alänge and Löwbäck 1981b), a minor investigation of product development activity was made. In response to market demand, a modification of the standard product was made. The result was a somewhat lower rate of raw material consumption but, on the other hand, introduction of new work elements disturbed the normal production somewhat. The main question then became, "Is it worth manufacturing this modified product, considering the profit estimated from this production volume?" This is the line of thought of the person responsible for the development in the case at hand but there are indications that reasoning concerning developmental work does not always follow these lines. The questions consequently arising are: How did the interviewed person learn to think in this manner? What shortcomings in the educational programme are exposed? In summary, the key question in this section is: What is the structure of thinking concerning product development, in terms of diagnosing, technical solutions and calculations and estimations of market opportunities?

3.5 Methodology - The process of capability acquisition

The process of capability acquisition might be influenced by many factors. The individual's background, learning capacity and motivation naturally have a decisive influence on the outcome. Also, the design of training programmes, the experience and motivation of instructors as well as possibilities of working in an industrial environment that provides learning-by-doing experiences, are essential factors. Furthermore, more gene ral economic conditions and environmental factors influence the small Tanzanian industrial firms and hence, in an indirect way, the learning opportunities. Moreover, different factors have a different influence during different time phases.

One of the main purposes of the present study is to identify factors influencing the capability acquisition process. A second aim has been to throw some light on the relative importance of different factors and sources and then especially to elucidate the SI programme's relative influence.

Our data collection was guided by a tentative model of factors affecting the accumulation of capabilities (see below). This model was based on findings from our pilot study. To this model's historical factors was added 'family background', a factor that in several studies (Marris and Somerset 1971, Utterback and Reitberger 1982) has been shown to be of importance for the success of small scale industries.

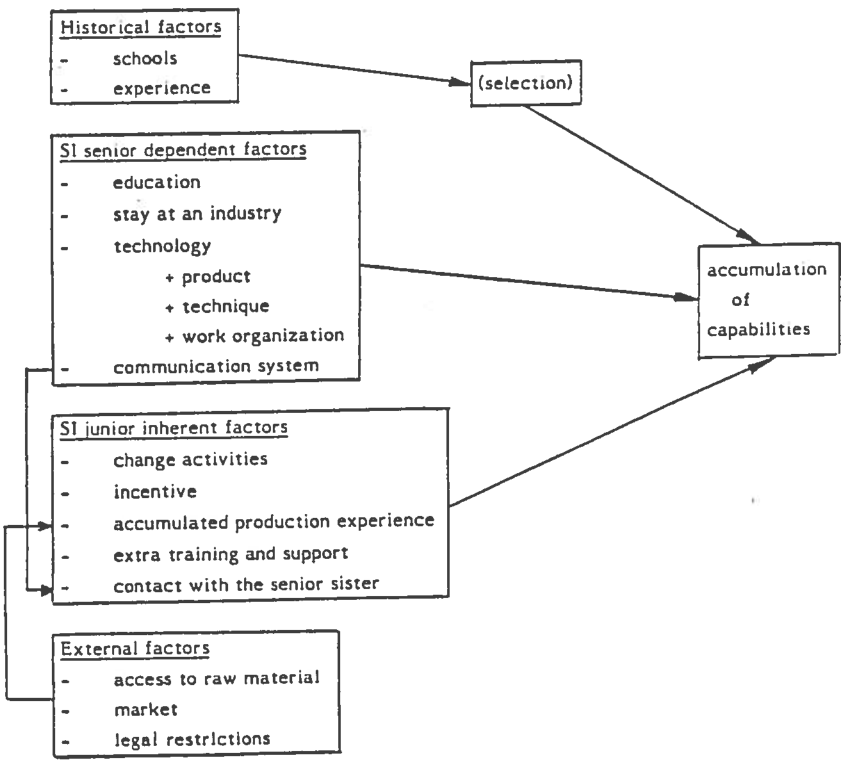


Figure 3.5 Factors affecting the accumulation of capabilities in the case of the SI industries in Tanzania
Source: Alänge and Löwbäck 1982, p. 123

This model influenced the areas covered during the data collection. However, the study has still had a certain explorative emphasis which has contributed to a modification of this tentative model.

During different phases different factors and sources are of importance. The tentative model (fig. 3.5) is in some respects static as it provides a picture of influencing factors during a certain period of time i.e. in the early phases of an SI project. However, there is a certain historical perspective through the emphasis on individuals' backgrounds, i.e. family, schools and industrial experience.

On the other hand the tentative model puts a heavy emphasis on the SI programme. This programme might provide a very important influence, at least during the contractual time, but in a more dynamic sense the SI programme and the senior sister will only be a part of all capability sources in a network contributing to the development of a new firm (see also section 10.4). Furthermore, it is not only a matter of sources but of determinants such as markets, legal restrictions, etc. Bearing these limitations in mind, this static model covers the most important sources for a junior firm at least during the initiation and early production periods of its life.

For an individual, the process of acqusition of technological and managerial skills begins previous to the commencement of an SI project. This implied that the study was bound to be carried out in a historical perspective. The accumulation takes place during the following three phases: before the SI project, during the training and implementation phase and finally also during the operational phase.

Hence, there was first a need to look back and find out what was acquired before the commencement of the SI programme. Secondly, the implementation phase was studied, focusing on the ways and the quality of capability accumulation (training, learning, etc.). Thirdly, the subsequent operational phase with its opportunities for learning, training opportunities within the SI programme, etc., was examined. Lastly, the final object of study was the present stock of capability.

The data collection was carried out through interviews, documents and observation.

i) Interviews

Referring to the key questions, the data collection was carried out through interviews with the following:

Individuals interviewed at / Key questions	junior sister	senior sister	Fidé	SIDO	Other industries
Previous knowledge	X	X		X	
Content of training, learning etc.	X	X	X		X
Nature and level of present stock	X	X		X	X
Sources	X	X			
Relative importance of different kinds	X	X			
What factors	X	X	X	X	
Differencies compared to other projects					X

Table 3.2 Data collection matrix concerning capability accumulation

The primary source for data collection was interviews with individuals at the junior sisters. Primarily, 18 SI entrepreneurs from 8 case projects have been interviewed. However, supplementary less comprehensive interviews have also taken place with other employees at these 8 firms, and SI entrepreneurs from another 14 junior firms have also been interviewed. Hence, the analysis is based on data from a total of 22 junior sisters. The interviews with the people responsible for training at the senior sisters, as well as SIDO officials and Fide representatives, further added to our knowledge of the history and potential of the contribution. The interviews with senior sisters primarily concern the 8 case projects, but interviews have also taken place at other firms. Personnel from a total of 18 senior sisters have been interviewed. The interview with Fide also covered the development of the training component in the SI programmes, based on experience since 1978. The interviews have been conducted over a longer period of time (1978-1986), and most individuals have been approached a number of times.

ii) Documents

Existing documents concerning the content of the training programme were used as a supplement to the interviews. Furthermore, utilized educational material provided a hint on the quality and range covered in the programme. Existing documents at the SI industries and SIDO concerning different kinds of calculations, feasibility studies, etc., gave further indications of the state of the stock of capability. Secondary sources provided an understanding of the Tanzanian economic environment.

iii) Observation

Direct observation of work routines, technical development, etc., served as a starting point for questions, as well as provided information concerning capabilities present.

Data collection - an example

As a more detailed example of the method and content of data collection, the study of the training (called education in figure 3.5) will be described. The data collection was in this case carried out according to the following:

- Interviews with the employees at the senior sisters responsible for the planning and execution of the training programmes in Sweden. In connection with the interviews, documents were studied concerning the content and time-schedule of the programme. These programmes involved a certain amount of training which could be characterized as partial learning-by-doing in a Swedish industrial environment.

- Interviews with trainees who were carrying out their training programmes, concerning their experience; what they perceived as missing, to what extent they could influence or participate in the planning of their training programmes.

- Interviews with ex-trainees 2 years after the completion of their training period and with 2 years of practical industrial experience, concerning their impression of the programme in retrospect.

- o Interview with Fide and document-analysis concerning Fide's role in the training programme design. Here, the development during the six years of duration of the programme was touched upon.
- o Documents from the training department of SIDO, which was carrying out interviews with trainees returning from Sweden, immediately on arrival in Tanzania.
- o Direct observation of training methods and participation in some training activities.

3.6 Methodology - Diffusion

The study of diffusion of capabilities starts out from a micro-level, focusing on the diffusion inside the firm to the employees. It then proceeds by examining different ways technology and management can be diffused from the firm to the surrounding environment. The principle ways in which the diffusion of capabilities can take place are shown in the model below. The areas considered in this study are also indicated in the model.

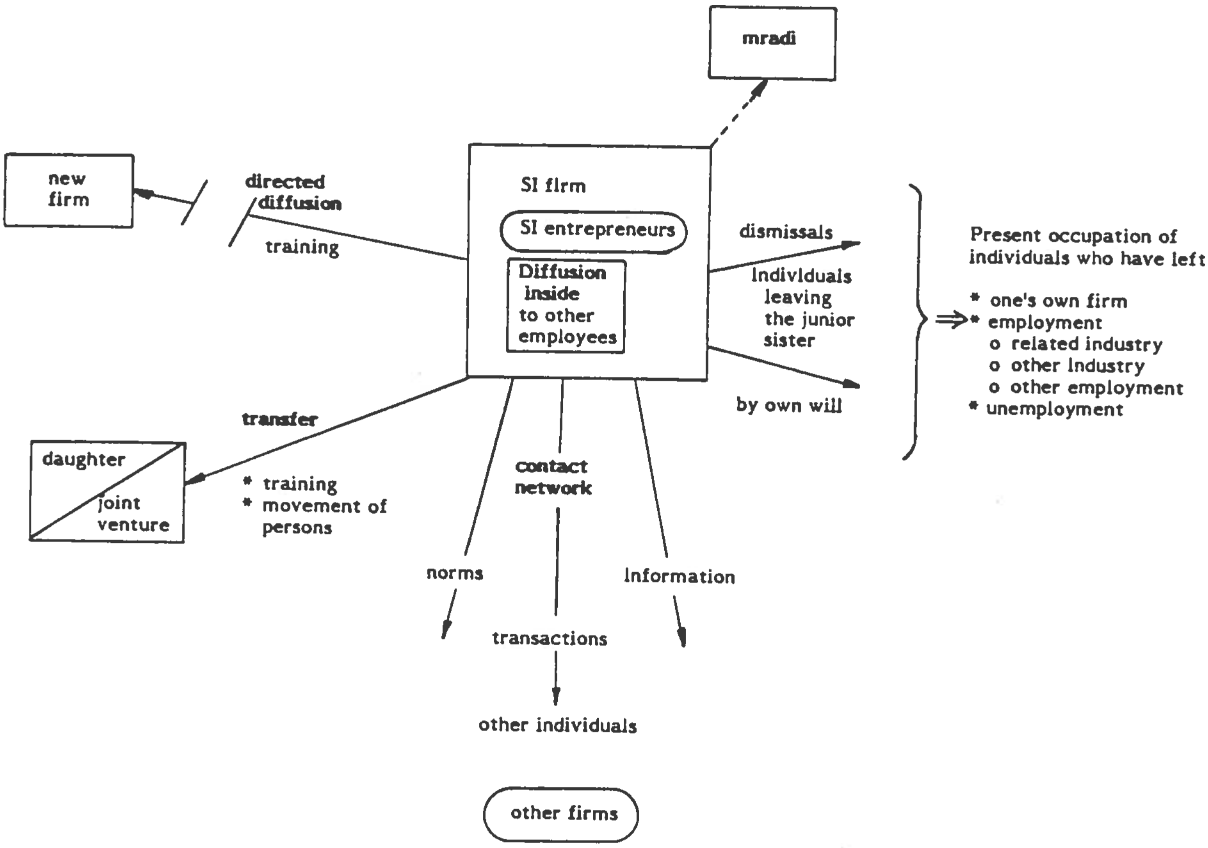


Figure 3.6 A model of capability diffusion

The areas considered and methods used for data collection are:

1. Diffusion inside an SI firm; A single case study of the spread of production capability. Each step in the production process is studied according to operation, set-up and quality control. The development of capabilities in a 2-year perspective is checked for all employees. The evaluation of capabilities is done subjectively by the production manager of the firm. He has also indicated the level of skill needed for each production step and the training time required.

2. Individuals leaving SI firms have been checked in two ways. First, through interviews with 6 of the first generation SI firms concerning which employees have left, why, and what their present occupation is. Second, by using secondary data which provides a view of the present employment of 59 SI entrepreneurs.

3. Side activities or mradis are analysed by using secondary data supplemented by our own scattered data, obtained through interviews and observation.

4. Linkages and contact networks have been studied through interviews with SI entrepreneurs.

5. The data concerning further diffusion comes from interviews and discussions with SIDO officials and representatives from the consulting firm in 1978, supplemented with a document concerning planned diffusion from 1986.

As the time period from start is still very short in the perspective of diffusion (8 years since start-up), the above partial studies only provide indications of diffusion.

This study differs from customary diffusion studies, in its emphasis on capability diffusion. According to our knowledge there are only a few studies that have had this emphasis.

3.7 Methodology - Costs and benefits

The analysis of costs and benefits is partial in that there are costs as well as benefits that are left out of the analysis.

3.7.1 Costs of international technology transfer

The analysis of costs primarily considers those that are visible through financing by Swedish aid of the sister industry programme. This data, available from secondary sources, is divided into the following costs; hardware, know-how, training in Sweden, training in Tanzania and the fee of the consultant. The training costs in Sweden are further divided into: travelling, lodging, accomodation, training costs, training fees, etc.

Other costs, such as local Tanzanian costs for the support organization SIDO, for the use of scarce human and financial resources, for learning due to local involvement, for absence of local involvement as well as for increased local involvement, will only to some extent be analysed in the discussion section. Firm empirical data is at present not available to us concerning these costs. The same situation exists for international transaction costs such as overprice due to missing bargaining skills.

3.7.2 Contribution of capabilities

The analysis of contribution of capabilities concerns the contribution to Tanzania as a country. In order to motivate the selection of and investment in specific capabilities, there has to be a need for these specific capabilities, manifesting itself in the demand for the desired and needed products and services. We start our analysis by looking at the products and technology chosen for the sister industry projects and by relating these choices to the official development goals that existed at that time, 1977-1978. The most important documents at that time was the Long Term Industrial Plan (20 years) (see a further description in section 4.2.2).

The next step is to examine whether the selected capabilities already existed somewhere in the nation and hence, if they were double-imported or new to the country. The first question is thus whether the production capacity was already sufficient for the estimated demand for the selected products, or whether new capacity was needed within the planning horizon. A second question concerns in what way and from where needed capabilities should be acquired. If already a certain capability existed in the country, the utilization of this as a source of knowledge for a new unit should have been considered. Here regional considerations have to be taken into account as well as evaluations of the teaching/learning capability of local or foreign sources, etc. The data has been collected in two complementary ways:

a) Interviews with the SI entrepreneurs concerning the existence of competitors or other industries with the same capabilities.

b) An analysis of secondary data concerning existing products and technology, provided by two different directories of industrial firms in Tanzania:

   1) TISCO (1981b), "The Directory of Industrial Enterprises and Products in Tanzania 1981".
   2) MEIDA (1981b), "Directory", which describes what can be offered by MEIDA members, June 1981.

Hence, this part of the analysis centres around the technique, i.e. product, process, etc. However, a discussion concerning managerial capabilities and the opportunity cost of the SI entrepreneurs has been included in section 9.3.3, but has not been touched upon in each specific case.

The third step is to make an ex post analysis, i.e. in the light of today's knowledge, analysing Tanzania's need of the present industrial capacity. Here we relate our findings to secondary data, primarily Wangwe (1983) and Skarstein and Wangwe (1985), who provide analyses of industrial capacity in Tanzania in relation to the present scarcity of foreign exchange and the resulting underutilization of installed capacity.

During the course of the analysis a method was developed to estimate the cost efficiency of the senior sisters' contribution to the junior sisters' capability acquisition (see section 9.3.3 and specifically table 9.17). It was based on an estimation of the value of the senior sisters' contribution (see section 7.2.4 and notes 7.6 and 7.7). To the estimates of cost efficiency were also added the opportunity costs of managerial resources and of foreign exchange used. See further section 9.3.3.

3.8 Methodological problems and solutions

3.8.1 Validity and reliability

Validity indicates to what extent the study measures what it aims to measure. It is never possible to be totally sure if a certain measurement method is valid or not. The researcher must make some sort of a subjective estimate of the validity.

Reliability reflects to what extent the measurement instruments provides the same answer after repeated observations. There are two aspects on this. First 'intrasubjectivity = "Repeated observation of the same respones by the same observer shall yield the same data" and second, 'intersubjectivity' = "Repeated observation of the same responses by different observers shall yield the same data" (Galtung 1969, p. 29).

3.8.2 Techniques to increase the validity and reliability

The interview has been the primary data collection instrument. To increase the validity and reliability and to obtain a more comprehensive analysis, a number of measures have been carried out. The measaures are presented in reference to three different phases of the research: the design, the data collection and the analysis

I. The design of the research instruments

The measurement instruments were tested in pilot studies where we had an opportunity of analysing the relevance, if we really measured what we were aiming at. This meant an increased validity as well as reliability. The design of the research also benefited from discussions with researchers from the department of education, who are specialists in using the in-depth interview as a data collection instrument. This was especially important as we were confronted with language problems as well as the task of developing the skills in interviewing. These discussions helped to improve the reliability of our instrument. Furthermore, during different phases of our research, the results have been discussed with cultural anthropologists with specific knowledge and experience of Tanzania. This has, to some extent, provided us with a somewhat deeper understanding of Tanzanian culture and concepts.

II. Data collection

A re-check with the interviewee in question has been carried out, especially when data was suspected to be unreliable.

The official interview situation with "formal" questioning and tape recording made some interviewees insecure, which resulted in very general answers avoiding sensitive areas. In those cases informal discussions after working-hours have provided a deeper understanding and some supplementary data.

The question areas have been the same for different data sources, e.g. SI entrepreneurs and Swedish consultants. Hence, the same stock of capability was analysed from different points of departure. All these measures have improved the reliability of the instrument.

III. Analysis

The results of the interviews have been discussed with our Tanzanian colleagues. Furthermore, the working papers have been discussed with and commented on by our Tanzanian colleagues, and hence we have benefited from their deeper understanding of Tanzanian conditions. This has improved the validity as well as the reliability.

Besides, the methodological assistance during the design phase, the analysis and the results thereof have been discussed with the researchers from the department of education.

CHAPTER FOUR

TANZANIAN INDUSTRY AND THE SISTER INDUSTRY PROGRAMME

4.1 Introduction

Tanzania is a federation between mainland Tanganyika, which became independent in 1961, and the island of Zanzibar, which has never been a formal colony or protectorate. The federation was established in 1964. The area of Tanzania is 942 000 km^2, which is twice the size of Sweden, and the population is about 20 million (1986). The majority (90%) live in rural areas and work in traditional agriculture. Agriculture's share of GNP is 50% and its contribution to export earnings is 80%. The main export crops are: coffea, tea, cotton and sisal. Tanzania had a steady economic growth up till the mid '70s, but has in the beginning of the '80s experienced a severe economic crisis. External factors such as the rapid increase in oil prices (1974), the break-up of the East African Economic Community (1977), the Tanzanian-Ugandian war (1978-79), deteriorating terms of trade as well as weather conditions with a severe drought, followed some years later by severe floods, have had a detrimental effect on the economic development. However, also internal factors such as the failure of agriculture owing to pricing policies, lack of 'incentive goods' for farmers and a general neglect of development expenditure on agriculture, have had a strong negative effect on the economic development. The applied macro-level strategies for industrial development also seem to have had negative effects, i.e. the 'processing strategy' during the second five year plan and the 'basic industry strategy' that followed, which both neglected the important link between agriculture and industry (Forss 1985b). The 'new project bias' among foreign aid agencies contributed to an increased foreign dependence, even to cover the running costs of the industry. However, also the measures of the Tanzanian authorities contributed, since they were the ones who took the final investment decision. As a result severe foreign exchange shortages have hampered economic activity and resulted in an under-utilization of installed capacity in industry (Wangwe 1983). This has led to a fall in the industrial sector's share of GNP from 10% in 1977 to 5% in 1982 (Forss 1985b).

4.2 Tanzania and its industrialization

4.2.1 The years from independence until mid-70

At the time of independence in 1961, there were altogether 220 industrial firms with more than 10 employees in Tanganyika. Most of these firms were located in Dar es Salaam but there were also some firms in Arusha, Moshi, Tanga, Mwanza, and Morogoro. These firms were owned by foreign companies or by Asian businessmen living in Tanganyika (Ståhl 1980). In the years before and immediately after independence the industrial sector grew rapidly, to a large extent as a result of investments in import substitution activities by the Asian community. Also some multinational companies made investments in Tanzania during these years. The Tanzanian policy during this time favoured import substitution and was in favour of direct investments in the country by MNCs. The Arusha Declaration of 1967 meant a shift in policy guided by the principles of socialism and self-reliance and by an emphasis on agriculture and rural development. "This emphasis had, however, almost no implications for the structure of production and investment. Investment continued much as before, with the difference that it was undertaken by public enterprises." (Forss 1985b). Shortly after the Arusha declaration Tanzania had also nationalized the banks and several major industrial firms or bought a dominating share in other large firms. During the second five-year plan, which started in 1969, a 'processing strategy' dominated the resource allocation, i.e. large plants processing tobacco, pyretheum, sisal, cotton, cashew-nuts and leather were constructed. "Large-scale manufacturing expanded faster than small-scale manufacturing, as small-scale industry did not receive any priority in practice." (Forss 1985b). Already at this point in time a significant under-utilized capacity emerged owing to various shortages, although there was an excess demand. In the Long Term Industrial Plan (20 years) of 1975 and in the Third Five-Year Plan a new strategy was introduced, that of building up basic industries. This strategy was primarily based on research by Rweyemamu (1973) and Thomas (1974).

4.2.2 The basic industry strategy (4:1)

With the establishment of the Long Term Industrial Plan (20 years) of 1975, Tanzania's industrial development entered its third phase. The primary goal of the new plan is an increase in linkages among domestic industries, thereby achieving a higher degree of economic self-reliance. The plan indicates that a condition for this policy is the development of a domestic basic industry. In Tanzania, iron, steel, metal processing, cotton textiles, leather, sisal, chemical industry, food processing, paper and wood, as well as construction materials, all come under the heading of basic industry.

Priority is mainly given to industries which provide for basic human needs such as clothing, construction, food, health service, water, education and transport. Furthermore, domestic raw material is to be used wherever possible.

Agriculture, in the foreseeable future the foundation of Tanzanian economy, shall according to the plan develop in harmony with industry. This means that agriculture's future primary goal will be the natural one of providing for the domestic population's food requirements. But agriculture will also play a significant role in industrial development, not only as a provider to industry of raw material but as a producer of grain for export, thus making a positive contribution to the balance of trade.

Another of Tanzania's goals is the decentralization of industrial activity. The country has therefore been divided into six different industrial zones, all of which have special areas allocated for intensive industrial extension.

As a stage in development leading towards economic self-reliance, Tanzania will in the immediate future invest considerable energy in the development of the metal-processing and machine industries. Today the metal-based industry represents only 15% of the total processing value of the industry. Because of the impossibility of achieving everything simultaneously, Tanzania has adopted a strategy for gradual development. The first stage consists of the establishment of industries producing spare parts and machine parts for the machinery already existing in the country. The second stage is the production of simple machines for machine parts. Finally, gradual development will lead to production of the entire machine.

Furthermore, Tanzania has chosen to concentrate her resources to five specific sectors. During the first stage, production of spare and machine parts will commence for the following sectors: agriculture, construction, water and electricity as well as transport and communications.

Industry is to be developed at three different levels under three different development authorities. The industrial activities are classified according to the following.

a) National Industries

National industries are large or medium-scale industries, producing manufacture and consumer goods both for domestic and export markets. The development of these industries is administred by NDC (National Development Corporation) and some other so-called 'national parastatals', such as TEXCO and NAFCO.

b) District Industries

These industries are small- or medium-scale industries. The Ministry of Industry delegates the responsibility for their support to DDCs (District Development Corporations) and to SIDO (Small Industries Development Organization). Production will primarily comprise consumer goods of a basic nature for the domestic market.

c) Village Industries

These industries are various types of small-scale industries. SIDO is the authority which supports establishment of this type of industry. The small-scale industries are primarily intended to meet the needs of a limited geographical area.

4.3 The small scale industry sector

4.3.1 Small scale industry in Tanzania

In Tanzania a small scale industry is defined as "... any unit whose control is within the capabilities of our people individually or cooperatively, in terms of capital required and know-how; it includes handicrafts or any organized activity based on the division of productive labour." (TANU 1973).

In 1973 the National Executive Committee of TANU gave a directive for the establishment and development of small scale industries in Tanzania. In this policy document it was pointed out that "Since independence various efforts have been made to start small scale industries. These efforts did not bring much success. This failure was due to lack of economic sense which would have obviated the need for small scale industries ... As a result we have not had proper planning for the small scale sector of industry. We have also lacked sufficient know-how and even the products of such small scale industries as existed got into problems of finding markets."

It was pointed out that small scale industry had an important role in contributing to the standard of living of workers and peasants. The small scale industry would also provide employment. In the rural areas this would be of specific importance as it would provide employment throughout the year as opposed to the seasonal employment in agriculture. Furthermore, it was hoped that small scale industry would contribute to self-reliance and to a reduced cost of industrial production. The Committee stated that "Therefore the National Executive Committee feels that there is a place for individuals to establish and run small scale industries." However, it was also pointed out that "there is no room for an individual to establish and run small industries in ujamaa villages. Small industries in such villages must remain the property of the villages, ...".

While the earlier existing organization for promoting small scale industries was found to be inefficient, the Committee made a policy statement concerning the importance of a new organization. "There is a need for a government institution that would concern itself with the development of small scale industries in the country. This institution should not own or run any industries. Rather, its role should be to render various services ..." (TANU 1973).

4.3.2 The Small Industries Development Organization (SIDO)

With the above TANU guidelines as a basis the Small Industries Development Organization, SIDO, was established by an Act of Parliament in the end of 1973. SIDO was organized into a headquarter with a director general and three different departments in charge of different activities within SIDO's field of interest. The departments were: research and planning, training, and marketing services. One of SIDO's main tasks was to provide equal services to all regions and hence, regional extension offices lead by a small industries promotion officer were established in Tanzania's 20 regions.

The object of one of SIDO's development programmes was to promote the development of industries in industrial estates. "The concept of an industrial estate, as a package measure to bring up small scale industrial units in a planned manner, has been tried with success in many countries. An industrial estate provides built-in factory sheds at reasonable rents. It provides well-developed infrastructure, by way of roads, water and electric connections, and common facilities like banks, testing laboratories, repair and training workshops and workshops for making jigs and fixtures." (SIDO 1976). These industrial estates were planned to be developed in regional towns, where some infrastructure was already available. The technology in these industries was also in general planned to be more advanced than the projects that SIDO supported in rural areas. In the terminology of the Long Term Industrial Plan of 1975, the estate industries were considered as 'district industries'.

4.3.3 African Entrepreneurship

The industrial sector is very small in Tanzania. In 1982 the value of industrial output was 568 million Shs and the share of GDP was 5%. At around 100.000 persons were employed in industry. In 1980/81 there were 4.890 small scale establishments with 68.700 employees (Forss 1985b). There are very few medium-sized industries with African Tanzanian management. In a study, Schädler (1968) pointed out that:

> "So far, African entrepreneurship in industry is practically non-existent in Tanzania. While efforts have long been made to have individual Africans and African co-operatives participate to a greater extent in commerce ... comparatively little attention was paid to the development of individual African enterprise in industry" (p. 31).

According to Schädler, some of the factors that had been influential were "traditional family obligations" (the extended family) that have hindered the formation of private capital and "lack of skill, education and finance". But on the other hand, Schädler was very definite in his opinion that "Tanzania will have to rely on African entrepreneurs for industrialization" as "a direct consequence of the Policy of Self-Reliance". (p.35). However, he pointed out that developing African entrepreneurs will be a gradual process, and "until this occurs, Asians will have to continue to fill the gap between small craftsmen ... and the larger industrial undertakings ..." (p. 35). The situation has not changed radically in the industrial sector since Schädler wrote these lines 18 years ago. The existing medium-sized industries, if locally owned, mostly belong to and are managed by Tanzanians of Asian origin, a group that has extensive experience of workshop production and business. However, contacts between the relatively small group of Asian origin and the large majority of African Tanzanians have been very limited throughout the years. This includes the area of management capability diffusion, i.e. the opportunities for African Tanzanians to be trained in Asian companies in the starting of their own businesses have been limited.

The situation described above forms the background to the search for models to promote African entrepreneurship. A consultancy study in 1976 (Sandkull et al. 1976) made some basic propositions for a sister industry programme, as a means of promoting such a development. Since 1977, this programme has been an essential and large part of SIDO's practical work to promote African entrepreneurship.

4.4 The sister industry programme

The sister industry programme in Tanzania is a foreign aid-financed programme for establishing small scale industries through international technology transfer by Swedish small or medium-sized enterprises.

This programme was started in 1977 and by 1986 30 new small industries had been started in different regions of Tanzania. The total number of employees in these industries was in 1986 about 700. The technology has been supplied by Swedish small or medium-sized industries, the majority being small industries. A contractual agreement stipulating a long-term cooperation (5-10 years) has been established between each Swedish industry (senior sister) and the parastatal SIDO (Small Industries Development Organization) in Tanzania. SIDO acted as the negotiator and party of agreement for the Tanzanian side during the early phases. Normally the senior sister produces the same type of products as the new Tanzanian industry (junior sister) will start to make. This facilitates the in-plant training that takes place in Sweden. This training is considered as an important component in the SI programme (SI = sister industry). In total about 100 Tanzanians have received training in Sweden, for periods varying from a few weeks up to almost two years. The junior sisters produce a great variety of products, e.g. locks, valves, handtools, electrical motors, clogs, rivets and metal nets (see section 4.5 and Appendix One for a short description of the 30 sister industry projects started in Tanzania).

The early entrepreneurial activities, such as the selection of product and technology and the negotiations and contracting with a Swedish firm, are performed by the parastatal SIDO. The people who will own and manage the new junior firms (the SI entrepreneurs) are not involved during these early phases. SIDO is assisted by a specific structure created for the SI programme. This structure can be described by the following figure which indicates different functions.

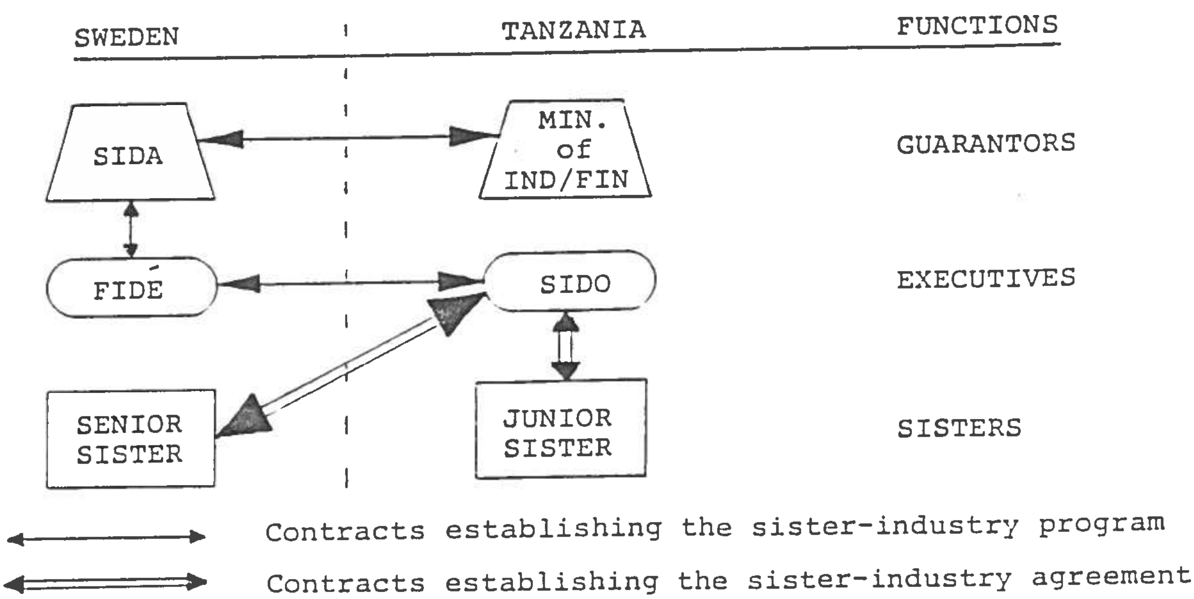


Figure 4.1 The sister cooperation as a contractual formation
Source: Alänge et al. 1981

Here we see that one of the central functions of SIDO is to contract with the parties involved. SIDO gets assistance from a Swedish firm of consultants (Fide) to procure suitable Swedish senior sisters and to negotiate and implement the contracts in all phases of the projects. Furthermore, the function of guarantor, e.g. that of monitoring the programme and providing economic and legal stability to the cooperation, is performed by the Ministry of Industry in Tanzania and the Swedish aid organization SIDA. The existence of the SI structure, guarantors and a party that has the power and economic stability to enter into a contractual agreement, has been of decisive importance for the possibility of involving Swedish small scale industries in this kind of international technology transfer. (Alänge and Löwbäck 1981a). These small industries do not normally have the interest or resources to involve themselves in business of this kind and would not have been interested if the support organization had not existed. With this support structure, the senior sisters experience the SI projects to be an almost 'risk free' business opportunity.

The sister industries were started as a part of an import-substitution programme. The initial technology transfer primarily concerned production capabilities subsidized by the fact that the initial investments in human capital were considered as a 'national cost' (i.e. a gift to the new firm) and by further direct subsidies in the form of low interest loans. In practice the industries have also received direct protection in that importation of competitive products was stopped as well as an indirect protection for the reason that at times, different local competitors have been out of raw material as a result of the country's foreign exchange shortage. This shortage has contributed to a very low capacity utilization in Tanzanian industry during the first half of the '80s. During this period the newly started junior sisters have benefitted from direct import support from Swedish foreign aid, which has kept their capacity utilization slightly above the Tanzanian medium. However, because of the increasing shortages of foreign exchange, the SI programme's emphasis has gradually been shifted towards scrutinizing the possibilities of export and then the question arises if the sister industries are competitive on the international market.

What is unique about the SI programme, in comparison with other modes of international technology transfer? The components of the SI programme can be found in other types of technology transfer projects as well. The uniqueness can be described better in terms of a certain comprehensiveness in project approach and in the combination of components. The following programme characteristics are significant:

- Design of production facility by the senior sister, based on its experience of similar production/products.
- The training is provided in a functioning small scale industry with the same type of production as that of the new junior sister as that of the new junior sister
- Continued assistance over many years
- The senior sister and the SI programme compensate for weaknesses in the local network
- Industrial estates and planned linkages between firms

4.5 The eight sister industry projects studied

The analyses in the present study is primarily based on detailed case descriptions that have been published separately (see Alänge 1986a). Excerpts from these are presented in the 'empirical findings' sections in Chapters 6, 7, 8 and 9. In order for the reader to have a quick overview of the case study firms, a short description is provided of the eight Tanzanian firms studied.

Firm	Turnover (81/82) (M Shs)	No. of empl. *)	Length of training	Location	Year of implementation	
AMI	5.2	39	long	Arusha	1979	
FAWIPMA	2.7	17	long	Arusha	1979	First
KIMESHA	2.3	23	short	Arusha	1978	generation
NEM	12.0	29	short	Arusha	1979	
UHANDISI	0.75	8	short	Arusha	1978	
MAFOTCO	5.7	12	long	Moshi	1981	Second
PEMACCO	8.0	22	long	Mbeya	1981	generation
TANLOCKS	1.4	26	long	Moshi	1981	

Table 4.1 The eight junior sisters studied
(*the figures concern the time of our data collection, i.e. 1982/83. Figures for 1986 are provided in Appendix 1)

CASE 1 **Arusha Metal Industries (AMI)**

The products of AMI are: globe valves, gate valves and water taps made out of gunmetal. The plant consists of a metal foundry employing 15 persons, a machining section with 8 workers and an assembly section employing 3. Altogether, including administration, 39 persons are employed. In Febr. 1980 the performance test was completed. The total sales in 1980/81 amounted to 5.2 M Shs and the net profit was 0.85 M Shs.

In the first phase (see section 3.3.1) of the SI programme six Tanzanians were trained and they occupy at present the positions of production manager and foremen. The present general manager and chief accountant were recruited later, during the first half of 1980. For the case description, the production manager was selected, being the only person of the original group of six in a management position. However, references are made to the other employees who have been trained abroad within the SI programme, i.e. the foremen and the general manager.

CASE 2 **Fabrication and Wire Products Manufacturers (FAWIPMA)**

FAWIPMA manufactures chain link fencing wire, mosquito wire gauze and coffee tray wire. It started production in March 1980 and employs 17 persons (1983). The production is partly manual, using hand looms for net weaving. In 1984 an investment in automatique looms was made. For the production of chain fencing wire a simple type of semi-manual machines has been used since the start of the firm. The turnover was in 1981 2.7 M Shs and in 1982 1.5 M Shs (the decrease is attributable to lack of raw material).

In the first phase of the SI programme the managing director and the production manager were trained for 9.5 months in Sweden. The experiences of these two persons have been used for the case descriptions. In phase II, a new investment in production capacity was made and at this time these persons were trained for 8.5 months in Sweden.

CASE 3 **Kilimanjaro Metal Shapers Ltd. (KIMESHA)**

KIMESHA started production in June 1978. A variety of aluminium utensils are fabricated, in sizes from small salt and pepper containers to cooking utensils for school kitchens. Most products are produced by the pressure spinning technique, i.e. by pressing an aluminium circle over a spinning mould on a lathe. In total 23 persons are employed. The production is in partial 2-shift. The turnover was 2.3 M Shs in 1982.

During the first phase of the SI programme, no persons were trained in Sweden. Instead all training was carried out in Tanzania. However, the managing director had previous experience of the same technique, as well as managerial experience from a firm in the same industry. In phase II, two persons were on a shorter study tour to Sweden, one of them being the managing director, whose experience has been used for the case description.

CASE 4 **Northern Electrical Manufacturers Ltd. (NEM)**

NEM manufactures fuse boards, switch boxes, cable trunkings, wall-lights, brackets, flourescent fittings and some other products in the electrical field. Furthermore, the company imports and carries out installations of industrial power distribution panels. The basic production operations at NEM are: sheet metal work including shearing, punching and welding (into different kinds of metal boxes), spray-painting and assembly. Altogether 29 persons are employed at NEM, including 6 office staff and 4 managers. The performance test was carried out in March 1979. The turnover was around 12 M Shs in 1982 (10 million in 1981).

Two Tanzanians, the present managing and production directors were trained for a short period during the first phase. The managing director has also received some supplementary training in international marketing, together with the present director of marketing. Finally, the production director received some training in Sweden before the installation of an added line of production (industrial power distribution systems). The experience of the managing director and of the production director has been used as the base for the case description.

CASE 5 **Uhandisi Cooperative Society (1974), Industrial Fasteners Project (UHANDISI)**

UHANDISI started its production of wood screws, steel rivets and aluminium rivets in October 1978. The products are made of steel and aluminium wires by cold-forming in steps (header machines, slotting machine, thread cutting machine, etc.). In total 8 persons are employed. The turnover was 0.75 M Shs in 1982.

Two persons, who were appointed general manager and production manager, were trained in Sweden in 1978. However, they were dismissed and the industry was closed down in March 1980. In May 1980 the industry was reopened under the leadership of two other employees, the former sales manager and the production foreman. These persons got assistance from Swedish instructors in Tanzania during the re-startup phase and later, in 1982, they received 6 weeks' training in Sweden. The experiences of these two individuals have been used for the case description.

CASE 6 **Mawenzi Forging & Tool Co. Ltd. (MAFOTCO)**

MAFOTCO is a forging plant situated in the industrial estate in Moshi. The majority of the production (knifeblades, scissor blanks, plye blanks, etc.), is producer goods that are further processed in other firms at the industrial estate. A smaller part of the production at MAFOTCO (ploughshares) is sold as finished goods directly to retailers . At present (Jan.-83) 12 persons are employed, 7 of whom are also owners. However, 43 persons will be employed when there is full production in one shift, according to an estimate by the general manager. The estimated turnover for 1983 will be about 5.7 M Shs.

During the first phase of the SI programme 8 persons have been trained in Sweden. Seven of them were trained at a larger plant of Gense, the senior sister. The eighth, received his training in a small forging firm called Barva Hammarsmide. For the case descriptions, two individuals have been selected, one being the managing director, who received most of his training in the large plant, the other being the individual, who received his training as a forger, in the very small forging plant. These two cases are described in parallel with each other.

CASE 7 **Pioneer Electric Machines and Consulting Co. Ltd. (PEMACCO)**

PEMACCO is a combined electrical motor producer and service and repair workshop for electrical motors and transformers. The principle operations in production are: motor-winding, assembly and testing. All in all there are 22 employees at PEMACCO. The performance test was carried out in Nov. 1981. The turnover was 8 million Shs in 1982.

The managing director and the production director spent one year in Sweden, being both initially trained in basic electrical motor technology in theory and in practice. The second part of the training was split into management and marketing for the managing director and further studies in production and design for the production director. Furthermore, the director of industrial installations spent 6 months in Sweden as did also 3 winders, being trained in manual work. For the case descriptions the training and learning experience of the production manager and the director of industrial installations were used. The training experience of the managing director is also touched upon.

CASE 8 **Tanzania Locks and Metal Products Co. Ltd. (TANLOCKS)**

TANLOCKS produces 2 sizes of brass padlocks and doorlocks (mortise-locks) made of electro plated steel. TANLOCKS itself has one machining section and one assembly section, while the electro plating is done by a near-by firm. A feature of lock-making is that it demands very close tolerances, i.e. in some instances ± 0.05 mm. The company employed 26 persons (1982) and the turnover was 1.4 M Shs (1981). The performance test was carried out in May 1981.

Four Tanzanians were trained in Sweden during a 10-month period. Their positions were in December 1982: managing director, marketing director, production director and assembly director. The case description is based on the experiences of all four trainees.

CHAPTER FIVE

MOTIVES FOR BECOMING AN ENTREPRENEUR

5.1 Introduction

5.1.1 Problem background

There is some evidence concerning the existence in LDCs of different types of entrepreneurs with different ways of functioning, e.g. in the formal as opposed to the informal sector (King 1977). Furthermore, the strong entrepreneurial group of Asian origin that exists in East Africa has some specific features. Hence, the focus of this section is on the reasons (i.e. conditions, opportunities, motives, etc.) why a person becomes an SI entrepreneur, and in what way this type of entrepreneur might differ from others regarding motives, e.g. entrepreneurs in LDCs as well as the "typical" entrepreneur in industrialized countries.

This part of the study also provides a background for the further analysis of the capability accumulation process and of capability stocks. The study's analysis of the junior sister entrepreneurs' motives balances the analysis of the senior sister industries' motives (see Alänge and Löwbäck 1986).

The SI entrepreneurs' assessment of risks is studied in this section. There is a tradition of preoccupation with risk in connection with business development studies, e.g. Knight (1921). Many studies make the implicit or explicit assumption that the entrepreneur is a risk-taker as compared to most people who are risk-avoiders (Kent 1982). Rural people "are wary of risk-taking" especially in LDCs (Broehl 1982). However, in a comparative study, Brockhaus (1980) found that attitudes toward risk did not distinguish entrepreneurs from managers or from the general population.

5.1.2 Research questions

The aim of this part of the study is to analyse the reasons for a person to start his own business within the sister industry programme (SI programme). Among the factors studied are conditions and motives. Furthermore, a comparison is made with the results of other studies, from African as well as from industrialized countries, concerning motivational factors for entrepreneurship. Also, correspondence/discrepancy in the motives of the senior sister industries for entering the SI programme is analysed.

The basis for generalization is limited in this part of the study, as only those finally selected to run industries within this particular SI programme were studied. However, an evaluation of the importance of the SI programme as a conditional factor is made in the discussion section.

5.1.3 Concepts

By SI entrepreneurs (or junior sister entrepreneurs), we mean the individuals selected to run the new industries in Tanzania, and personally work in their industries; i.e., the expression "entrepreneur" is used in a specific way as compared to the wider Schumpeterian definition (see below). In most cases, the SI industries were not started by individuals, but by groups of SI entrepreneurs.

Schumpeter (1912) saw the entrepreneurs as the group of individuals who realize the potential of basic inventions, largely exogenous to existing firms, and take the risk of developing these inventions into innovations. This hazardous activity, not undertaken by the average capitalist, is undertaken only by exceptional entrepreneurs. (Freeman et al. 1982, pp. 38-41). In Schumpeter's words, (1934, p. 74) "... the individuals whose function is to carry them (new combinations) out we call 'entrepreneurs'." New combinations include; 1) a new good or new quality of a good, 2) a new method of production, 3) a new market, 4) a new source of supply, and 5) a new organisation of any industry (Schumpeter 1934, p. 66).

The function of an SI entrepreneur is entrepreneurial in the above Schumpeterian sense. It includes starting a new company, in itself an innovative activity, introducing a product that is new to the market, and in many instances introducing a method of production new to the economy. The transfer of technology from an industrialized country to an LDC involves adaptations to this specific country, and one might say that "The sheer process of adaptation in environments markedly different from the original is itself an innovative act." (Broehl 1982, p. 265).

A difference between Schumpeter's entrepreneur and the SI entrepreneur is that the former is working independently in a market economy, while the latter has been selected by and receives continuous support from a governmental organization. If we, in accordance with Phillips (1971) and Freeman et al. (1982), call the above described process of entrepreneurial innovation Schumpeter mark I, in contrast to the later Schumpeter who emphasized the large corporations with internal R&D activity, i.e. Schumpeter mark II; we might add yet another model. This third model, which might be called "mark III", adds government as yet another entrepreneur, or at least as performer of some of the entrepreneurial tasks, before the tasks are handed over to the SI entrepreneurs. (See also section 10.1). In this context, the following quotation from Kent (1982, p. 25) might be contradicted in this study:

> "One thing is certain: Government is important in allowing the supply of entrepreneurs to come forth. In the underdeveloped world, and increasingly in the developed world, governmental activity is growing inimical to entrepreneurship." (our emphasis)

As a parallel to the 'entrepreneur' concept, we will use the concept 'entrepreneurial event', which puts the emphasis on activities considered to be 'entrepreneurial', without limiting the analysis to a specific individual (the entrepreneur). This is in line with Schumpeter who used the term entrepreneur to describe an individual acting in an entrepreneurial way. Schumpeter (1934) pointed out that it is, "... rare for anyone always to remain an entrepreneur throughout the decades of his active life ..." (p. 78). According to Shapero and Sokol (1982, p. 78), the entrepreneurial event is denoted by:

1. Initiative-taking. An individual or group takes the initiative.
2. Consolidation of resources. An organization is formed or restructured to accomplish some objective.
3. Management of the organization by those who took the initiative.
4. Relative autonomy. Resources are disposed of and distributed with relative freedom.
5. Risk-taking. The organization's success or failure is shared by the initiators.

Further essential concepts in this section are; strategy, condition, motive and risk. Strategy in this study refers to a vision individuals may have of what they want to accomplish in their lives, here regarding the start-up of their own businesses. By conditions we mean those economic, cultural and social factors having an influence on an individual's desire to become an entrepreneur. According to Webster's New World Dictionary (1975) a motive is "... an inner drive, impulse, etc. that causes one to act." In this study the action considered is to start one's own business. Finally, risk is the experienced possibility of failure when starting a new business.

5.1.4 The SI procedure

The procedure of initiating a sister industry project on the Tanzanian side of the project will be described in short, providing a background for this part of the study. The need for certain production is identified by SIDO, and when a senior sister has been found in Sweden, SIDO advertises to find suitable persons to become SI entrepreneurs. Thus in the majority of cases, the initiation of an individual's involvement as an SI entrepreneur has started by his taking notice of an advertisment. However, in exceptional cases individuals have come to SIDO to express their interest in starting a certain industrial production or to show a general interest in becoming an SI entrepreneur, whatever the type of industry.

Most individuals involved in the SI project, at least in active management positions, left their previous employment to start their own businesses. In a few cases the SI entrepreneurs already had their own businesses. When the first sister industries were started, SIDO did not have any examples to show of successful industrial projects of this type, as SIDO (established in 1973) was a relatively new organization at that point (1977).

5.2 Methodology

The study of the motives for becoming an SI entrepreneur, i.e. owner and manager of a small industrial firm, has been conducted during two different phases. First, some interviews were conducted with individuals during a training programme in Sweden, which took place before the firms were started. The next set of interviews were conducted after the start-up phase. All respondents were already selected for the SI programme at the time of the interviews. A total of 50 SI entrepreneurs, at 20 different companies, have been interviewed.

The method employed has consisted of direct questions such as, "Why, did you want to be an entrepreneur?" or "What motives did you have ...?" However, these questions were supplemented by situational follow-up questions as well as by a system of questions gradually developed since the first interview. Furthermore, direct questions have been asked concerning the assessed risk when starting one's own business. The validity of the answers has also been increased by comparison with the information obtained through observation. This system of questions is closely related to the elements of theory concerning entrepreneurial events (Shapero 1980), that are discussed further in section 5.5.2.

The data and the analysis are presented according to the following outline; strategy, conditions and motives. Furthermore, risk has been added as a separate variable to the above outline. The outline provides a basis for comparison with the strategies, conditions and motives found in Alänge and Löwbäck (1986). That study provides an analysis of the senior sisters' motives for involving themselves in international technology transfer projects with a developing country.

Individuals seldom have a very clear strategy, but some of the interviewees stated that they had a clear intention to have their own businesses, before taking any notice of a SIDO advertisment. We call this a personal 'life strategy'. In some cases, this could be rationalization. However, while interviewing Swedish industrialists in a small scale industry intensive area, we found the same clear intention in many cases; "I knew when I was 14 years old that I would go into business for myself, but not in what industry."

Conditions refer to the state of affairs at the time when an individual applies to be an SI entrepreneur. Here we can see the background influencing the potentiality of an entrepreneurial event. The conditions reflect the economic and motivational situation in the country as a whole, as well as more specific personal conditions.

Motives concern the expectations and desires that an individual, in retrospect, indicates having felt at the time of application. This is a purely subjective judgement. The motives mentioned in this text are the motives expressed by the individuals without modifications. However, in the discussion section, some of the motives mentioned will be discussed and analysed. The motives are analysed within the structure of the incentive scheme given by Friberg (1975), where incentives are separated into the headings of coercive, material, social, and inherent incentives.

Finally, risk is treated as a separate variable. As literature concerning entrepreneurship attributes considerable importance to this factor, we have chosen to analyse it separately. This can of course be an objective, as well as a subjective, variable.

5.3 Literature summary

The literature concerning conditions and motives for individuals to start their own businesses is mostly found under the heading of entrepreneurship. Most studies concerning entrepreneurship are based on experiences from industrialized countries. However, entrepreneurs' motivations in developing countries have also been a concern for the psychology based studies by McClelland and others. McClelland's thoughts, especially concerning the 'need for achievement', have been extensively spread throughout the world.

McClelland (1961) argues that differences in social action among societies can be explained by three basic motives; need for achievement, need for affiliation and need for power. Of these motives he found that the need for achievement (n Ach) was the key motivating factor for the entrepreneur and he also showed that a high n Ach was related to economic growth. The n Ach can be defined as a want or drive within the person that motivates behavior toward accomplishment. What is meant by high n Ach can be illustrated by the following characteristics of successful high n Ach entrepreneurs, given as a list for self-analysis in Schöllhammer and Kuriloff (1979): Innovative ability, tolerance for ambiguity, desire to achieve, realistic planning ability, goal-oriented leadership, objectivity, personal responsibility, adaptability and ability as organizer and administrator (pp. 14-15). Based on the assumption that high n Ach was the most essential factor for increasing the supply of entrepreneurship in all cultural settings and that the n Ach could be increased through training, McClelland and his collaborators started training programmes in many different countries. The first reports from this (e.g. McClelland and Winter 1969) pointed in the direction of success in increasing the n Ach through training and also reported on a better economic result for the individuals who had participated, e.g. in the SIET Institute's courses in India. In follow-up studies similar results have been found, and Miron and McClelland (1979) in an overview summarize, "... achievement motivation training significantly improves small-business performance - provided there is some minimum of support from the economic infrastructure ..." However they also add that, "The most impressive evidence of its efficacy comes from evaluations carried out in the United States ..." (p. 27). This last comment might partly explain some of the criticism of the assumption of n Ach as being a universal motive.

According to Peterson (1981), McClelland's findings, "have been challenged at every point, from the choice of measures to the final conclusions drawn." He also points out, referring to Kilby (1971), and Nafziger (1977) that, "the need-achievement measure has no great empirical power" (p. 69). Tests of an adapted version of the McClelland instrument in Tanzania, "... do little to encourage optimism that real measures of Chagga achievement motivation have been created. Inter-test correlations are weak and sometimes contradictory and none of the tests consistently correlate with either measure of actual achievement ..." (Ostheimer 1965, p. 27). The author discussed the reasons why the instrument did not work well in terms of having used wrong measures of achievement and held that the test was culture bound, i.e. made in a Western country based on another value system than the one existing in Tanzania.

Hofstede (1980) in his extensive cross-cultural study of motives and values, related his variables to McClelland's. Hofstede found that high n Ach was correlated to low 'uncertainty avoidance' (willingness to take risks) and high 'masculinity' (assertiveness or ambitiousness), which are primarily characteristics of the Anglo-American group of countries, i.e. Great Britain, Ireland and the United States. Hence, the n Ach might not be as universally applicable as McClelland and others assumed. Hofstede (1980) points out, that "It is therefore doubtful whether McClelland's achievement motive should be offered as a universal model for economic success in all countries, as it has been. McClelland, an American, has been describing a typical Anglo-American value complex - one present in his own environment - and offered it as a model to the world." (pp. 127-128). However, Hofstede's analysis is based on data on managers from one single MNC and its subsidiaries in 40 different countries. That the entrepreneurs as a group show the same cultural values as the managers can not be taken for granted, but it is likely that the same type of tendencies can be found in the same country.

A final comment concerning McClelland's psychology-based theory is that it assumes a scarce supply of potential entrepreneurs, i.e. high n Ach individuals. Hence, there is a need for fostering its development in people. This assumption has been refuted by studies which suggest that, "there is a substantial reservoir of achievement oriented individuals being trained in developing societies." (Peterson 1981, p. 71). Peterson continues, "... all studies agree that the significant blocks to the expression of entrepreneurship are legal, administrative, political, economic and social, rather than characterological." (p. 71). Hence, scholars with a background in cultural-anthropology, economics and sociology have emphasized the need to consider not only the supply side, but also the demand side, i.e. the opportunities for exercising entrepreneurship.

Leibenstein (1957) with a background in economics argues that, "It is the size of the anticipated profit that determines whether or not he will engage in the entrepreneurial activity involved." (p. 130). However, he also mentions factors such as lack of prestige in being an entrepreneur as inhibiting growth, i.e. in this case influencing individuals' motives to carry out entrepreneurial events. Other authors have argued that it is a combination of individual, environmental and situational factors that motivates an individual to become an entrepreneur. Shapero (1980) presents a model of the entrepreneurial event formation process, indicating a multiplicity of factors influential during the different stages leading to the company formation. It includes positive pull, negative displacement and 'between things factors' leading an individual to consider changing his 'life path' and going into business. The particular action taken by the individual is then influenced by the 'perceptions of desirability' and by the 'perceptions of feasibility'. Shapero's model is presented in more detail in section 5.5.2.

Empirical studies of entrepreneurs' motives in industrialized countries have shown that the motives vary over time. In Sweden during the pre-World War II period many companies were started by workers and many of, "... these firms were started without any aspirations of development on a larger scale; their main function was to provide an independent means of livelihood ...", and further on, "... in depression years. Unemployment, or the risk of becoming unemployed, ... was the most important, though not the only, motivating factor." (Dahmén 1950, p. 421). During later periods other motives have been important in Sweden. Johannisson et al. (1976) found that the self-fulfilment motive, to be able independently to develop one's own product ideas, was important for successful Swedish entrepreneurs. However, were also other motives found in this study, e.g. risk of unemployment. Johannisson et al. found, like Dahmén and others, that it is mostly not a single motive but a combination of motives that are of importance.

Hult and Odéen (1983) argue that it is hard to describe entrepreneurs in terms of "the average entrepreneur", as is done in most studies. They have found that, "cultural variations imply that entrepreneurs in different regions, act in different ways." (p. 161, our transl.). However, for Sweden they have found two broad groups of entrepreneurs, classified primarily on the basis of their background and technical knowledge. The two groups are "general" entrepreneurs and "technological" entrepreneurs.

According to Hult and Odéen the primary motives for the general Swedish entrepreneur are; self-employment (positive) and dissatisfaction with previous employment (negative). For the technological Swedish entrepreneur the motives are self-fulfilment or to realize one's own idea (positive) and a need for independence, or a desire not to be an employee (negative). Hult and Odéen also add that the general entrepreneur has a limited number of alternatives while the technological entrepreneur generally has a large number of alternative life paths.

The above differences in motives between different kinds of entrepreneurs are based on Swedish conditions. Probably, the differences between different groups in an African society would be at least as large. An assumption is that the differences might be considerable between the entrepreneurs heading modern industries in urban areas as compared to individuals with their backgrounds in the "traditional society" in rural areas, i.e. in the "economy of affection" in the words of Hyden (1980). "The economy of affection is primarily concerned with the problems of reproduction rather than production. Work, or improved productivity, is not an end in itself. While in the modern economies - both capitalist and socialist - the leading motto is 'live in order to work', in the economy of affection it is 'work in order to live'." (p. 18).

There are a number of empirical studies of African entrepreneurs' motives for having their own businesses. Marris and Somerset (1971) conducted interviews with 87 small business entrepreneurs in Kenya. They found that the African entrepreneurs, although relatively successful in their previous employments, were still dissatisfied with their jobs and felt their aspirations to be blocked. This was a personal frustration over chances missed through lack of schooling. The establishment of one's own enterprise is the only way of being independent and creative and reaching an achievement that will command the same respect as occupations of the highest status. Hence, money is secondary to the establishment of business as an occupation of recognized social importance.

Harris and Rowe (1966), in a study of Nigerian entrepreneurs' motives for entering into business, found that the most common motive was to, "make more money." Kilby (1969) put more emphasis on money as a means of achieving something. One reason is that traditions such as bride-price, hospitality, etc. have become monetized; another is that money is valued for what it can buy and hence "is status", and finally, the Nigerians' demand for goods and services is high (pp. 217-221). Kilby's mention of the importance of the status motive has some similarities with Marris and Somerset's findings. Another study from Nigeria shows findings even more similar to the Kenyan studies. Onyemelukwe (1973) pointed out that many of the African entrepreneurs were motivated by, "a spirit of adventure and a desire to be independent." They also have a need to show that Africans can hold their own businesses and many see their businesses as, "a source of prestige and a great boost to their social standing." Hence, "Profit motive is, therefore, not often their main propelling force, ..." (p. 61).

Hart (1972) made a study of African entrepreneurship in South Africa. Instead of posing the question directly - 'Why did you want to start your own business or what motivated you to start your own business?', Hart asked an indirect question. The entrepreneurs were asked to choose between relatively attractive employments and present self-employment. In this way the question concerns the opposite view, i.e. the motive to stay in their present businesses and not the motive to start one's own business. Hart's findings were that among entrepreneurs there was, "a relatively high need for autonomy and achievement (from both economic and non-economic points of view)" (p. 139).

In the table below a summary of the African studies' findings is provided. The motives are ordered with the most frequently mentioned motive at the top. In some of the studies the frequencies are provided.

Marris and Somerset 1971 Kenya	Harris and Rowe 1966 Nigeria	Kilby 1969 Nigeria	Onyemelukwe 1973 Nigeria	Hart 1972 South Africa
independence (autonomy) 51%	money 40%	money to meet:	independence	independence 63%
contribute to development 32%	security through experience 18%	consumption needs status requirements	status	enjoyment and interest in business 23%
broadening of experience 21%	provide jobs for people 6%	traditional obligations	profit	money 12%
money 20%	independence 6%		contribute to development	

Table 5.1 Empirical studies of African entrepreneurs' motives

The entrepreneurs in Marris and Somerset (1971) are the recipients of loans from the Industrial and Commercial Development Corporation. Interviews were conducted at 47 industrial firms and 40 commercial firms. According to Marris and Somerset their selection of firms seems, "... to have included most of the enterprising African industrial entrepreneurs, and many in commerce". Harris and Rowe (1966) based their study on data from saw-millers in Nigeria. The Hart (1972) study is based on interviews with 80 owners and managers of enterprises in towns. Their average size and sophistication were somewhat greater than the general level of African enterprises in South Africa. The Onyemelukwe (1973) Nigerian study has taken its data from a group comparable with the Marris and Somerset's Kenyan study. The typical Nigerian entrepreneurs are self-made men who have come up the hard way, usually making a start with very little capital and with only elementary school education (p. 60 - 61).

5.4 Empirical findings

The empirical findings are presented under four different headings: strategy, conditions, motives and risk.

5.4.1 Strategy

Out of the 50 SI entrepreneurs interviewed, very few (5) expressed a reason for becoming an SI entrepreneur that we classified as a strategy for starting an industrial business of one's own. However, the interviewee was not asked directly if he had a long-term strategy; instead, more general questions concerning motives were asked. The following five were classified as having a strategy but, as can be shown by the quotations, this strategy was not very clearly pronounced.

> "5 years before going to Sweden I told my future partner (and neighbour) that I was interested (in starting an industrial firm)."

> "I had slight ideas from the beginning of my own business. I had a vague idea of first taking a degree, then working for 5 years, and finally having my own business, which was almost exactly the way it went."

> "I wanted to own a factory sometime, because my ambition when I came back to Moshi ..., I decided whether I just could have my own garage to do some work of mine, so when I met with these people we decided, because most of them had been schooling together, and they said they had this chance of taking this workshop so I joined them."

> "We had an electrical contracting business, and plans to start a hardware shop when the SIDO advertisment showed up, and we thought it was a good idea to get into manufacturing." "I was already planning to pull out of GT."

> "Yes, after getting my pension, I thought about starting my own workshop."
> "I'm in the engineering sector, so therefore I thought about starting anything within the engineering sector, ... could be motor repair, could be constructural work by making ... steel windows, steel doors ... but also could very much be determined by the amount of money I had at that time, to see how much assets I could put in."

The last quotation is an example of a personal life strategy after retirement. However, in the SI programme, only a few persons were close to retirement, as in general the selection system has favoured those around the age of 35. Otherwise, in Tanzania, civil servants and teachers retire at about 50 years of age and it is common that the pension together with money saved serves as a down-payment for starting a business as a second career. This is made possible by a pension system in which a common alternative is for the individual to receive a lump sum (half of the pension sum saved) at retirement and then a reduced pension during the following years. Aided by this pension system and by the experience and contact channels developed during the years as a government employee, it is quite common for a pensioner to start a business or a small workshop. Using our definition of strategy, one could say that a large share of the soon-to-be-retired have a sort of strategy to go into business on their own. However, it is not very common to go into an industrial business.

5.4.2 Conditions

By conditions, we mean the situational variables that positively or negatively influence the individual's motives and desires to start a new industry, i.e. to carry out an entrepreneurial event.

The conditions are structured under the following headings:

- I. Traditions of Entrepreneurship
  - a) Family background
  - b) Role models
- II. Work Experiences
  - c) Previous employment
  - d) Alterations in the standard of living
  - e) The incentive scheme for public organizations
- III. Opportunities
  - f) The existence of the SI programme
  - g) Employment in home district versus other regions
- IV. Other
  - h) Other conditions

The findings will be discussed in relation to a time schedule, as certain environmental differences exist between the conditions for the first sister industry entrepreneurs and for the SI entrepreneurs in the most recently established projects.

I. Traditions of Entrepreneurship

It has been shown that the traditions and values of entrepreneurship in an individual's closest environment have an influence on the desire to start one's own business. One component of this is the family background, and another is the prevalence of other entrepreneurs in the local community, i.e. role models (see section b).

a) Family background

In Tanzania, most of the population live off agriculture, which is mostly organized in a structure of small independent farmers, each having his own plot. This means that the majority of Tanzania's population have a close connection to this kind of small business. The custom of establishing small trading businesses etc. varies between regions, being very common especially in the Kilimanjaro region. Quite frequently, business activities in other regions are undertaken by people originating from the Kilimanjaro region.

Values concerning entrepreneurship are often said to be formed early in life and hence, the focus is on the family background of the entrepreneurs. Above all, the background of the entrepreneurs' parents is known to be of importance, especially in terms of whether they were employed or independent. Table 5.2 lists the principal occupations of the SI entrepreneurs' fathers. The categories are similar to the ones used by Marris and Somerset (1971, p. 59).

Father's principal occupation	No.	Percentage	
Businessman	6	24%	independent 72%
Peasant farmer	12	48%	
Craftsman, self employed	-		
Craftsman, employed	-		employed 28%
Unskilled, semi-skilled labourer	-		
Schoolteacher	5	20%	
Clerks etc. government emp.	2	8%	
Total	25	100%	

Table 5.2 Principal occupations of SI entrepreneurs' fathers

As shown above, the majority of SI entrepreneurs (72%) had self-employed fathers. The most common occupation was that of farmer (in almost half of the cases), which is, however, largely a reflection of Tanzania's general occupational structure, where about 90% of the population work in agriculture. As mentioned above, most farms are very small business units and the difference between this kind of activity and the activity in a modern small scale industry might be substantial, as compared to the difference between a corresponding farm/small scale industry in an industrialized country. However, the tradition of being independent and self-employed is strong in the Tanzanian society as a whole as well as in our sample of SI entrepreneurs' fathers. The following quotations are representative of the environment in which the SI entrepreneurs have their roots:

> "Father was a businessman, sold cows and everything and also was a tailor. My mother kept the banana garden."

> "My parents were farmers and some of my brothers and sisters have their own business."

> "My father has just been a peasant throughout his life. He has his farm up in Marangu, and mostly farms coffee and some bananas ... it is typical of Chagga land ..."

> "In my home area most of them have their own business. My father owns a small shop, and he is also a farmer, ... and he used to have transports."

The SI entrepreneurs whose fathers were employed as teachers, etc. also had close contacts with small businesses and craftmanship:

> "My father was a teacher, one of the 30 in the very first group of Tanzanians that were educated as teachers, when the Englishmen took over. One uncle of mine has had 7-8 buses for 15 years."

> "My father is a teacher, my uncles are technicians and carpenters, and one brother has a carpentry workshop."

The SI firms are a part of the modern monetary sector as opposed to the traditional rural agricultural sector. To a large extent the parents of the SI entrepreneurs have already taken part in the modern sector.

Forss (1985a) studied a larger sample of SI entrepreneurs (81 individuals) and found that, "40% of the sample came from families that have left the agricultural sector - or at least where the father in the family had a job in public administration, business or something else outside peasant agriculture" (p. 6). Forss also found that the educational level in general was high in the SI entrepreneurs' families. More than 70% of the parents had been to school and 28% had secondary education or higher. Furthermore, the education of the eldest brother was at university level for more than one fourth of the SI entrepreneurs and the great majority had eldest brothers with secondary education (75%).

b) Role models

The very first SI entrepreneurs had no role models; i.e., black Tanzanians who had started their own industrial firms. To a certain extent people started small repair shops, electrical consultant firms, etc., but not companies of the size of SI firms. For this first group, the step was considerable, as can be shown by the following quotation.

> "My wife thought I was mad, leaving a well-paid job with free car, swimming pool, etc. for a very insecure future."

As SIDO, the governmental support organization, had no records of success to show at that time, the risk involved was considered to be high. This was the situation for a few individuals at the start of the programme (in 1977), but since then, these individuals have had considerable importance as role models for subsequent SI entrepreneurs. The role models meant a lot especially in the northern areas, Arusha and Moshi.

> "I had seen some of my friends as SI entrepreneurs and Richard Moshi (one of the first SI entrepreneurs) advised me."

> "Richard, my student had joined the SI programme before. I saw how they were doing, and then I thought that it would also be a good chance for me."

Soon however, knowledge of the SI programme spread all over the country, and the future SI entrepreneurs of Mbeya, in the south, saw the Arusha entrepreneurs as role models.

> "I knew about Arusha."
> "I had seen our friends in Arusha (being successful)."

Hence, the existence of role models has been of considerable importance for all SI entrepreneurs, except for the very first group in 1977 who were the pioneers.

II. Work experiences

Former professional experience might have a considerable influence on an individual's desire and decision to start his own business. The work experience in itself often provides the basic skill and knowledge for the start-up firm. Negative push-effects as a result of unpleasant working conditions, deficient incentive schemes, etc. have an impact, as well as the more positive demonstration and role model effects, that are strong especially in small companies where it is possible to obtain perspective of the operations.

c) Previous employment

The most recent previous employment for 54 SI entrepreneurs is given in the table below. Here, previous employment is divided into six different classes; self employment, foreign private, local private, parastatal, other governmental organization, and unemployed. 'Foreign private' includes joint ventures with the Tanzanian State as majority owner. 'Parastatals' are certain independent government-owned organizations. 'Other governmental organizations' include work directly under different ministries. In table 5.3, the SI entrepreneurs have been divided into 3 groups, comprising SI entrepreneurs selected in 77-78, 79-80 and 81-82, respectively.

			EMPLOYMENT				
	Total number	Self-employed	Foreign private	Local private	Para-statal	Other governm.	Un-employed
First group 1977-78	28	4	14	3	3	3	1
		14%	61%		22%		
Second group 1979-80	19	2	3	1	4	9	-
		10%	21%		68%		
Third group 1981-82	7	-	1	-	5	1	-
			14%		85%		
Total number	54	6	18	4	12	13	1
Total share		11%	40%		44%		2%

Table 5.3 Previous employment of the SI entrepreneurs (numbers and relative percentages)

There is a trend in the background of SI entrepreneurs selected over the years. While a large share (61%) of the first group came from private industry, this share was significantly reduced in the next two groups, in favor of people coming from state-owned organizations and parastatals. The relative development of the three groups; 'self employed', 'private industry' and 'parastatal or government' is shown below in figure 5.1.

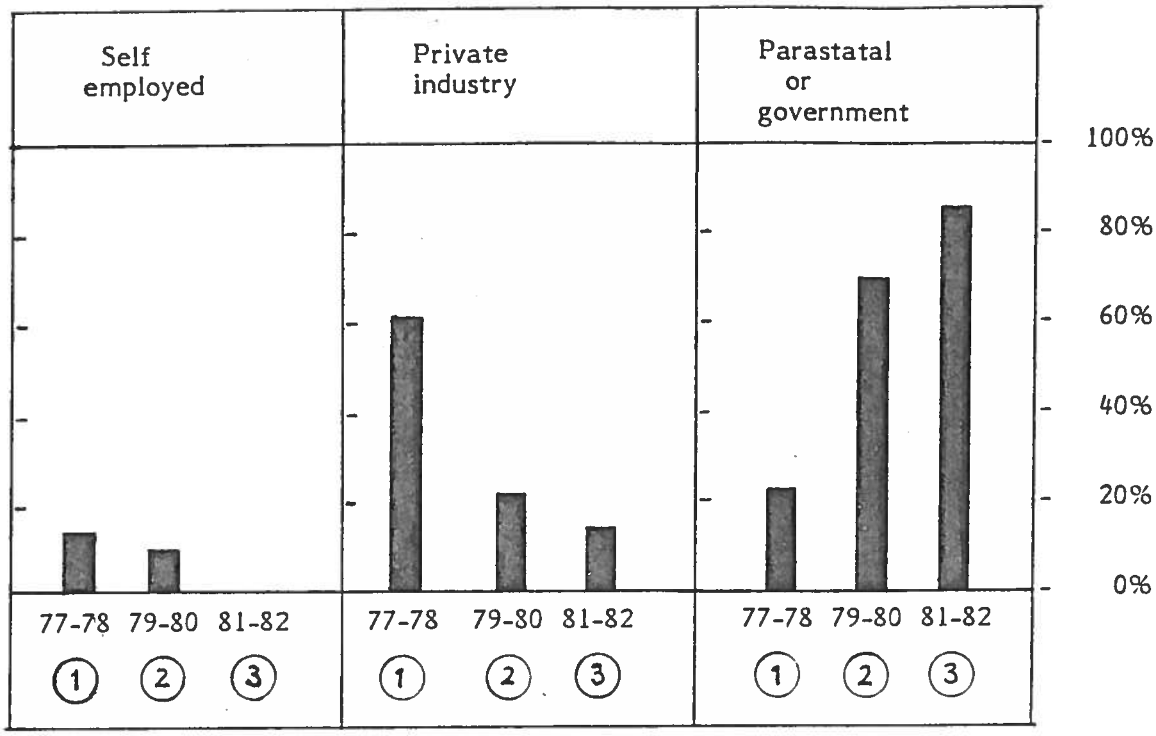


Figure 5.1 The relative proportion of SI-entrepreneurs' previous employment

Of the 14 SI entrepreneurs in the first group that were previously privately employed, 8 persons in 4 different SI firms came from the same firm, General Tyre E.A. Ltd. in Arusha.

d) Alteration in the standard of living

The cost of living in Tanzania has increased substantially during the past decade. As shown in table 5.4, the increase was 480% for people living in the urban, monetary sector of the economy. In order to analyse the possible effect of this on people's motivation to leave employment and start their own business, a comparison will be made with salary level development during the same period (1969-1981).

The majority of the individuals selected as entrepreneurs within the SI programme are technicians with 5-10 years experience of industry. This group of SI entrepreneurs was not homogeneous in salary levels. For comparison with the cost of living index (based on costs for goods and services), the government salary schemes for technicians will be used.

In Tanzania, salaries are controlled and reviewed by the government. However, since independence in 1961, there have been very few major salary increases. During the period 1969-78, when the cost of living increased by 260%, there was no change in salary level. For the individual technician, only a marginal increase in monthly pay owing to seniority was visible, i.e. there was a strong decrease in purchasing power. Because of this, "... it was found that the structure did not give enough incentive and motivation to the different categories of technicians ..." (Mushi, 1983).

"To bring about motivation and to enable the technician to rise to a higher scale it was necessary to revise the structures for all government and parastatal employees." (Mushi, 1983). This was accomplished in February 1979, when a new salary scheme was introduced. Two years later, in July 1981, a minor increase of 15% was added, while maintaining the same basic structure of the salary scheme. However, during the same period (1977-81), the cost of living increased by 63.9%. (See table 5.4)

Year	Cost of living index for urban dwellers		Salary structure index for technicians
1969	100		
1970	103.5		
1971	108.4		
1972	116.7	260% increase	Constant salary
1973	128.9	in cost of	level (1969-1978)
1974	154.1	living (1969-1978)	
1975	194.3		
1976	207.6		
1977	231.8		
1978	260.0		
1979	293.0	100	100
1980	382.4	-	-
1981	480.4	163.9	115

Table 5.4 Cost of living index and salary structure index
Source: Economic Survey 1981 and the Tanzanian Governmental Salary Scheme

Hence, while the cost of living has increased substantially during the period (480% from 1969-1981), the salary levels have not increased at the same rate. This implies that the standard of living has decreased for salaried people during the whole period, except for the adjustments in 1979, that to a certain extent reversed the tendency. However, the gap between cost of living increase (63%) and salary increase (15%) during the following two years, further reinforced the negative tendency. In comparison, people who run their own businesses have been better off, and the gap between salaried and self-employed people has widened during this period. Hence, salaried people have increasingly tried to go into business for themselves whenever an opportunity arises. This partly reflects the importance an individual places on relative salary levels; i.e. one's own salary as compared to those of friends with equal education/experience but self employed, a variable that has been shown to be of utmost importance in countries like Sweden (Dahlström et al. 1966, p. 41).

However, in Tanzania the absolute salary level is also of considerable importance, as reduced purchasing power has severe effects. It has become hard or almost impossible for a breadwinner to rely on salary alone. Most employed people must also have a side activity, which brings in a little extra money. This is even reflected in the Tanzanian language, where the swahili word 'mradi', orginally meaning project, is now the common word for all kinds of side activities (see Africa Now, Dec. 82, pp. 67-69). "So a little shamba (farm), a few chickens, some typing after working hours, consultancy work, even a rich boyfriend, have all become 'mradi'. It is now almost impossible to maintain one's standard of living without a 'mradi'. "(ibid. p. 67) There is a consensus among Tanzanians in general, that the only way to be 'better off' is to have one's own business, either employment and mradi or a business of one's own.

In our interviews however, the lowered standard of living was not frequently mentioned as a condition/motive for going private. This partly reflects the gradual change in the economic situation. In 1977-78, when most SI entrepreneurs were selected, the economy was in better shape, and high-salaried people were relatively well off, especially if they also had some fringe benefits, like free housing or a free car. Furthermore, among the first group of SI entrepreneurs there were many employed by private companies which were able to pay higher salaries than the parastatals and government agencies. However, the rising cost of living must be considered as a very strong negative condition (push) influencing an individual's desire to go private. As this condition became worse, the SI entrepreneurs selected later (79-82) may have been even more influenced by it. This might partly be reflected in the composition of the SI entrepreneur group during this period, when the part coming from parastatals and government offices gradually increased. (See sections c and e).

e) The incentive schemes in public organizations

Many of the entrepreneurs in the SI programme were previously employed by public organizations or parastatals. One important reason for leaving this employment to go into business on one's own might be the construction of incentive schemes for these organizations. As Nyoni (1982) puts it, "The major problem ... is that these incentive schemes are not related to the performance ... ." He continues, "The rewards are predetermined and given to employees even before they produce anything" and "... when good and bad performers are all rewarded equally, performance is adversely affected." This study by Nyoni (1982) primarily discusses the low efficiency of public organizations, but it can be claimed that this system also provides at least one motivating factor for individuals to leave such organizations to "test their abilities" in an environment that will provide another kind of feedback and incentive. The following three quotations all refer to dissatisfaction with employment in public organizations:

> In the former employment (a parastatal), "if you work harder you might get lower pay and lower job satisfaction as well."
>
> "My full resources would be utilized, which was not the case at the former employment," where the work was going "sluggishly".
>
> "The determining impulse to start a business of one's own arose while working at the Mail Services, under an incapable management with deficient responsibility."

According to Nyoni (1982), "... the average Tanzanian manager, like the ordinary worker, is still motivated by extrinsic factors" (lower level needs satisfaction). But Nyoni also comments that, "workers are increasingly becoming aware of the importance of non-material rewards." As an example of this kind of reward, Nyoni mentions responsibility, meaningful work, participation, and feedback. Having one's own business provides an individual with all of these intrinsic rewards, as indicated by the following quotations.

> "It is better to decide for oneself and to be able to guide the development oneself."

> "I don't want to work for other people all the time, I want to have my own business."
>
> "I had been employed for a long time and was feeling exploited."
>
> "I applied because I wanted to be self-reliant, because when self-reliant you can do some more things, many things. If you are employed you are tied to the time and the regulations your employer and I wanted to be free."

The existence of intrinsic rewards and motivations will be further treated in section 5.4.3 Motives.

III. Opportunities

f) The existence of the SI programme

After the Arusha Declaration in 1967, Tanzania put its effort primarily into developing large state-owned companies, sometimes in cooperation with foreign capital, and to some extent into supporting private small scale simple industries (village industry). Ten years later, in the latter half of the '70s, a renewed interest arose in modern small/medium scale industries led by individuals, primarily in the organizational form of partnerships, cooperatives, and limited liability companies. The SI programme was the first successful step by SIDO towards establishing this kind of so-called district industry. For a Tanzanian technician with industrial experience, this programme offered perhaps the only possible way to start an industry of this type and size, given the financial and structural constraints existing in the country. This offer, which came to the know-ledge of most potential SI entrepreneurs through an advertis-ment, served as a strong pull to leave employment for an industrial business of one's own.

Why has there been a trend in the selection of SI entrepreneurs, from the majority of the first group coming from private industry and self employment to the last group of entrepreneurs coming from parastatals and other government employments? (see figure 5.1, section C). Part of the explanation has been provided before, i.e. the push effects of detoriated standard of living and of deficient incentive schemes in public organizations. Another part of the answer might have more to do with which group responds to the opportunity. According to Mushi (1986), "The Government and/or parastatals have a large pool of educated technicians, etc. This educated elite is the first one to take up the opportunity wherever it arises. These people may not have an investment elsewhere and therefore, since they are starting from scratch, they have not much risk. They are there to gain. On the other hand for the other groups, the self employed and those in private industry the trend shows a decline because since they have tested the 'business' market they are very cautious to venture into new undertakings. They are risk averters, rather than risk takers. Furthermore, since the SI programme is something from outside, the educated will rush for it because they are more enlightened of the outside world than the other two categories."

For the first SI entrepreneurs, the assessed risk was considerable, but for later SI entrepreneurs, the SI programme has functioned as a guarantor against risk, by offering technical and educational, as well as financial support. For a further discussion of the assessed risk, see section 5.4.4.

One hypothesis concerning the selection trend could be that the first group of entrepreneurs being risk takers created the basis for others' perceptions of the SI programme's feasibility. From then on the large group formed by the educated elite employed by the State, responded most easily to the opportunity offered from outside and made increasing efforts to become SI entrepreneurs. Hence, this group was responsible for an increasing share of the new business startups.

g) Employment in home district versus other regions

As in many other cultures, people working in regions far from where they were brought up long to move home. In Tanzania, this tendency is stronger than, for example, in Sweden. In some of the responses to our interviews we have found the desire to move back home a motive for participation.

> "I had been out of the homeland and wanted to come near the mountain (Kilimanjaro)."

However, this longing might also work in the opposite direction, as individuals with a good job in the home area might be more reluctant to leave their employment for an insecure future.

> "Maybe it would be hard to get a job that would pay me well in Arusha. You see, I'm established here in Arusha. I have my own house, I've got my family here, my mother lives here, so it would not be easy for me to move out of Arusha."

h) Other conditions

For a few individuals some other conditions, unique for each individual, were of importance for the decision to become an SI entrepreneur. Among these conditions were:

- trial employment
- unemployment
- reached top of the professional career
- a hobby became a profession
- already in the process of starting his own business when the SI programme was started

5.4.3 Motives

As mentioned in section 5.2, motives for starting one's own firm concern the expectations and desires that an individual in retrospect indicates having felt at the time of application; i.e. a purely subjective judgement.

In this section, the motives will be structured according to Friberg's incentive classification (1975 and 1976).

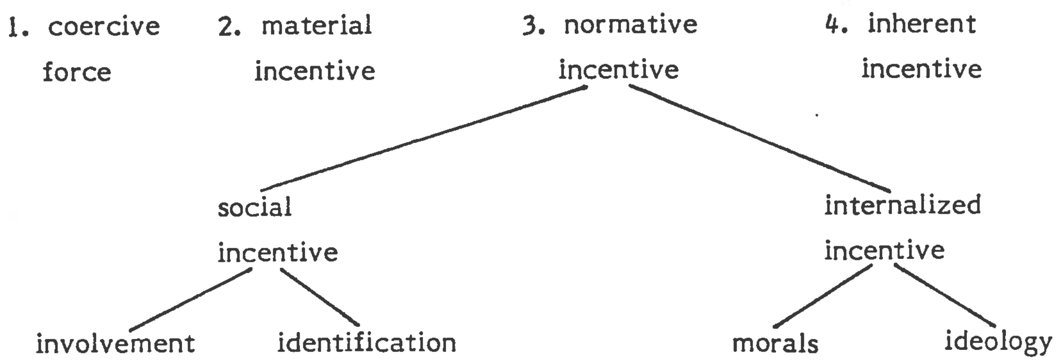


Figure 5.2 Classification of incentives
Source: Friberg 1975

According to Friberg, the different types of incentives show the following features: (Note that "the incentive" of an individual is mostly a combination of different types. Also, incentives may be both positive and negative, except for coercive force that by definition is negative.)

Coercive force is a negative incentive coupled to physical and biological sanctions, or threat of sanctions. Coercive force might be direct as well as structural, the latter referring to the structure of the society, e.g. if salaries are so low that they lead to partial starvation and no alternative employment exists, then the coercive force is intrinsic in the societal structure. Coercive force is useless as a means of getting people to perform tasks demanding initiative, interest, concern and responsibility, at least within the organization that is using the coercive force. It only yields an apparent submission, resulting in attempts to evade the demanded task. Furthermore, coercive force undermines other incentives. Another example of coercive force is the threat of being dismissed (the last example may also involve negative material incentive; i.e. taking the material incentive away).

Material incentive is defined in terms of consumption of goods and services. A typical example involving material incentive is piece-work pay; i.e. pay according to performance. Pay or other material incentives may be directed towards the individual or the collective, i.e. group bonus etc. The effect of material incentives on performance shows extreme variations. In industry, material incentives have proved to be of the greatest importance at the blue collar and middle management levels. However, material incentive is limited, as it stimulates the individual to perform his tasks in a routine manner, not innovatively and independently. Also, Friberg points out that in an industrialized society like Sweden, where the social security system is well-developed, the potency of material incentive has become more limited. However, in a society where the purchasing power decreases severely and the salary becomes insufficient for survival, the individual might experience a strong negative material incentive to do something radical. This could include leaving one's employment and starting one's own business, i.e. a negative material incentive stimulates a creative and independent move.

Normative incentive can be subdivided into two groups, social and internalized incentives. The social incentive is related to group effects such as involvement (the individual performs a task in order to obtain approval from the primary group) or identification (the role the individual takes on in relation to specific groups or persons). The social incentives are among the strongest incentives known, and experience from many countries shows that it is possible to utilize this kind of incentive in production systems. The social incentive, especially involvement, is (in combination with internalized incentive) today considered to be of importance when designing new production systems in Sweden.

Internalized incentive is a type that has been incorporated into the personality. Morals are acquired in youth and ideology is incorporated later on as an adult. In opposition to material and social incentives which may be utilized to obtain almost any goal, there is a close relation between the ideological incentives and the goals possible to work for. Hence, this kind of incentive is of more limited utility for industrial work. Morals have a strong influence on the norms and attitudes towards work, discipline etc. The risk with this type of incentive is that it develops into a rigid system of rules hampering creativity and problem-solving.

Inherent incentive exists when an individual performs a task because the performance itself is rewarding or reduces tensions within the individual. The inherent incentives often vary between different individuals. All creative tasks probably demand a large share of inherent incentive. The distinction between inherent and internalized incentives is that the internalized incentive presupposes a prior socialization process. It is not possible to derive the inherent incentive from other basic incentives. Classic organization theory denies the existence of inherent incentives, while they do play a role in the work of White, Piaget, Allport and Maslow. (Karlsson 1979). McClelland's "need for achievement", i.e. a need or drive within a person that motivates behaviour towards accomplishment, is to a large extent based on internalized incentives, e.g. acquired during childhood through a socialization process. However, other types of incentives are also influential on the n Ach.

According to Friberg, the inherent incentive is underestimated in Swedish society. In recent developments in the area of production systems (especially the socio-technical school), inherent incentive is utilized consistently, resulting in changes in work content by means of job-enrichment, etc. At the same time, ideological and social incentives are used in the form of broader participation in decision-making and by supporting the unity of work groups. Inherent incentives are very important on the management level of organizations. However, when organizational changes are made to increase the inherent incentive at lower levels, this might negatively influence the inherent incentive at the top, and hence create a resistance to change (Friberg 1975 and 1976).

Coercive force did not exist as an incentive for the SI entrepreneurs to start their own businesses. Instead, as Nyoni (1982) points out "the average Tanzanian manager, like the ordinary worker, is still motivated by extrinsic factors", i.e. material incentives. We have found strong support for this in our data, even though different kinds of inherent incentives were even more frequently mentioned.

As has already been pointed out above, starting one's own business is one of the few methods available for raising the standard of living, and obtaining a certain amount of wealth. However, we can separate two groups of material incentives according to time span; those that are aimed at providing benefits in the long run, and those that are short-term. The motives mentioned in the interviews are long-term ones, primarily;

"obtaining shares in the company, better future prospects, making more money, more advantageous, security when you get old." Obtaining security might be a more important motive than is obvious in our study. Better future prospects might be an indication in this direction. Otherwise, the most common motive is to obtain a better economic standard.

> "It would be something of my own, then I could work hard and make some money and a better living."

> "I have always thought about doing things on my own and making more money."

The short-term motives are not mentioned officially, but for some individuals the opportunity to go to Sweden and to be able to import some capital goods have had considerable importance. Another short-term motive, of which there are some indications, is to "squeeze" money out of the company, with no consideration for the future of the firm.

As mentioned above, the inherent incentives are the ones most frequently mentioned. This might partly be attributable to the approach of questioning, as a certain bias in favour of inherent incentives in relation to material incentives, might arise. However, it may also reflect the growing importance of this kind of incentive at management level in Tanzania.

The general theme in the inherent incentives is a longing to be one's own boss, to be self reliant etc., but also quite frequently a wish to test one's own ability. This wish to grow and to utilize one's own resources is often accompanied by comments about the previous workplace where these opportunities did not exist or were not appreciated enough. This was mentioned especially by individuals previously working in public organizations; i.e., this might be a further indication of a deficient incentive system. This wish to develop and test one's own capacity was expressed very strongly in several cases as illustrated by the following two quotations.

> "It's different to work with your own work, rather than being employed, you see. You have the ambition to develop all the time, to work harder and harder. I worked hard (at my former workplaces) but when you work harder and you are working under somebody, especially in these big companies, they don't feel that you are working harder."

> "Well I needed to, yes, I wanted to see how much I can work on my own and how much I can practise the knowledge I had", ... "well, being that I was very much interested in this metal-forming, I thought I could on my own do something and I was very anxious to do this."

In comparison, some other SI entrepreneurs accentuated autonomy and self-reliance as such.

> "I applied because I wanted to be self-reliant. Because when self-reliant you can do more things, many things. If you are employed, you are tied to the time and the regulations of your employer and I wanted to be free."

The above quotations are typical examples of what have been classified as inherent incentives. Of course, these quotations might also represent combinations of several incentives. For example, social motives might be behind the desire for autonomy (i.e. 'involvement' through approval of the primary group etc.) or there might even be internalized values that have been socialized earlier and now are being fulfilled by obtaining a relative self-reliance.

However, internalised incentives, while seldom mentioned, probably have a certain significance. The morals incentive, acquired during childhood: that it is good to start one's own business, that it is "a natural thing", naturally influences the decision to go private.

> "It is important to start up a business and to do something with your own hands."

Ideological incentives, while considered to be of great importance by the political leaders, probably have a very limited influence on the decision, even though there are statements such as "helping our country", "rising for the future Tanzania", and "increasing the economic development of the country."

> "We are technical people and want to use our capabilities to develop for the betterment of our country. By starting the company from scratch, we can grow with it and have our own ideas and help our country economically."

However, Marris and Somerset (1971) found in their study of Kenyan businessmen that, "An entrepreneur in Kenya is, then, likely to have identified himself with the struggle for independence" (p. 69) and business, "where lack of educational sophistication was less of a drawback" became a substitute for both administrative and political leader ship. (p. 67). The SI entrepreneurs were, however, in general much better educated, and furthermore, they were not like their Kenyan counterparts, who had participated in the struggle for independence as adults. Instead the SI entrepreneurs belong to the first post-independence generation of the work force.

The social incentives for starting one's own business are less well covered by this study. However, identification in the sense of having role models of entrepreneurship to identify oneself with, has considerable importance. Furthermore, involvement probably has a certain significance, in terms of the status involved, to be better off, to have a nice car, to be one of the "boys", to obtain approval in the primary group, consisting of former schoolmates, work colleagues, and fellow SI entrepreneurs, as well as one's own family.

5.4.4 Risk

Preoccupation with the entrepreneur's risk-taking is common in many studies of entrepreneurship. The situation of an SI entrepreneur might differ from that of the free market entrepreneur in this respect. There are different types of risk that could be considered. Hult and Odéen (1983) make a division into four types of risk; financial risk, career risk, family risk and psychic risk. Most answers by the SI entrepreneurs concerned career risk and family risk, including that of starving. Also financial risk was mentioned. A description of the assessed risk is given below.

In general, the SI entrepreneurs are a well-educated group in the Tanzanian society, with relatively long experience of industrial production. As there is a great shortage of experienced technicians in Tanzania, there are no real problems for hardly anyone in this group in getting a new job, if their SI firm would fail. This has been indicated in several of our interviews where the interviewees were quite confident of their chances to obtain employment, if they tried to find it.

> "I had to take risks, but I was determined, because I left GT with my certificates and if anything goes wrong here I'll go back seeking employment. I would get a job at GT again because I've got my certificates."

> "I was a bit confident with myself and with my qualification, that whenever, if I failed, I can always get a job anywhere, without any problem. I could either join again my former job, they still needed me, and some different companies also they are trying to get me all the time. Philips, for instance, know me, they are all time trying. 'You come and work with us'."

Hence, most SI entrepreneurs, at least those with a background as technicians, did not think there was a risk of unemployment if their SI project failed. However, there are other risks involved, such as taking a step backward in one's career or losing a very good job, the risk of having to move to another region to find a nice job, and of course, also the risk of losing one's share in the company's equity, a sum several entrepreneurs had raised through personal loans.

The assessed risk differed depending on the point at which the individual entered the SI programme. For the very first group of SI entrepreneurs in 1977 the assessed risk was considerable, as the SI programme was a new, untried way of establishing privately owned small scale industries. Furthermore, the programme was carried out under the guidance of an inexperienced support organization, SIDO, established only three years earlier (in 1973) and thus there were no examples of previous successful projects to show. The early entrepreneurs holding relatively high employments were especially conscious of this risk.

> "My wife thought I was mad, leaving a well-paid job and free house, car, swimming pool etc. for a very insecure future. I sold my truck, cars, pigs, everything except my small farm to put into the industry."

> "When I was at General Tyre, I had an employment that ... was well paid according to our standard of living. I was not sure whether this would pay me and if this fails I would be out of job."

> "Yes (I considered it as a big risk) because of, leaving the work I was doing (plant manager) and all the privileges I had."

SI entrepreneurs occupying middle level positions in industry assessed the risk as minor as they thought it was likely that they could obtain employment similar to the one they had left for the SI programme. However, the SI entrepreneurs with less technical education and/or less industrial training were more worried about the success of the SI project.

> "It's risky but we said OK. All the family depends on me, it's a risk if I'm not being able to support them."

> "If we could not run the factory we would both lose the job and we could not run the business, and could not have something to eat."

Primarily, this first group of entrepreneurs seemed to estimate the risk-taking in terms of their possibilities to obtain employment similar in quality to their previous one. In only a few cases the risk of losing the equity, etc. was mentioned. These early SI entrepreneurs also expressed a certain concern about what would happen if their businesses grew, as in 1977/78 the policy with regard to privately owned industries was changed, but no practical examples existed.

> "Another risk that we might have been thinking of, is nationalization, because Tanzania was nationalizing certain businesses and properties. But then we didn't think it was important, since SIDO is a government agency, and they had decided to establish the small scale industries. Nationalization seemed distant, we didn't think it would arise."

For the second and third group of SI entrepreneurs (1979-82) the assessed risk was very limited. This was primarily due to the existence of role models, in this case successful projects on the Arusha Industrial Estate that were well-known among potential SI entrepreneurs all over Tanzania,

> "I didn't care. My husband keeps his job if I fail. I'm a teacher, I'm marketable. I had seen our friends in Arusha (being successful)."

> "Risk didn't play any important role. When the decision was taken to start an industry other things were secondary (risk etc.)."

> "I didn't think about any risk. There is no competition."

Hence, the later SI entrepreneurs considered the risk to be very low, even though this opinion was not shared by everyone in their immediate vicinity.

> "My father was against it. A lot of people (schoolmates and colleagues) tried to discourage me. They told me to continue my former employment."

In comparison with most individuals in this study who were in the middle of their careers, a few SI entrepreneurs close to retirement were risking more. For instance, the following SI entrepreneur was risking more than just losing the equity, but still considered the risk to be low, bearing in mind earlier successful projects.

> "I lost my pension, I had only four years to go until I get my pension, then I lost my whole pension. Quite a big thing. I'm fifty years old this year."

In summary, the assessed risk when joining the SI programme was generally very low with a few exceptions among the early SI entrepreneurs. The existence of role models has been especially influential on the assessed risk of later SI entrepreneurs. However today, the risk may again be considered to be of a larger magnitude as a consequence of the general economic decline. Today, several Tanzanian companies are standing idle because of a raw material shortage. This is reflected in interviews from 1983.

> "Risks involved depend on the economic condition of the country. We might have to close down. There are a lot of stories of companies failing."

However, most SI entrepreneurs were still confident concerning the existence of SIDO/SIDA and that these support/aid organizations would never accept a failure of the SI programme. It should also be emphasized that this study only concerns individuals who became SI entrepreneurs between 1977 and 1982; i.e. during a period when the risk was generally considered to be low.

5.5 Discussion

5.5.1 Important factors - a summary and discussion

In this section, the results of the empirical study will be summarized and commented on in relation to the results of other research.

Strategy

A clear strategy was not found in any of the cases. However, a few respondents had a diffuse strategy for starting a business of their own. "I had a vague idea ...". No specific ideas existed concerning how it should be accomplished, or in what specific field or industry. These findings are in accordance with other research; for example Shapero (1980, p. 13) notes, "In my own field research only one of the hundreds of entrepreneurs interviewed claimed to have planned a step-by-step process leading to the formation of a business, though many reported that they had often thought of it". On the other hand there are examples of a very thoroughful planning in advance for the start up of new businesses. According to Markkula (1986), the start of Apple Computers in 1976 was preceded by three months of planning for every single step and anticipating all possible outcomes.

It should be noted however, that individuals seldom try to formulate clear strategies in the same way as industrial companies tend to do; i.e. when you have an organization consisting of several individuals, the need to formulate strategies for the business arises.

Conditions

In Tanzania there is a tradition of having one's own business, especially in the north, in the Kilimanjaro region. Most people in the area are independent in the respect that they work for themselves and not as employees. Mostly, this means very small businesses or small farms. Literature is rich in examples of the importance of tradition within the family as well as within the whole ethnic group (see Carroll 1965, Shapero et al. 1973, Marris and Somerset 1971).

However, this tradition merely refers to very small businesses, primarily in the field of trading and farming. In the industrial sector, there are very few examples of African privately-owned firms; instead this sector has been dominated by state-owned and Asian privately-owned industries. However, while African industrial entrepreneurship was "practically nonexistent in Tanzania" at the time of the Arusha declaration in 1967 (Schädler 1968), and still was very limited at the end of the '70s, the start of the first SI projects provided role models of industrial entrepreneurship for the followers, which has constituted a very important condition for later SI entrepreneurs. The extreme importance of entrepreneur role models is well-known from other studies (see Draheim et al. 1966, Hult 1979, Frej 1981).

Previous employment may influence the individual's desire to start his own business in a negative as well as a positive way; e.g. through unpleasant working conditions or by 'learning' in combination with a feasibility demonstration, respectively. It has been pointed out that, especially in small organizations, it is possible to see oneself in the future role of company head. (Cooper 1971, Shapero 1980) In the first group of SI entrepreneurs, the majority came from private industry, while the later SI entrepreneurs primarily were recruited from the public sector.

An influential condition, while not frequently mentioned in our interviews, was the decline of the Tanzanian economy with rising costs of living in combination with almost constant salary levels. To have one's own business has been one of the few possibilities to be "better off" than an employee.

For employees in public companies and organizations, prevalent incentive schemes have contributed to dissatisfaction with one's work situation and to a desire to start one's own business. Dysfunctioning incentive schemes as motivators for individuals to leave an organization and start a new business are also known from other studies. There is an anecdote about a deficient bonus system at IBM. When a top salesman achieved the yearly bonus maximum in a few months' time he left in order to form a competing company (Shapero 1980).

The mere existence of an SI programme offering support, a "risk-free" road towards one's own business, successful examples to show, etc., is in itself a strong condition which was influential for all but the very first SI entrepreneurs. Especially, this seems to have attracted the educated elite employed at state owned organizations, when the feasibility of the SI programme had been made clear by the first group of risk taking entrepreneurs.

Other more personal conditions are a few cases of persons losing their jobs, a few individuals were at the top of their careers with no further possibilities for advancement and challenge, and some individuals held employments far from their home region and wanted to return home. Furthermore, in some cases the individuals were already in the process of starting their own businesses, when they by coincidence found that the SI programme provided them with greater potential. Finally, for some individuals the condition could be characterized as truly "coincidental", such as the case when an individual is offered a partnership by a friend, but had no intention of going into business when the offer came. The latter kind of positive pull is found quite frequently in studies (Shapero 1980, p. 13).

Motives

The material incentive was important for the SI entrepreneurs, a finding which is in concordance with other studies of motivation in Tanzania

(Nyoni 1982). Mostly this concerned a long-term effort to obtain better future prospects and a higher standard of living. However, more short-term motives prevailed as well; e.g., the opportunity to import capital goods to Tanzania.

Inherent incentives such as a wish to test one's own ability and to be self-reliant were very frequently mentioned in our interviews. This might reflect the situation for this group of relatively well-educated and experienced technicians, who are motivated to a growing extent by inherent incentives. Findings from this middle management level in industrialized countries also indicate the growing importance of inherent incentives (e.g. Friberg 1975).

Internalized incentives were less frequently mentioned but they also exist. The morals incentive; i.e., that it is good or natural to start one's own business was mentioned. This is closely connected with existing entrepreneurship traditions. Ideological incentives were mentioned as well, especially as part of the effort to develop Tanzania's economy. The importance attributed to self-reliance may also, to a certain extent, reflect an ideological incentive (see documents such as the Arusha Declaration in Nyerere 1968), but, as expressed in our interviews, self-reliance was mostly related to the personal work situation, and is thus more in line with inherent incentives.

Social incentives, finally, were less frequently mentioned, but the importance of role models; i.e., identification, has been elucidated in section 5.4.2 b. Furthermore, approval by the primary group of former schoolmates, work colleagues, other SI entrepreneurs, as well as one's own family, probably has a certain significance.

Risk

In short, the risk was considered to be high for the first SI entrepreneurs, who were risking losing a good job, the down payment, etc, by joining a programme run by an inexperienced support organization (SIDO) with no previous positive record. However, this picture changed radically very soon. The second group of SI entrepreneurs (1978/79) had successful role models to rely on, as well as confidence that SIDO/SIDA "never would allow" an SI project to be a failure. However during 1982/83, the picture has again changed concurrently with the ongoing economic decline and the plans for structural adjustment. This last change is, however not included in the empirical data in this study, as all interviews concerned accession to the SI programme during or before the "no-risk" period. However, it should be emphasized that this group of relatively well educated and experienced technicians are generally very sought after on the Tanzanian labour market, and hence the risk of future unemployment, if the SI project should fail, is very limited.

5.5.2 The entrepreneurial event formation process

The discussion concerning motives and conditions will be conducted in relation to a model of company formation process created by Shapero (1980). This model is based upon research primarily carried out in the US and other capitalist economies, which differ to a certain extent from a third world economy like Tanzania's. Furthermore, this model describes the process in which an individual (or group of individuals) gradually takes steps to start his own business on his own initiative, which is different from the SI programme, where the process is initiated by a governmental support organization.

Hult (1980) demonstrated these differences by giving examples of typical activities during different phases in the company formation process in a capitalist country (trial-and-error process) as compared to the process within the SI programme ("planned" process).

Phases	Examples of activities in the "trial-and-error" process of business formation.	the "planned" process of business formation.
Idea	The entrepreneur has a general idea of starting a company of his own.	The ideas are proposed by local people, SIDO or government institutions.
Test	The entrepreneur has now selected one business idea and start testing it on his family, his friends a s o.	Feasibility studies by SIDO, of the proposed industry's effects. Search for a possible Swedish sister company.
Preparation	The entrepreneur is making prototypes, doing simple market research, trying to get needed capital, buying needed used machines.	Identification of the Tanzanian industrial management group. Negotiations and contract formulation.
Starting	The entrepreneur works very hard, often part time. He works hard in order to get a good production unit.	Training Tanzanian entrepreneurs. Buildings, machines, capital are allocated.
Operation	Still working hard with the production unit. Working with product development.	Checking and control of the new industry. The industry goes into the market.

Table 5.5 Activities during different phases
Source: Hult (1980)

The differences in the company formation process are substantial due to the role of SIDO, the support organization, during early phases. However, the individuals taking part in the SI formation process also has to cope with many conditions similar to those of the self-made man in a capitalist country.

The purpose of this part of the study is to discuss factors influencing and motivating individuals to become SI entrepreneurs, in relation to the model presented by Shapero (1980) and later slightly modified by Shapero and Sokol (1982). According to this model, the entrepreneurial event formation process could be described according to following figure:

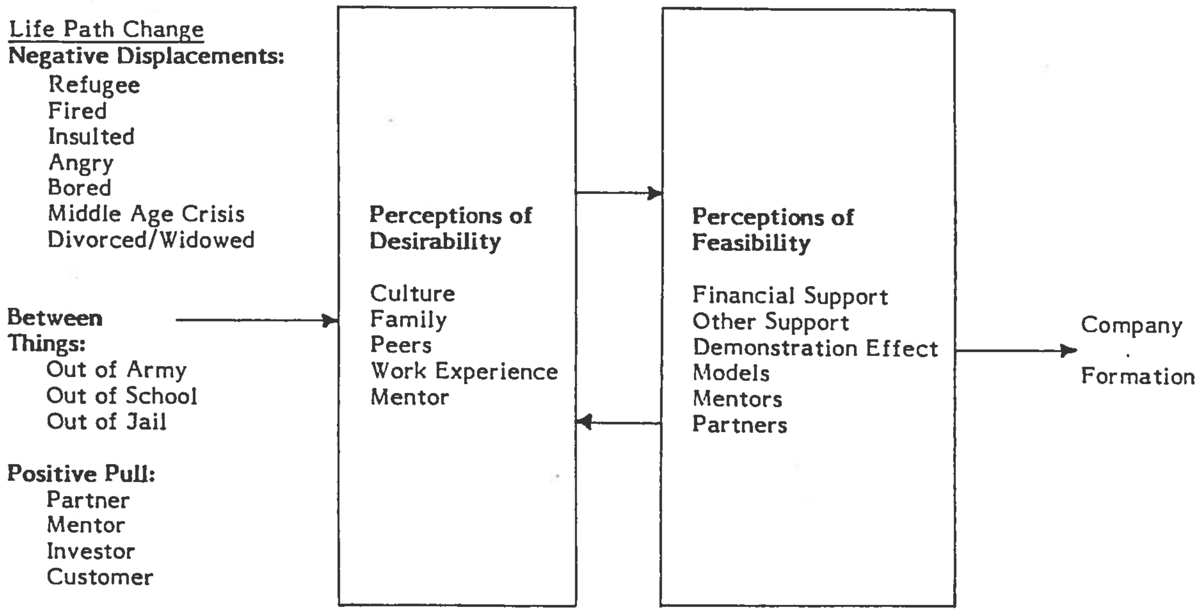


Figure 5.3 Entrepreneurial event formation process
Source: Shapero (1980)

Shapero argues that for an individual to take the big step of undertaking an entrepreneurial event, such as company formation, the influencing factors must be very strong, as "It takes a powerful force in a new direction or the summation of many detracking forces before an individual is pushed to or consciously opts for a major change of life path." (p. 9). This change is influenced by three types of factors: negative, positive and the so called "between things". Among the more prominent negative factors (push) are: the threat of becoming a refugee, job-related factors like getting fired, job dissatisfaction, but also internal factors like middle-age crisis. Positive factors (pull) could be the appearance of a partner or an investor, a potential customer, or a mentor. "Between-things" factors, finally, refer to the situation in an individual's life, when the life pattern has not been stabilized, as is the case when someone leaves school, the army, or a prison. These three types of factors are the ones that set an individual off towards a life path change, but there are many different alternative routes available.

The choice of action to be taken is, according to Shapero, strongly influenced by social and cultural environments. Shapero (1980) points out that; "Perceptions of desirability and perceptions of feasibility are products of culture and social environments, and it is these perceptions that help determine the actions seriously considered and the actions taken" (p. 13). Among the factors affecting perception of desirability are family and ethnic group traditions, role models among peers, previous work experience, previous life path changes, etc. As Shapero points out, "perceptions of desirability and perceptions of feasibility necessarily interact ...", and they are also partly influenced by the same factors. The factors Shapero takes into consideration concerning perceptions of feasibility are: availability of financial resources, existence of would-be partners, presence of support organizations, mentors, role models, etc.

Arguably, Shapero's model of the entrepreneurial event formation process uses a very broad concept, in which almost any kind of initiative is regarded as an entrepreneurial event (see for example Harwood, 1982). However, for our purpose of analysing the conditions and motives influencing SI entrepreneurs to start their own businesses, Shapero's model offers a starting point for a comparison with the free market entrepreneur. Furthermore, Shapero's model served as a form of check-list during the data-gathering phase, not, however, completely restricting our set of questions. One advantage of Shapero's 'entrepreneurial event' concept is that it provides an opportunity to discuss matters concerning individuals performing entrepreneurial events without touching on the difficult issue, perhaps superfluous to this study, of judging an individual's entrepreneurial ability. In this way, the entrepreneurial event concept is more dynamic, as it does not focus on personality factors to the same extent as current concepts of entrepreneurship. Nevertheless, in the individual case, personality factors are of course also of considerable importance. Shapero's working definition of an entrepreneurial event (including initiative-taking, consolidation, management, relative autonomy, risk-taking) also merits some discussion in the SI case, as the support organizations SIDO/SIDA are more influential than in an ordinary market economy during the early phases.

The findings from the SI programme will, in accordance with Shapero's model, be discussed in section 5.5.3 'The road to action', 5.5.4 'Perceptions of desirability', and 5.5.5 'Perceptions of feasibility'.

5.5.3 The road to action

Almost all the individuals interviewed were employed, with the exception of one former owner of a garage. However, some people already had a small business parallel to their employment, such as an envelope factory, an electrical consultancy firm, and in several cases the individuals also had a shamba (small farm), which provided them with food and to a certain extent yielded produce for sale on the market (poultry, coffee etc.). In general, however, the decision to start one's own industrial activity could be categorized as a major life path change.

While negative factors, according to previous studies, normally tend to dominate, the data from the SI programme gives few indications in this direction. There was loss of previous employment in only two cases, both in consequence of deteriorated political relations with Kenya; when the East African Community Center was discontinued, an employee of that center lost his job. The second case was an entrepreneur who, before the border was closed in 1976, had almost all his business activities in Kenya. To a certain extent though, we have found that job dissatisfaction has been of importance, especially among the SI entrepreneurs from southern Tanzania. Finally, there are also a few clear cases of internal displacements generated by the passage of time. A few individuals of above-average age had advanced as far as possible in their present careers as employed and "wanted a change and an adventure". Also in one case, an individual was approaching retirement (within 4 years, at 50 years of age) and this fact intensified his search for a new life path. (See section 5.4.1 for a description of the Tanzanian pension system).

This last example could also be described as approaching a "between-things" condition. Otherwise, out-of-place/between things conditions are rare. There was one individual who had recently left school and had a trial employment. The reason for this might be the employment situation in Tanzania which, for this group, mainly consisting of experienced technicians, meant that almost everyone had a steady job at the time of application.

Positive factors mentioned by Shapero are, the unexpected offer of a contract by a would-be customer, the offer of partnership by a friend, the offer of financial support, or the advice and encouragement of a mentor.

It is our impression that positive factors play a very crucial role in getting individuals involved in the SI programme. Firstly, the existence of a ready-made scheme, a path to follow, triggered of by the advertisements for entrepreneurs, is of importance. By using Shapero's examples, one could say that the individuals are offered financial support (given that they can make the down payment) and good market opportunities by SIDO. Secondly, many SI entrepreneurs were offered partnerships by colleagues and friends, as the SI programme stipulates that the SI entrepreneur should be one of a group, or form a partnership. Thirdly, many of the later entrepreneurs have had one of the first SI entrepreneurs as a mentor, giving advice and being a successful example of entrepreneurial talent.

There is seldom only one factor of importance; mostly there is a combination of positive and negative factors, with the positive "pulls" in a somewhat dominating position. This means that the data from the SI programme differs in this respect from the findings of previous research. This might, however, be attributed completely to the specific SI programme structure.

A summary of the important factors for the "road to action" is given below. The data obtained is not of the type to permit statistical presentation, but an assessment of the frequency of occurrence of each factor is made and indicated by ⊕ for frequently mentioned, O for less frequently and ⊖ for factors seldom mentioned.

NEGATIVE PUSH	BETWEEN-THINGS	POSITIVE PULL
⊕ job dissatisfaction O longing for home area O cost of living as compared to salaries ⊖ lost job ⊖ reached top of career	⊖ retirement ⊖ leaving school	⊕ offer of a ready made SI programme ⊕ offer of partnership O mentor

Table 5.6 Factors influencing individuals to act in order to become SI entrepreneurs

In Shapero's model, a central question, once a major change in life path is plausible, is "Why is one action taken rather than many other conceivable actions available to an individual?" As Shapero points out, this is a product of situational factors as well as socially and culturally implanted predispositions. This is presented in sections 5.5.4 Perceptions of desirability and 5.5.5 Perceptions of feasibility.

5.5.4 Perceptions of desirability

Cultural and social factors strongly influence the company formation process through the formation of individuals' values.

Family

According to Shapero (1980), "the family ... plays the most powerful role in establishing the desirability and credibility of entrepreneurial actions for an individual" (p. 14). An important influencing factor is whether the father was independent or employed. Of the SI entrepreneurs' fathers 72% were independent and 28% were employed, all of these by government or in the school system (see table 5.2). In comparison, among Kenyan entrepreneurs, 80% had independent parents (according to a study by Marris and Somerset 1971), while almost 89% of Nigerian entrepreneurs were in the same situation in 1965 (Harris 1970), which can be compared to 50-58% obtained in studies conducted in the US. Of the total US population, less than 12% were self employed. However, the African figures are bound to be a bit distorted in comparison with the US figures, since the classification scheme here puts all peasants in the category 'independent', and since the governmental as well as private industry sectors are much less developed. Hence, most entrepreneurs will have independent parents by definition. Marris and Somerset (1971) also point out that the family background of their sample of Kenyan entrepreneurs "does not seem unusual" (p. 60).

When the SI programme is compared with the Kenyan study, the number of independent fathers is somewhat lower, 72% and 80%, respectively. The only striking difference is that the number of teachers is larger in Tanzania (20% vs. 3%). However, the low number of respondents (25) makes is impossible to draw any statistically valid conclusions. Furthermore, the fact that the interviews in the Kenyan study were conducted with entrepreneurs of 30-50 years of age in 1966-67, while the Tanzanian figures were obtained 15 years later, might also explain the difference. However, if our data is supplemented with the findings of Forss (1985b), we find that the SI entrepreneurs come from families with much higher mean level of education than the rest of the population. This is also a difference in comparison with Marris and Somerset's (1971) Kenyan entrepreneurs.

Role Models

Literature (Shapero 1980, Hult 1979) reveals the importance of role models, i.e., people who have become entrepreneurs earlier. The greatest role model effect occurs when the role model is someone who used to occupy the same or a lower position (Draheim et al. 1966); "If he can do it, I will make it as well."

If we look at the selected group, we find that the vast majority of the SI entrepreneurs are people at about the same level (peers), "technicians with 5-10 years of experience from industry." The first SI entrepreneurs did not have any role models, since African industrial entrepreneurship was very uncommon, and SIDO had no cases to show when the SI programme was introduced. However, the existence of role models was very important for subsequent SI entrepreneurs, i.e., the success stories of the first SI entrepreneurs, made visibly demonstrated by the start of new modern industries, as well as the fact that most people came back with their own car when returning from training in Sweden. This last factor might have considerable importance, as the opportunity for many Tanzanians in this group to acquire their own car was very limited.

However, there is a certain difference when comparison is made with the small scale intensive area of Småland, the area of origin of most senior sisters. While the models in Småland, during the period when many of these industries were established, represented the "small man", the models in Tanzania belong to a relatively well-educated group.

Ethnic Groups

The Tanzanian society consists of a large number of ethnic groups with their own languages and cultural traditions. Among the Tanzanians of Asian origin the entrepreneurship traditions have been strong, but also among the African ethnic groups traditions of entrepreneurship can be found. The SI projects are localized in Mbeya in the south and Arusha and Moshi in the north. The ethnic group Chagga of the Kilimanjaro area in the north are over-represented as SI entrepreneurs in Arusha and Moshi. It is a well-known fact that the Chaggas are involved in a great deal of the business and industrial activity in Tanzanian society. There is a strong tradition of starting one's own business among the Chaggas.

> "In Machame (home village) there is a shortage of land and people are trying to diversify into industry etc."
> "In my home area most of them are doing their own business."
> "In Moshi it is common to start one's own business."

In a similar way the Kikuyu tribe in Kenya was over-represented in the study by Marris and Somerset (1971). The reason for this was not quite clear but Marris and Somerset indicated that the Kikuyus were "more sensitive to the political and occupational frustrations" as they had participated in political opposition and had been in closer contact and "acquired a wider experience of the colonial civilization than other people, ..." (p. 72). In Tanzania the penetration by the colonial power was most intensive in the Kilimanjaro region, from which the Chagga stem and hence, this might be at least part of an explanation of the developed entrepreneurial traditions in this area. According to Oberschall (1973) referring to field studies in Zambia, this over-representation might be the function of high social and cultural barriers. If the barriers were lower, entrepreneurs would be recruited more evenly from all sections of the population (Nafziger 1977).

Previous Work Experience

In studies in the US (Cooper 1971), it has been found that it is more likely that an entrepreneur will spring from a small organizational context (incubators) where, "it becomes possible for the potential entrepreneur to see the role of company head as credible for himself" (Shapero 1980).

Most of the SI entrepreneurs have a background in relatively small companies, as almost all Tanzanian companies are small on an international scale. General Tyre East Africa Ltd, for example, which previously employed 9 of the SI entrepreneurs, has about 800 employees, and is one of the largest industrial companies in the country. In some cases this opportunity to obtain a perspective of the whole company has been directly described.

> "I was working in an Indian firm and I could see their system in 78, and I learned how to manage a company and I saw that it's possible if you are careful."

Mentor or Peer

The role of mentor, i.e. an experienced older friend, relative, former employer, etc. to turn to for advice and support, has proved to be of value for new entrepreneurs (See e.g. Shapero 1980). One of the first SI entrepreneurs gradually took on a new role, and instead of remaining a peer he became a mentor at an early stage, and has influenced and advised subsequent SI entrepreneurs.

5.5.5 Perceptions of feasibility

An entrepreneurial event, while perceived as desirable, may not be perceived as feasible owing to financial constraint, high risk, lack of skills etc. Among important factors which increase an event's perceived feasibility are availability of financial resources, existence of would-be-partners, and support organizations.

In the case of the SI programme, the existence of SIDO, as a technical and financial support organization, heavily influences the perception of feasibility. For most of the SI entrepreneurs, the SI programme was the only feasible way to start their own industrial businesses. Through this programme, free training was provided free and the hardware investments were supplied under very beneficial financial terms. Furthermore, as SIDO usually assures that the SI firms are started by a group of partners, moral support, needed skills and shared risk were normally obtained at an early stage.

For the perception of feasibility, the role models and the demonstration effect, i.e. successful early SI entrepreneurs with the same background (peers), have considerable importance. ("If he can do it, I can.")

5.5.6 Correspondence and discrepancy between motives in Tanzania and Sweden

In another report (Alänge and Löwbäck 1986) the motives for the senior sisters to involve themselves as suppliers of technology to the junior sisters in Tanzania have been analysed. This study shows that the most important factor for involvement was, "the existing <u>link</u> (SIDO - Fide) which provided the Swedish industries with concrete project frames, a party with the right to make decisions, and a guarantee of continuous assistance, which altogether form a relatively risk-free basis for business transaction" (p. 33). This report presents its results according to the same basic structure as the present chapter, i.e. strategy, conditions and motives.

Below we will make a comparison between the Swedish senior sisters' and the Tanzanian junior sister entrepreneurs' motives for involvement in an SI project. However, the differences between the parties are substantial. First, the motives for involvement refer to companies on the Swedish side, while we are studying the motives of individuals on the Tanzanian side. Second, the Swedish companies are existing units, while in Tanzania the industries are in the process of being established. However, for both parties, the SI programme involving international technology transfer, represented something totally new, and the outcome of the SI programme may to a certain extent be influenced by the existing previous motives. Hence, an analysis of motives on each side will be made, as a basis for discussion.

Strategy

There were no strategies on either side, for international technology transfer or for starting an industry with the exception of one senior sister who had a clear strategy for establishing production units in a number of developing countries, in order to import less complex products from these units in the future. In this respect, there are similarities between small firms and individuals, while the differences would be clearer if they were compared with large companies which, having more often a world-wide market, have formed a strategy for technology transfer. For example, an MNC like Philips has a clearly defined strategy (see Philips 1978) and the same is true for other MNCs.

In the case of the SI programme, where neither the senior sister nor the entrepreneurs had any clear strategy, the process for both parties was more of a learning experience. Hence, the SI structure exerted a much greater influence, since SIDO, SIDA and the firm of consultants, Fide, all had strategies for their work within the SI programme. These three organizations did in fact have documented strategies (which later have been modified by experience), when the first contacts were established with the other parties.

In the case of the project where the Swedish party had a strategy, no results of this strategy were found distinguishing this case from other SI projects. However, this was a single case and no generalizations can be based on it. As was found in the study of the Swedish firms, several companies have now formulated strategies for future technology transfer projects, based on what they learned during the projects studied. In the case of the Tanzanian party, where individuals entered into the SI project, there was naturally less inducement for them to have a strategy. However, when the organizational unit, the junior sister, had been formed and based on what was learned during the first phase, there were indications of a more structured procedure (strategy) when moving into phase 2. This development could have taken place during continued contacts with the same Swedish sister company or with new firms, in those cases where negotiations have started with new Swedish firms as well as with companies from other countries. An example of this is one of the new Tanzanian firms which wanted to extend its line of production and appointed a local firm of consultants which made a study of potential lines of diversification. With this study as a basis, contacts were established with a company in a European country, and with an aid organization from the same country which would be willing to finance the project. Other Tanzanian firms have also been thinking along the same lines, but have not yet been able to process them as far.

Conditions

A general condition in both Tanzania and Sweden was a certain economic decline and under-utilization of existing capacity in industry. As mentioned above, this was a very important condition in Tanzania, which motivated individuals to become SI entrepreneurs. In Sweden, we have some cases where the senior sisters were actively searching for every available alternative during the recession. However, a more plausible assumption is that the existing overcapacity was a prerequisite for almost all Swedish firms to become interested in an international technology transfer project completely outside their normal line of business.

The very existence of the SI programme, including SIDO and SIDA, has been of the utmost importance for the Tanzanian entrepreneurs as well as for the Swedish industries. For the majority of the Swedish firms, the SI programme could be described as a prerequisite for considering involvement in this kind of an international package deal. For the majority of the Tanzanian SI entrepreneurs SIDO and the SI programme constituted the only feasible road to having one's own company.

The importance of the governmental incentive scheme as a general condition has no direct counterpart in Sweden. However, the opportunity to spur the staff further through the SI project (training in Sweden and start-up in Tanzania) was frequently mentioned by the Swedish industrialists. There is also strong evidence for Swedish consultants having a very high level of motivation for doing their best while working in the Tanzanian industry. However, this factor was not very important as a general condition for involvement, but it certainly had a contributing function.

The tradition of having one's own business was of importance for the Tanzanian SI entrepreneurs. Through the SI projects they met Swedes with the same tradition. Most Swedish companies originate from small scale industry intensive regions (Småland, Eskilstuna etc.) and these traditions no doubt facilitated contacts and cooperation. However, this naturally was a factor of minor importance for the Swedish firms' involvement in a technology transfer project.

In a very few cases, individuals lost their jobs and were forced to look for new ways of earning a living in Tanzania. We have a few similar examples on the Swedish side; companies ceasing production or going bankrupt. In the case of the Swedish firms, the selection procedure has in most cases excluded this kind of company. We do not know if there is a similar situation in Tanzania. Cooperation over a longer period of time, a basic idea of the SI projects, is negatively affected by not having access to a senior sister. In practice, however, this problem has been solved in some cases by letting another company assume the obligations of a sister.

Motives

According to Friberg (1975), as previously discussed, motives are divided into; coercive, material, normative and inherent incentives. Normative incentives were then further divided into social and internalized incentives.

Material incentives are strong in Sweden as well as in Tanzania. A basic prerequisite for the Swedish companies to become involved in SI projects is the expectation of profits, a natural motive for any commercial undertaking. Expectations of different kinds of material incentives have had considerable importance for individuals in Tanzania as well. A specific point of departure for an analysis is to study the material incentives in relation to time. In this case, there are clear indications of negative outcomes of projects where one of the parties has short-term material incentives, be it Swedish or Tanzanian.

Several of the SI entrepreneurs expressed motives that can be described as inherent or, in some cases, inherent in combination with social incentives. This expression of inherent incentives seems to reflect a feeling of comprehensiveness of the totality of a company, acquired through earlier working experience. In most cases, this seems to be the case with well-functioning firms. Unfortunately, the question structure in the Swedish interviews does not permit any comparison in this area, but in some cases there are clear indications of Swedes who express the same kind of inherent motivation. Mostly, however, this motivation was acquired gradually during the project process and did not influence the decision to become involved in the project.

Risk

With the exception of the very first SI projects, the parties on both sides have judged the risk to be very low. For the Swedish industries, SIDA has been the guarantor and the only problem has been to design the plant with a capacity margin, permitting the agreed capacity to be reached with no more effort than necessary. The SI entrepreneurs shared the belief that, "SIDO and SIDA would never let an SI project die." While probably in many cases being a prerequisite for the parties to become involved, the low risk profile may also have attracted some adventurers to the SI programme.

5.5.7 A comparison with motives mentioned in other studies

If we go back to table 5.1 where the motives of African entrepreneurs in five other studies were presented, we find the following similarities/differences. In order of frequency the SI entrepreneurs primarily mentioned 'broadening of experience/job satisfaction in testing one's abilities' and 'independence'. Somewhat less frequently mentioned were 'contributing to development' and 'money', here in a long-term perspective. Hence, we can see that the most frequent motives mentioned by the SI entrepreneurs are the same as the ones found in the Marris and Somerset (1971) Kenya study, although in a somewhat different order. The importance the SI entrepreneurs put on the motives of broadening one's experience and testing one's own ability might reflect a higher educational background of the average SI entrepreneur compared to that of the entrepreneurs in the Kenyan study. The striving for independence was also very significant, as it has been shown to be in most other African studies. Money had less importance for the SI entrepreneurs, but is nevertheless included in the top-four list. The top two motives of independence and self-fulfilment (broadening of experience) of the Tanzanian entrepreneurs are also similar to the motives mentioned by Hult and Odéen (1983) for Swedish entrepreneurs. Hence, it is possible to assume that the Tanzanian SI entrepreneurs have a motivational structure not very different from their Swedish counterparts. One restriction though is that in the larger Swedish firms the counterparts were employees and not entrepreneurs, i.e. they might have been individuals with a higher level of job satisfaction and lower striving for independence than the average Swedish entrepreneur.

5.6 Conclusions

There are more factors than the purely psychological "supply" factors that are influential in motivating an individual to start his own business. Here, we have chosen to present our findings according to the structure: strategy, conditions, motives and risk.

No individual had any clear strategy for becoming an entrepreneur, although a few had vague ideas about the desirability of having one's own business.

Traditions of African entrepreneurship mostly meant having a very small business, maybe parallel to traditional farming. There were very few examples of African privately-owned industrial firms in Tanzania when the SI programme was started in 1977. The first SI entrepreneurs have, however, served as important role models for other Tanzanians. The opportunities of learning at earlier industrial employment and especially of getting an overview of an industrial firm, have had a considerable importance for the perception of the feasibility of starting a business. One of the most influential positive pull factors was the mere existence of an opportunity, the SI programme, providing finance, contacts and a risk-free route towards one's own business. Sometimes this opportunity arose in the form of an offer from a friend or colleague to participate in an SI project. Negative factors of importance had to do with job dissatisfaction, especially in public organizations; resulting in an urge for independence. Also the decreasing standard of living for the employed has had an influence.

Motivation can be structured in seven different incentive types, according to Friberg (1975). These are: coercive force, material incentive; two kinds of social incentives: involvement and identification; two types of internalized incentives: morals and ideology; and finally, inherent incentive. The last mentioned motivates the individual from within and cannot be derived from the other types of incentives. The internalized incentives have been incorporated in the personality through socialization processes. The social incentives refer to relations with primary and secondary groups for involvement and identification, respectively. In general, motivation is a combination of different kinds of incentives.

The material incentive to obtain a higher standard of living on a long-term basis was important for the SI entrepreneurs. However, inherent incentives such as a wish to test one's own ability and to be self-reliant were also of considerable importance. Social incentives in terms of identification with role models and approval by the primary group have also been influential, although they were less frequently mentioned. Internalized incentives also exist to a certain extent. These include aspects such as the advantages of having one's own business (morals) as well as ideological incentives of developing a self-reliant Tanzania.

The risk experienced by the entrepreneurs mainly concerned their career, family and to some extent the financial risk. Among the very first group of SI entrepreneurs the risk was experienced as high, while later SI entrepreneurs have experienced a very low risk.

We have found that several motives are similar to the ones mentioned in other studies, from Africa as well as from Europe. Nevertheless, we are of the opinion that a more thorough comparative cross-cultural study of entrepreneurs' values and motives would be of interest.

Especially so, as existing studies are not directly comparable as a result of different methods of sampling, diverging methodology and varying time of data collection.

CHAPTER SIX

STOCKS OF CAPABILITY

6.1 Introduction

6.1.1 Problem background

Recent literature on international technology transfer has distinguished between static and dynamic capabilities, stressing the importance of the latter. However, there is little empirical evidence as to whether technology transfer contributes to the enhancement of dynamic capability and if so, in what way. Furthermore, the evidence of change activities in developing countries, given the prevalence of dynamic capabilities, is scarce. In most studies there is no separation between technological and managerial capabilities.

6.1.2 Research questions

Our focus in this section is on the nature and level of the present stock of capability. Concerning the nature of the capability stock, we distinguish between static capability and dynamic capability and between technological and managerial capability.

Literature reveals that certain areas are the most essential for the functioning and development of an industry. This part of the study aims at an investigation of selected areas concerning the nature and level of the capability stock in these areas. Furthermore, this capability stock will be studied in relation to performance in terms of technical change activities.

The key questions that guided this part of the study were:

- What is the nature and level of the stock of static and dynamic technological and managerial capabilities in selected areas?
- In what areas are the weaknesses of the capability stock most manifest and why is this so?
- What are the consequences of these weaknesses?

This part of the study only concerns five case studies, all from the first generation of SI projects.

6.1.3 Concepts

Technology and management (as knowledge) applied in industrial companies are oriented towards two interacting and, sometimes, counter-acting activities:

1. Production and marketing of the existing product assortment, utilizing existing resources and prevailing management routines.

2. Activities directed towards change of technique and management practices and towards the development of new resources.

This division is a somewhat artificial one, as there is no clear dividing line between the two activities because in reality, all industrial activity includes some degree of change. For instance, in a replication of the Lundberg (1961) study at the Horndal Steelworks, it was found that labour productivity increased by 3.7% per year in spite of no investments except repair and replacements being made during a period of 25 years (note 6:1). This increase was partly explained by a gradually increased utilization of latent capacity, (new investment in '52) but a significant part of the increase was attributable to a shift in output composition. During this 25-year period, there was a concentration on a more limited range of steel dimensions and qualities which, together with a standardization of products, reduced the assortment. This assortment reduction provided the opportunity to utilize economies of scale which then showed up as productivity increase.

Hence, while we are aware of the real-life situation that 'always' contains some sort of change, this study will, for analytical reasons, use a purely static, routine state as a comparison with more dynamic states. A basic, and in this study central, distinction is made between a static and a dynamic state of knowledge, in terms of both technology and management. On the one hand, "static technology refers to those kinds of knowledge, which, once possessed, permit the successful carrying out of certain routine tasks, in a more or less fixed fashion and with more or less given equipment". On the other hand, we can identify dynamic technology: "The possessor of dynamic technology, by contrast, is usually seized of the scientific principles undergirding his work, and as such tends to have a capacity for innovation and invention." (Farrel 1979b, pp. 239-240). Our definition of technology differs from Farrel's as we do not include management. An extraction of the management components from the above definitions by Farrel would include: 'static management', which means knowledge about how to make use of existing management procedures, and 'dynamic management' which involves knowledge of how to develop and apply new management principles and procedures, but also involves different activities of business development that are performed in a non-routine manner. Schumpeter (1934) used them in a similar way, referring the terms static/dynamic to a zoological analogy. Originally they were used by the zoologist de Blainville and reached Schumpeter via Comte and John Stuart Mill. Static is here used in line with Schumpeter's use, i.e. not in a strict sense preventing all growth. In the words of Perroux (1935) it includes 'quantitative dynamics', i.e. the capability needed for accomplishing growth in the physical factors of production, but it does not include 'qualitative dynamics' which is characterized by the introduction of new combinations of factors.

By utilizing the above definitions of static versus dynamic knowledge, four different capability fields will be defined in figure 6.1. These capabilities do not only involve the knowledge component, but also existing equipment and applied procedures and practices, i.e. the technique and the management procedures.

		MANAGEMENT static	MANAGEMENT dynamic
TECHNOLOGY	static	PA	PE
TECHNOLOGY	dynamic	IA	IE

P = production capability (static)
I = inventive capability (dynamic)
A = administrative capability (static)
E = entrepreneurial capability (dynamic)

Figure 6.1 Capability matrix

Production capability refers to the ability to use the technique while inventive capability concerns an ability to develop technique, i.e. products and production processes. In a similar way administrative capability refers to routine management, while entrepreneurial capability has a meaning of doing something new (6:2).

Production/administrative (PA) capability includes the element of skills and knowledge to operate the existing production system, as well as other elements such as procedures, and organization and management structures that are required to produce industrial goods. PA capability is primarily discussed in relation to the transferred production system. A high PA capability means that the management (including technicians and engineers) have acquired all capabilities to run the company, with the given product and existing resources. The PA capability, idealized to consist solely of static technology and static management, can be regarded as a variable, with values from 0-100%.

Inventive/administrative (IA) capability consists of the stock of resources, including dynamic technology, that can be utilized to develop new products, new equipment, etc. IA capability includes, besides dynamic technology, equipment, machine tools, etc., needed for development work. However, by definition, management is static.

Production/entrepreneurial (PE) capability, on the other hand, is defined as consisting of dynamic management but static technology. PE capability consists of the capability stock needed to mobilize resources for the development of business firms. As the dynamic component of technology is missing, the ability to develop products and processes by one's own effort is missing, as well as the capacity to lead the development and assess the achievements in technical fields. PE capability has more connection with development of the business unit as such, which might include development of technique, but in such a case, expertise is hired for technical development work and technical assessment. However, the assessment of business opportunities in relation to the technique developed, and decision-making ability is included in the concept of PE capability. PE capability includes information systems, etc., needed to carry out the managerial tasks.

Finally, dynamic technological and managerial capabilities combined in one firm, will be called inventive/entrepreneurial (IE) capabilities. In the words of OECD (1981), production/administrative capability could be called the "ability to use" technology, while inventive/entrepreneurial capability refers to "the 'ability to master' a complete process from design and development to production and marketing". IE capability can also be regarded as a variable.

Doing something new should be seen in a relative way where the newness refers to the specific context and time. For example, the very first time a small industry in Africa examines alternatives to the existing raw material supplier and selects a new one, entrepreneurial capability is involved, even though this is nothing new "for the world". The decisive point is that it is new for that specific small industry at that specific point in time. The next time raw material is imported, the process is more routine and hence, more related to administrative capability. The activities related to entrepreneurial capability are closely connected to the strategic development of a firm, while the administrative capability is more related to its daily activities. The concept of entrepreneurial capability is closely related to the Schumpeterian concept of entrepreneur (Schumpeter 1934, 1976), the entrepreneur being the individual who performs managerial change activities, or entrepreneurial events (Shapero 1980).

Our aim is to analyze the effects of an international technology transfer programme on the stock of capabilities within selected industries in a developing country. Furthermore, the effects of the capability stock on change activities are studied. This emphasis on stocks differs from the more usual concern with technological flows, but is in concordance with the suggestions of Leibenstein (1957, p. 135), Bell and Hill (1978), and with Bell and Hoffman (1981), who, however, have a slightly different focus.

Bell and Hoffman focus on international technology transfer to developing countries, and its effect on the stock of technology-capital; i.e., the technological capability needed to develop new production capability. Hence, Bell and Hoffman make the distinction between production capability (capacity) and technological capability (capacity).

> "We distinguish between the industrial production capacity and the industrial technological capacity of an economy. The former consists of the physical production facilities (buildings, equipment etc.), the particular human skills and resources required to operate those facilities, the specified operating procedures, and the organi sational and managerial structures that are used. The latter consists of a stock of resources which are used to exploit the potential of technical knowledge and to transform it into the various components of industrial production capacity. The output of the former is manufactured goods, while the output of the latter is a range of services by which production capacity is created or changed." (Bell and Hoffman 1981, p. 1)

> "The first set of physical, human, and institutional resources constitutes the industrial capital stock of an economy, created by the mobilisation of finance-capital. The second set of resources can be seen as constituting an economy's stock of industrial technology-capital, and we shall use terms like "technological capability," "technological capacity", and "technology-capital" more or less interchangeably. This set of resources includes the stock of disembodied technical knowledge that is effectively available to a society: but it also includes (i) the accumulation of human embodied skill and experience for both using and augmenting that knowledge, and (ii) the structure of institutions and the functioning links between them which enable technical knowledge to be transformed into new or changed production systems." (Bell and Hoffman 1981, p. 2)

One basic difference between our study and the one mentioned above, is that we emphasize management and treat it as a concept separate from technology. Hence, we see production/administrative capability, as a relatively static state, composed of technology and management more or less limited to the "ability to use" the technique and to practise the management routines. According to our definition, the function of development is excluded. Our use of the concept 'production/administrative capability' is thus similar to Bell and Hoffman's 'production capability'.

Our main concern, however, is with dynamic capabilities, which we see as consisting of technology as well as management. We call these change capabilities 'inventive capabilities' and 'entrepreneurial capabilities' as defined above.

6.2 Static and dynamic capabilities - empirical findings

The stock of capabilities in the junior sisters will be presented here in short descriptions for each company. In the discussion section (6.3), there is a comparison between the different companies' static and dynamic capabilities within different "problem areas". Our empirical data reveals the situation at one specific point in time, namely early 1983. As the stock of capabilities, in most cases, is continously changing due to on never ceasing learning processes, the stocks of capabilities are different by the time the reader sets his eyes on this text.

The basic structure of the capability descriptions below is; production and administrative capabilities, inventive and entrepreneurial capabilities and finally some remarks concerning missing capabilities within the firms.

AMI - Static and dynamic capabilities

AMI's primary strength is in the area of production capabilities. AMI has a qualified team of production people who have had considerable practical industrial experience prior to joining AMI. The average formal educational level is relatively low, but the production manager, for example, had got several years of vocational training at a former employer's in-house training school. The work experience has mainly been on a blue collar level and hence, the experience of supervision was somewhat limited.

The Swedish training has further developed the stock of production capabilities. The result is that AMI is able to produce the products, introduced by the senior sister, with a high quality. The quality control of finished products works very well although the follow-up on rejects could be improved. AMI has a very high repairing and trouble-shooting capacity and also conducts a planned preventive maintenance scheme of a routine type. However, the philosophy of preventive maintenance and control is not fully established. The relatively complicated production process puts demands on the different production steps, but above all on the production planning and control. There are three sections in production; foundry, machining and assembly. Foundry requires considerable experience but AMI is able to handle this section well. Machining functions relatively well and assembly is a relatively simple process. The primary weakness is in production planning. The batch sizes are often too large which brings about large in-process stocks and an uneven load, especially in the assembly section. Sometimes this section is standing idle; other times it has a very heavy work load.

The AMI employees that were sent to Sweden for training during phase One had very limited administrative experience and the Swedish training only provided a very marginal insight into management and marketing. Today AMI has a considerable stock of administrative capability, acquired through the hiring of an experienced accountant and a general manager. The general manager has had supplementary training in Sweden in the areas of management, marketing and planning. AMI keeps very good administrative order. However, cost auditing for the production is a present weakness.

Hence, AMI has a solid stock of production/administrative capabilities. At present marketing is no problem as two big customers buy everything AMI is able to produce, but it might need to be strengthened if AMI wants to introduce other products with another customer structure. The relatively complicated technology puts demands on production planning and control, and in these areas the capabilities of AMI need to be improved.

AMI has a certain stock of inventive capabilities, visible in a number of new products introduced and some improvements in the production process including a modification of the originally introduced information flow card system. AMI has cast some new products in aluminium, but has been hindered by lack of knowledge in pattern making. The initial Swedish training did not include training in pattern making, although this knowledge is the most essential for being able to make new products in a foundry. At present, AMI has a certain pattern-making capability, as the production manager, besides his own trial-and-error experience, was trained in pattern-making during 5 months in Sweden in 1983-84. However, to be able to fully master pattern-making normally takes a long time. As AMI has a knowledge of the different components in raw material and process material for its standard products, it thus has a basic capability to search for alternative sources for these inputs. However, owing to perceived restrictions (due to quality demands) on using sources other than the senior sister for these inputs, no alternative sources have been approached.

AMI's stock of entrepreneurial capability can be seen from two different perspectives. One is that the management team of AMI has a certain entrepreneurial capability visible in different 'mradis', i.e. different activities outside the domains of AMI. This is partly a reflection of the Tanzanian economy at present but also is due to the form of ownership and reward system at AMI. Contrary to the other SI firms, AMI's managers are salaried personnel, i.e. they do not experience the motivational incentive that ownership provides. This is especially so in the prevalent economic situation, when the salary level makes it hard for a bread-winner to supply his family on the salary alone. The other perspective is that although ideas for continuing development of AMI are needed, the motivation for entrepreneurial activities is dependent once again on the ownership structure and the reward system, which might retard needed ideas and their implementation.

AMI has only to a very limited extent considered export which can partly be explained by the fact that the present capacity not is sufficient for covering the needs of the two big national customers.

In summary, AMI has a certain dynamic capability that is manifested primarily in a number of new products. Two barriers against innovation have been present; the first being lack of knowledge in pattern making, now partly overcome, and the second that the structure of ownership and reward system does not encourage innovation. AMI's entrepreneurial capability has hence not been very visible. However, AMI has shown that it possesses an inventive/entrepreneurial capability to develop new products as a response to; i) raw material shortages and perceived restrictions on the search for alternative sources of raw material for the standard products, and ii) firms wanting to subcontract.

FAWIPMA - static and dynamic capabilities

FAWIPMA has a considerable stock of production/administrative capabilities. The SI entrepreneurs have a technical educational background on diploma course level but had more limited industrial experience before starting FAWIPMA. The training in Sweden has provided solid production capabilities, which show up in good quality products and an increasing productivity. Furthermore, the management has been aware of and identified existing problems such as production bottle-necks and quality problems on certain products. These problems have been due to inferior design, i.e. are primarily dependent on the technology transferred and not on the skill level as such.

The SI entrepreneurs did not have any business experience before starting FAWIPMA. They were quite aware of this and therefore hired an experienced 'general adviser'. Hence, FAWIPMA today has an administrative capability that benefits from the general adviser's university level education in material management and accounting and from his work experiences. FAWIPMA has no marketing problems and has a good record of amortization of the SIDO loans, which also points in the direction of solid administrative capabilities. Furthermore, FAWIPMA has made a qualified analysis of its competitors, including the identification of factors that explain differences in price levels, product quality and sales tax.

Hence, FAWIPMA has a solid stock of production/administrative capabilities, needed for the operation of the present complexity of the firm. The technology is relatively simple; there are few employees and few production steps and hence less demand for coordination and control. In the future there might be a need for more qualified production and cost statistics and the new investment in automatic looms requires improvements in the maintenance area.

FAWIPMA is also in the possession of a certain stock of dynamic capabilities. Several new products have been developed, with the prime aim of making more efficient use of the scarce raw material resources. The Swedish contribution in developing this area seems to be very limited. The way of making cost calculations of these products is through a marginal cost analysis. Quality problems and bottle-necks in the production were identified at an early phase, and FAWIPMA analysed the effects of these problems on the possibilities of selling their products.

> "The only way out to obtain good quality is to invest in automatic looms. The customers want the higher quality now impossible to reach." (Mr Mbise, 1980)

FAWIPMA has been totally dependent on imported raw material from its Swedish counter-part. To overcome the shortages, FAWIPMA has, besides a more efficient utilization of scrap material, also tried to find alternative sources for foreign exchange, as well as actively searched for local raw material sources.

FAWIPMA has a certain dynamic strength which shows up in the introduction of new products and new investments. On the other hand, FAWIPMA does not have the same visionary entrepreneurial aim as some other SI entreprenerus (e.g. NEM or MOCCO). However, FAWIPMA has been shown to possess an inventive/entrepreneurial capability to innovate as a response to identified problems such as; i) production bottle-necks, and ii) raw material shortages.

KIMESHA - static and dynamic capabilities

KIMESHA has a very solid stock of production capabilities. KIMESHA had from the very start of the company considerable production capabilities through the managing director's extensive experience of a similar type of production.

The raw material planning and the production planning are functioning well, resulting in a steady increase in turnover. Between 1978 and 1982 the following increase in sales volume took place; 0.18 - 0.67 - 1.4 -1.5 -2.3 M Shs. The last year's increase was 53% without any investments. KIMESHA has a simple system for quality control and the product quality is comparable with the competitors on the Tanzanian market. The company also has a simple system for production control, providing information on daily production by product and worker.

KIMESHA has a good administrative capability. The managing director had previous experience of managing both a smaller and a larger company. KIMESHA was one of the very first companies at the industrial estate that made their own simple cost calculations, without external assistance. However, this area might have to be further strengthened in order to obtain a full perspective of the cost structure. In comparison with some other SI industries KIMESHA has its documents in less order. This might reflect the fact that KIMESHA received no training in this field in Sweden.

In summary, KIMESHA has very solid production/administrative capabilities.

KIMESHA's stock of inventive capabilities is substantial, which is shown in developments in the product, process and work organization. Since its start KIMESHA has developed a lot of new products and continuously improved the design of the existing products. Initially the new products were made by the same spinning technique that was acquired from Sweden, but gradually KIMESHA has developed new products for which another production technique is used. The ideas for new products come partly directly from the market but KIMESHA also makes a lot of effort to search through alternative sources, e.g. trade associations, foreign firms and aid organizations. In addition the Swedish sister has directly contributed with product ideas. KIMESHA has improved the spinning process itself, e.g. through a centering device on the spinning lathes. KIMESHA also has a capability to analyse the production organization and to introduce modifications on the incentive scheme, work hours, etc. to obtain increased productivity.

The management of KIMESHA has a certain stock of entrepreneurial capability. Both the managing director and the chairman of the board previously had their own companies. KIMESHA has a very good knowledge of its competitors and has a strategy of trying to position the company in some product fields where it can be alone on the market. This strategy demands continuous product development. KIMESHA also has a lot of plans to diversify and to invest in new technology, presses and fabrication through welding, which opens up new market areas; and KIMESHA has made some of these investments. KIMESHA has to a certain extent benefited from business ideas from its senior sister; e.g. being a subcontractor to NEM.

In summary, KIMESHA has a considerable stock of dynamic capabilities and no real weaknesses. KIMESHA has shown itself to be very innovative and has developed many new products, made process improvements and developed new business areas. KIMESHA has shown its inventive/entrepreneurial capabilities as a response primarily to market demand and ability to compete with other firms using another technology with greater economies of scale.

NEM - static and dynamic capabilities

NEM has an impressive stock of production/administrative capabilities. The SI entrepreneurs had schooling and work experience in all fields, including supervisory experience. Their solid background knowledge has facilitated further capability acqusition within the SI project.

There are no weaknesses in the production capability. Production planning and scheduling for standard as well as special products work well. NEM has an information system that provides production records and a system that gives information concerning the stock. Product quality is high, partly due to an improvement in the quality control initiated by the NEM management. Maintenance is carried out regularly. Furthermore, the work force is continuously becoming more skilled, through in-plant-learning and through evening courses, paid for by the company.

NEM has a solid stock of administrative capabilities. The accounts department functions well and provides budgets, follow-ups, balances of accounts, etc. NEM has a well functioning management system and a good overview of the personnel. Finally, marketing and sales have been strong parts of NEM. NEM is well-informed about their customers and has been shown to have a sensitive ear for needs of customers. Hence, NEM has a basic strength in the area of production/administrative capabilities.

The stock of inventive capabilities is impressive. NEM has developed a wide range of new products, introduced modifications in work design, introduced a new incentive scheme in production, etc. NEM has also been shown to grasp the relation between production cost and the introduction of new products. Furthermore, NEM has a capacity to identify problems and opportunities and to search for information from a wide group of sources, including consultants and foreign firms.

Also the entrepreneurial capabilities are impressive at NEM. Several of the SI entrepreneurs already had businesses before starting NEM. They have shown ability to search for and analyse new markets. NEM has also identified the need for selling a complete product range and hence identified and developed products supplementary to their original product. To overcome the problems due to shortage of raw material, NEM has taken several measures; export marketing, increasing the share of locally made components in their present products through a tool-making programme and development of new products using local raw material. NEM has also been very open to new forms of cooperation with different companies concerning joint marketing, subcontracting, etc.

NEM has very strong dynamic capabilities, inventive as well as entrepreneurial. As a guiding principle NEM has as a vision of growth to become the sole supplier of electric fittings in East Africa. NEM has made innovations in most areas which have been stimulated primarily by; i) market demand, ii) raw material shortages, and iii) a clear vision of developing the industrial business firm.

UHANDISI - static and dynamic capabilities

UHANDISI's management team had little formal education and limited industrial experience when they took over after the former directors who were dismissed. They had very little experience of supervising production or of general management.

The limited experience in production has caused difficulties in the set-up of tools in the machines, resulting in frequent break-downs. However, through some extra training, UHANDISI is now able to produce with more accuracy and the break-downs are not as frequent. One reason for this is that the routine maintenance functions well. Daily check-ups and inspections have become routine at UHANSISI. There are few production steps and planning of the production is simple. The company has the flexibility to change product type. When needed, production for stock is replaced by customer-ordered special products.

The administrative capabilities are less developed, but the managing director has considerable experience as a salesman. However, the company is small, only employing 8 persons in total, and thus requires less administrative effort.

In summary, UHANDISI has developed some production/adminsitrative capabilities. The production functions satsifactorily when raw material is available.

UHANDISI's dynamic capabilities are considerably less developed, both regarding inventive and entrepreneurial capabilities. UHANDISI does not search for alternative sources, although it experiences is a shortage of raw material. The reason is that UHANDISI perceives itself bound to an agreement between SIDA and SIDO of only importing raw material from Sweden. The UHANDISI managers are employees and in combination with certain restrictions in their freedom of acting, this may partly explain why dynamic capabilities seem to be non-existent. Furthermore, lack of tool-making capability is a barrier for product development.

In conclusion, UHANDISI seems to be very weak regarding dynamic capabilities. There have been no attempts in neither product development nor in entrepreneurial activities.

6.3 Discussion

In the following, the static and dynamic capabilities are analysed within four essential areas; raw material planning, production planning and management, maintenancne and product development (sections 6.3.1-6.3.4). The analyses are based on data acquired through in-depth interviews in the five 1st generation SIs. In section 6.3.5 an alternative way of analysing capabilities is used. The capabilities of each junior sister's management team is estimated, based on the case studies. Here, all eight case projects are analysed.

6.3.1 Raw material planning

A focus in the in-depth interviews in this section has been on the time/quantity relations in connection with raw material planning and ordering. However, due to foreign exchange problems in the Tanzanian economy, factors beyond the control of the individual companies have influenced the raw material supply. Hence, all firms studied but one have experienced raw material shortages. The irregular availability of foreign exchange has also influenced the planning procedures at the firms, in the direction of a more reactive planning once the allocation of foreign exchange has been approved.

There have also been varying degrees of search for alternative raw material sources. Because of the influence of the above mentioned external factors, an increased emphasis has been put on the analysis of the firms' capabilities to handle the raw material shortages in a dynamic way. This includes the searching of local sources, developing new products using other locally available raw material, etc., i.e. their capability to handle those factors which are within the control of the individual firms.

Below, a summary table (6.1) of the static and dynamic capabilities of the studied firms, is provided. This table is based primarily on in-depth interviews concerning raw material planning.

	STATIC	DYNAMIC
AMI	Dependent on the senior sister Totally dependent on import support The raw material supply through the SI relation runs smoothly (but a shortage)	Does not search actively for other raw material sources for the main product Searches for new sources through the development of new products using locally available raw material to some extent
FAWIPMA	Dependent on the senior sister Has tried to get foreign exchange through Bank of Tanzania several times without success Dependent on import support	Has searched actively for local raw material sources Has developed new products that increase the utilization efficiency of imported raw material, and others that use local raw material
KIMESHA	Uses local raw material Well functioning planning, close contacts with local supplier Makes yearly budget and a monthly break-down of raw material need	Has not experienced raw material shortages Obtains right quantities through the ordering of four times more
NEM	Ability in cyclic planning of raw material need Started early (1978) to apply for foreign exchange from Bank of Tanzania; has succeeded once Dependent on import support	Has tried to avoid the raw material shortage in several ways: 1. export marketing 2. developing new products using local raw material 3. tool programme to increase local components in existent products 4. concentration on products with lower import content
UHANDISI	Perceived themselves to be bound to an agreement between SIDO and SIDA that prevents raw material imports from other places than Sweden Knows about plans of local production of raw material	No active search for alternative sources of raw material; neither abroad nor in Tanzania

Table 6.1 Raw material planning

KIMESHA has never had an incentive to search for alternative raw material sources, as they have been locally available. Instead the raw material planning and the contacts with the local supplier have gradually been developed, resulting in a very high production/administrative capability. For the other four companies the dependence on Swedish aid for import support has influenced the planning horizon, leading to a more static time perspective. The time/quantity relation is not emphasized. Furthermore, the smooth running raw material deliveries through the senior sisters in combination with the common feeling of an obligation to import raw material from Sweden (for Swedish aid money), has had negative impact on the search for alternative sources of raw material (at least for the originally introduced products). This feeling of obligation is further enhanced by the junior sisters' knowledge that one of their senior sisters' motives for involvement is sales of raw material and components. Nevertheless, NEM has high and UHANDISI relatively low PA capabilities. FAWIPMA and AMI have some capability in this field. If the companies were to be rank ordered according to the static capabilities, KIMESHA would be placed at the top, maybe together with NEM.

For four of the firms, the raw material shortage is similar, but the way of handling this situation differs considerably. This indicates differences in inventive/entrepreneurial capabilities among the cases. These four firms can be ranked according to their ability to handle the situation in an innovative way (referring to the number of alternative actions and the intensity):

NEM
FAWIPMA
AMI
UHANDISI

NEM shows high capabilities in inventive/entrepreneurial capabilities. UHANDISI on the other hand shows no signs of inventive/entrepreneurial capabilities. FAWIPMA and AMI show capabilities in the dynamic field and are ranked in between.

6.3.2 Production planning and management

In the area of production planning our focus has been on the time/quantity relations, i.e. the way of determining batch sizes, sequencing and scheduling. In some of the firms the production process only involves a few steps and hence the planning is very simple, mainly dependent on raw material availability and market demand.

Another area of interest has been the production information systems used and the way of collecting the data. Finally, the system used for motivating the workers in production is commented on.

In table 6.2 a summary is provided of static and dynamic capabilities in the firms.

	STATIC	DYNAMIC	Influential factors: market demand raw material (RM)
AMI	Several steps in the production process, i.e. complex process. Governed by the raw material availability and customer orders. Too large batch sizes, which result in uneven work load and large in-process stocks.	Has modified the card system introduced by the senior sister. This has been supplemented with a log book and assigned a specific person to collect production data. This has been done as a response to the badly functioning card system.	Market secured RM shortage
FAWIPMA	Simple planning process, few production steps. A simple system for collecting daily production data.	Has introduced a target system to increase productivity. The extra income is provided each week. Free lunch is provided when working over-time.	High market demand RM shortage
KIMESHA	Simple weekly planning shown on planning board. Flexible, customer order initiated, short lead times. Simple information system concerning type, quantity and quality produced per worker.	Productivity increase through: a) incentive scheme based on target + piece pay above target or free to leave, when reached target b) partial 2-shift The system introduced is based on an analysis of human skills, fatigue and incentives.	High market demand No RM shortage Production capacity (and technology) the limitation
NEM	Several steps in the production process. Smooth production flow. Daily production information concerning volume, raw material use and manpower use. Monthly summaries. Distinguishes between standard and special items - different procedures.	Has introduced a new system for stock control by hiring an experienced store keeper. Yearly general bonus system. Industrial incentives through individual wage adjustments.	High demand on new products but less demand on original product RM shortage
UHANDISI	Simple planning, few production steps. Flexible change between production of stock items and customer order initiated non-stock items.	Non existent	Some marketing problems Some RM shortage Some production problems (tools)

Table 6.2 Production planning and management

Raw material shortages have negatively influenced the production planning in all companies, including KIMESHA which at times has had a shortage of certain sizes of aluminium circles. The shortages have resulted in low capacity utilization which puts a lower demand on proper production planning and scheduling, i.e. the time/quantity relation has been less emphasized.

Among the cases there are big differences in the need of planning and control systems, mainly depending on the nature of the production processes. FAWIPMA and UHANDISI have very few production steps and hence, do not need a very sophisticated system. AMI and NEM on the other hand, have many different production steps, in machining sections as well as in assembly, and they both do need more advanced systems for the control of raw material use, work force use, etc.

The static capabilities do not seem to differ much between the cases where less sophisticated control systems are needed, i.e. FAWIPMA and UHANDISI, which both have few products and few production steps. KIMESHA is similar, although with a wider variety of products. A comparison between the two firms with more complex production processes shows that AMI has had some problems in planning the suitable batch sizes, while this problem has been minor at NEM. Both firms have found a need to modify the originally introduced production control systems, and changes have been carried through, which points in the direction of dynamic capabilities.

As far as incentive schemes are concerned some of the firms have surely been innovative while others have shown this ability to a lesser extent. KIMESHA has the most advanced approach for increasing productivity through a combination of an incentive system with direct feedback and a way to increase the utilization of the machines and the experienced work force, through a partial 2-shift system. NEM has an annual general bonus system which provides all personnel with a bonus product at the end of the year if the comany's production goal has been achieved. However, this means that the 'feedback time' might be too long and as it is a group bonus for the whole company it might not be enough tied to performance which lessens the impact. On the other hand, the selection of bonus products (bicycles) is also an innovative way of solving a transport problem. FAWIPMA has a target system with more direct feed-back, where the workers get their monetary bonus within a week.

Within the area of production planning and management all but one company have been shown to possess dynamic capabilities all the way from the diagnosing of problems and the generation of alternative solutions, to the implementation of these innovations. As the companies' size and their production processes are different, the relevant solutions differ and thus, different actions have been taken. However, compensating for the various demands of different technologies, a ranking according to dynamic capabilities is provided below.

KIMESHA
NEM
FAWIPMA
AMI
UHANDISI

Referring to the differences in technology level it might be argued that the rank order of KIMESHA versus NEM as well as FAWIPMA versus AMI should be reversed.

6.3.3 Maintenance

Traditionally, maintenance in African industry has almost exclusively been of a corrective type, with limited understanding of the need for preventive maintenance. The focus in this section is on the prevalence of preventive maintenance versus corrective maintenance in the sister industries. Furthermore, it is of interest to see to what extent the junior sisters are able themselves to further develop systems and establish routines for maintenance. Due to restricted time for data collection, 'maintenance' was not covered to the full extent for all cases. The discussion below is primarily based on the findings from two cases, supplemented by more superficial data from other cases. Hence, our data does not permit any rank ordering of the different cases.

In the SI contracts it was noted that the senior sisters should provide the junior sisters with maintenance manuals. This has also been done in most cases. As a result routine maintenance is carried out at the junior sisters; normally it is a weekly greasing, checking-up, etc. in combination with regular overhauls, often through the senior sisters' direct assistance on-site in Tanzania. In several cases the SI entrepreneurs had previous experience of this kind of routine maintenance from their former employments. This experience facilitated the introduction of similar systems at the juniors sisters.

The philosophy of preventive maintenance does not seem to get established only through the introduction of maintenance manuals and planned routine maintenance. There has been a tendency to run the machines until break-down in several companies. There are probably two explanations, one being the lack of diagnosing ability, i.e. the ability to check and inspect the machinery to find out what is soon going to break, at an early stage. The other is the attitude towards preventive maintenance which has to do with time aspects, of doing things in advance. This attitude is not found in traditional African society or generally in African industry. This component might be the one that is hardest to 'transfer' through training programmes, and in the case of the SI project it has not been heavily emphasized.

However, in some of the projects the SI entrepreneurs themselves have become aware of their limited maintenance capabilities, having experienced break-downs of the machinery among other things. Hence, supplementary training has been asked for and training at this stage, when the entrepreneurs have substantial practical experience of running their own industry seems to provide a deeper understanding of the importance of preventive maintenance.

6.3.4 Product development

Product,. process and market developments demand by definition dynamic capabilities. Our analysis primarily starts out from product development, but often this also implies market development and changes in the production process. Most of the junior sisters have carried out innovative activities, mostly product developments. In this section, the focus is on the driving forces, the initiative and the considerations behind the innovative activities.

Table 6.3 provides a picture of the dynamic capabilities for product development in five junior sisters. The information is given under seven different headings: driving force (DF), initiative/idea source (I), technology (T), barriers (B), evaluation (E), strategy (S) and innovative activities (IA).

AMI	DF:	Raw material shortage
	I:	Subcontracting initiatives from other firms Limited search for new ideas or market research
	T:	Flexible technology that can be used for a variety of new products
	B:	Limited knowledge in pattern-making has been a barrier. Through supplementary training this is now partly overcome, more experience is, however, needed for expertise The ownership structure influences the motivation for innovation negatively
	E:	n.a.
	S:	Keep on with present products
	IA:	Acting as subcontractor (castings), limited jobbing
FAWIPMA	DF:	Raw material shortage
	I:	Limited search for new product ideas or market research
	T:	The technology can be used for some variants of the original products. The raw material (wire) can be used for a great number of different products, e.g. through hand/jig forming, i.e. a new technology.
	B:	Imagination, entrepreneurial visions, foreign exchange
	S:	Keep on with present products, mechanize production
	E:	Simple calculation of marginal contribution of new products
	IA:	Utilizing scrap-raw material for manual production of simple products, utilizing production jigs
KIMESHA	DF:	Competitors' advantages in terms of economies of scale. A certain raw material shortage.
	I:	Active search for new ideas from different sources, e.g. potential customers and product catalogues. Previous knowledge of the market and the competitors Product propositions from senior sister.
	T:	The technology can easily be used for a huge number of variants on the same theme. Has a basic capacity to make needed moulds.
	B:	One man doing all managerial and inventive tasks.
	E:	n.a.
	S:	Niche strategy, trying to find products that not are produced by large volume producers Diversifying into supplementary product areas using new technology.
	IA:	Developed a large number of new products that are continously the subjects of minor improvements Developed into new product areas using two other production technologies, i.e. fabrication including welding, and pressing Initiated joint projects, working as subcontractor Made minor improvements on machinery and organized production in an innovative way (incentive system + partial 2-shift)

Table 6.3 Product development

Key to table 6.3

DF = driving forces	B = barrriers	S = strategy
I = initiatives/ideas	E = evaluation	IA = innovative activities
T = technology	n.a. = data not available	

table 6.3, cont.

NEM	DF:	Vision of becoming East Africa's electrical fittings supplier Raw material shortage. Market demand.
	I:	Very systematic and active search for new product ideas from a wide arrange of sources; customers, product catalogues, imported products, senior sister, etc. Cooperation initiatives from other firms Market research, conducted by hired firm of consultants, is carried out when considered needed. Systematic collection of all customer inquiries.
	T:	Flexible technology that can be used for a large variety of products.
	B:	No clear barriers
	E:	For new products an estimate is made of profit in comparison to setting up tools and other disturbances in on-going production. Contributions from different kinds of innovative activities are considered
	S:	A vision of becoming the leading supplier of electrical fittings in East Africa Total flexibility in the means to reach this vision, e.g. o lowering of import content of raw material and components o supplier of a full assortment which makes one product contribute to others' sales volumes through complementarities o using different subcontractors where in-house technology is not sufficient Efforts to enter the export market
	IA:	Developed a large amount of products that fit into the strategy of supplying a full range of electrical fittings Some products are totally in-house made, other utilize components made by subcontractors and yet others are totally made outside but marketed as a part of a full product assortment Developed own tools, modified assembly work places, made new production lines, etc.
UHANDISI	DF:	n.a.
	I:	Very limited search for new product ideas
	T:	The technology can be used for minor variants of original products
	B:	Tool-making capability as well as the management's limited industrial education/experience
	E:	n.a.
	S:	Keep on with present products
	IA:	No innovative activities carried out During previous management a very minor product modification was done

Key to table 6.3

DF	=	driving forces	B	=	barrriers	S	=	strategy
I	=	initiatives/ideas	E	=	evaluation	IA	=	innovative activities
T	=	technology	n.a.	=	data not available			

The main driving force behind almost all innovative activities has been the shortage of raw materials, that all the junior sisters to some extent are suffering from. This is a difference from the situation in many industrialized countries. Where the raw material is available and thus, there is a choice between specialization "sticking to what you are best at" and development into new product areas. For LDCs, shortages of different kinds put greater demands on the firms' flexibility in making different products and using different inputs. For KIMESHA the tough competition from competitors with greater economies of scale in some product areas, creates a strong incentive to search for new product niches. For NEM, the general strategy of developing into a leading electrical fittings supplier in East Africa also has a certain character of a driving force in itself.

Regarding search for ideas and initiative there is a marked difference between the companies. Two companies, KIMESHA and NEM, are outstanding in their continuous search for new product ideas from multiple sources. Their knowledge of their potential markets and competitors is deeper than the other junior sisters' of theirs. NEM is somewhat more systematic in its search for product ideas than is KIMESHA. One reason might be that KIMESHA is to a great extent dependent on one person whereas NEM has a well composed management team. FAWIPMA and AMI do a more limited search for new avenues, but both show a certain interest in new products, UHANDISI finally, does not actively search for new product ideas.

For some firms the technology opens up certain roads while it acts as a limitation for other firms. The technology of AMI and NEM is very flexible and offers a great variety of different product possibilities. The KIMESHA technology is possible to use for making a large number of variants of the original product. The FAWIPMA and the UHANDISI technologies are also more restrictive, but permit variants on the same concept, possibly with different markets. However, the FAWIPMA raw material (wire) can by simple manual devices easily be transformed into a wide variety of products. For example the whole industrialization of the small scale industry intensive village Gnosjö in Sweden was totally based on the capability of bending wires into different kinds of products (Frej 1981).

Different kinds of barriers to innovation are influential in the firms. These are to a certain extent due to the technology utilized. For AMI the limited pattern making capability has been a barrier, as this is the most essential capability for making new cast products. However, the ownership structure and 'reward-system' at AMI also has a negative influence, as the managers at present are not encouraged to search for new roads. For KIMESHA the fact that the technology is uncompetitive at larger volumes restricts the possible product range somewhat. On the other hand this barrier has been overcome by KIMESHA through investment in alternative technologies. The barriers for FAWIPMA are more in the area of limited entrepreneurial visions of new products, than in the technology, once the firm had started to embark on the road of using jigs for manual production. Tool making is a barrier for UHANDISI in combination with the management's limited industrial training and experience. NEM's barriers are less visible, and are more in the area of general restrictions on a fast growing small scale firm.

The calculation of potential costs and benefits of a new product, and evaluation of new product introductions are done on different levels of sophistication in the firms. NEM has the most advanced way of calculating benefits in relation to various costs, including the disturbance of other production, the value of a complete product group, etc.

The strategy reflects the way of searching for new product ideas, or vice versa. The firms that do not actively search for new products all have a strategy to keep on with their present products. The two firms which actively search for new ideas have quite different strategies, reflecting their different competitive environments, but also their general policy. NEM has as its guide-line the vision of becoming the leading supplier of electrical fittings in East Africa. NEM hence has interest in export marketing and in having a full product range to offer. Due to the shortages of raw material NEM also has as its strategy lowering the import content of components and raw material in different ways. NEM is open to all forms of local subcontracting and cooperation to reach its goal of having a full product range. KIMESHA's strategy centres around two roads; one being to find product niches for low volume production, the other being the investment in other technology to cover large volume products (presses) and large specialized products (fabrication).

As a result of these strategies the innovative activities have been very high for NEM and KIMESHA, in relation to the rest of the companies. AMI and FAWIPMA have carried out several innovative activities, although not nearly as much as the two formerly mentioned, whereas UHANDISI's innovative activities are marginal (6:3).

The comments above form the basis for the following rank ordering of the firms according to dynamic capabilities in the field of product development, including aspects of production and market nature.

NEM	-	"The visionary"
KIMESHA	-	The innovative niche strategy
AMI	-	"The hired managers"
FAWIPMA	-	The well-run operation
UHANDISI	-	The keep-on-with-the-present

The capability of NEM and KIMESHA is above the other firms, with NEM at the top. The rank ordering of AMI and FAWIPMA is not an easy task. However, if the impact of ownership is neglected, there are some indications of AMI ranking above FAWIPMA at least in the area of inventive capability. UHANDISI is ranked last.

6.3.5 Management composition

The analysis in this section is based on data from all eight case projects. The focus in this analysis is on the capabilities of the management group. In the area of high order skills, e.g. managerial capabilities, it has been pointed out that an individual ought to have a complete register of abilities, as a low level of one ability cannot be compensated by high levels of other abilities (Welford 1980). However, it has been shown that individuals working as a management team might supplement each other's abilities and jointly form a strong unit. In enterprise history there are several examples of this kind of team (Granstrand 1979). Recent research on new industry start-ups also reveals the importance of having a group of people with supplementary abilities, to increase the likelihood of success

(Hult and Odéen 1979b, Utterback and Reitberger 1982, Karlsson and Gadde 1983).

In the SI programme an aim has been to select a team of SI entrepreneurs with supplementary capabilities, although the technical knowledge and experience have been emphasized. Below we have used a modified version of the 'management depth' instrument, developed by Utterback and Reitberger (1982), to get an overview of the strengths and weaknesses of the junior sisters' management composition. This instrument observes four fields of capabilities; technical expertise, marketing expertise, financial expertise and general management skills. The capability level in each of these fields is then classified according to a 3-level scale; little, moderate and great. The estimation of level is based on the case studies of the junior sisters. The scorings in each of these fields are then summarized to get an overall measurement of management depth. One limitation of this aggregated measurement is that it does not consider the effect of a skew distribution of abilities, i.e. where according to Welford (1980), low in one ability is hard to compensate by high in the other abilities.

In this overview of management depth three 2nd generation SI projects are also included; MAFOTCO, PEMACCO and TANLOCKS. The capability ratings are provided in the table below.

	Technical expertise	Marketing expertise	Financial expertise	General management	Total
AMI	3	2	1	2	8
FAWIPMA	2	3	2	2	9
KIMESHA	3	2	2	3	10
NEM	3	3	3	3	12
UHANDISI	1	2	1	1	5
MAFOTCO	2	1	1	1	5
PEMACCO	3	3	3	3	12
TANLOCKS	1	2	1	1	5

Table 6.4 Management depth in the junior sisters
Source: Alänge (1986a)

The aggregated measure of management depth indicates that KIMESHA, NEM and PEMACCO have great management depth. In the case of KIMESHA this goes back to one single individual, but in the other cases it reflects well composed management teams. AMI and FAWIPMA are classified as having a moderate management depth. Finally, UHANDISI, MAFOTCO and TANLOCKS have little management depth, due to weaknesses in several of the fields considered.

If we multiply the figures, instead of adding, we get the following result:

AMI	12
FAWIPMA	24
KIMESHA	36
NEM	81
UHANDISI	2
MAFOTCO	2
PEMACCO	81
TANLOCKS	2

Table 6.5 Modified measure of management depth in the junior sisters

The figures above might better represent the strength of the management composition if the note by Welford (1980) transferred from an individual to a management team is true. In this case it is shown that the strength in management structure shows very big differences. The performance of the firms also reflect these figures to some extent.

6.4 Conclusions

The capability rankings within different 'problem areas' provide a relatively consistent picture of the companies' capability stocks. In general, NEM ranks at the top in dynamic capabilities, with KIMESHA one step behind or at times equal. In all cases UHANDISI ranks last, showing weaknesses in static as well as dynamic capabilities. A comparison of the 'management depth', i.e. the management teams' strength in the areas; technical expertise, marketing expertise, financial expertise and general management, provides a similar result; NEM is at the top followed by KIMESHA, and UHANDISI is low in 'management depth'.

Considering the firms in the middle range, the ranking is not as clear. AMI and FAWIPMA show strengths in somewhat different areas leading to different rankings. To a certain extent this might depend on differences in complexity of the technology. For example, the production process in AMI requires more advanced capabilities, which makes a direct comparison between the two firms more difficult.

Hence, differences in technology and planning complexity make a comparison harder. Furthermore, the presence or lack of external factors influencing the demand for dynamic capabilities might not only obstruct an estimation of the stock, but also hinder the firms' learning of dynamic capabilities. Concerning raw material planning, KIMESHA was rendered high in static capabilities while, at the same time, the external factors never provided any incentives for KIMESHA to utilize dynamic capabilities (here, primarily search for alternative sources of raw material). On the other hand, the other four firms all had strong incentives to use dynamic capabilities in the search for new sources of raw material (due to raw material shortages).

Nevertheless, we believe that the analysis of the capability stock shows a reliable picture and that the tables and the empirical summary provide a useful qualitative description. The ranking of the capability stock should be seen as an aggregated, and thus less nuance-rich measure, which is primarily to be used in the comparative analysis of the capability acquisition processes in the following chapter.

CHAPTER SEVEN

THE PROCESS OF CAPABILITY ACQUISITION

7.1 Introduction

7.1.1 Problem background

The process of capability acquisition in connection with international technology transfer and the subsequent development and maturation of infant industries is poorly understood and conceptualized. The SI programme, involving small scale industries as suppliers of technology to new LDC firms, offers possibilities of studying these processes and their effects in more detail.

7.1.2 Research questions

The aim is to analyse the process of capability acquisition in some projects within the SI programme.

The key questions concerning the process of capability accumulation are:

- What was the previous knowledge and experience of the individuals?
- What was the purpose and content of the training programmes and learning opportunities, provided by the SI projects, i.e. in what areas did a potential for capability accumulation exist?
- What was the relative importance of different kinds of capability accumulation?
- What were the sources of capability accumulation; did the SI project contribute significantly?
- What factors were most important for determining the nature and level of the SI contribution?
- What inherent features are there in the SI programme, and what might equally well be carried out outside this programme?

The analysis of the capability acquisition process is based on case descriptions of 8 SI projects, which show variations in training programmes, resulting capability build-up, etc. All cases are, however, based on a common theme, investment-related international technology transfer projects involving small scale industries as suppliers of technology. To a limited extent, the findings from these cases are compared with data from two international joint-venture projects involving multinational companies as suppliers. On the other hand, the findings are not discussed in relation to other potential ways of acquiring capabilities, e.g. the gradual capability build-up that might occur in the so-called informal sector or the possibilities of training entrepreneurs in business schools.

7.1.3 Concepts

Our interest in the process of capability acquisition is focused on the individual's build-up of knowledge of and skill at running industrial businesses. In principle, the means of increasing this capability are training (a purposeful formal training programme), learning (knowledge and experience acquired in connection with performing work tasks), disembodied technical knowledge (e.g. handbooks, manuals, etc.) and capital-embodied technical knowledge (that can be acquired through a process of reverse engineering) (note 7:1). Seen from the perspective of the firm, the movement of persons can also be seen as a means and what is more, as one of the most effective ones of acquiring capabilities, e.g. hiring of experienced and knowledgeable individuals.

In this study, <u>training</u> is defined as capability accumulation which is planned with the ultimate objective of capability accumulation. Training can be provided for an individual at the same work-place, doing the same work, as in a learning-situation. The distinction between learning-by-doing and training is that for the latter the objective is not to 'produce', but to accumulate capabilities. Training at the work place, if included at all, is normally only one component of a training programme.

<u>Learning-by-doing</u> refers to the capability accumulation that takes place when an individual performs his work tasks. The objective is not the learning in itself, but some sort of 'production' (7:2), whether it is blue or white collar work. Feed-back of information concerning work performance or enterprise performance makes the learning more efficient (7:3).

Opportunities to ask knowledgeable/skillful persons (which may be foreigners in an international transfer project) as well as to receive some guidance, increase the potential learning effect. The present study focuses mainly on individuals' learning, but the concept 'learning' might also be used on a firm level, e.g. in connection with discussions about accumulated production experience/learning curves (7:4). It has been emphasized that 'learning' or acquiring experience is not automatic, on the contrary it requires conscious efforts (7:5).

<u>Disembodied knowledge</u> refers to oral information as well as all types of documentation like books, journals, contracts, manuals, etc.

<u>Capital-embodied knowledge</u> is embodied in the capital goods and in the product transferred (if the transfer does not include the production of all components of the product), by an investment-related transfer project. This knowledge (technology) might be extracted by the recipient firm. The distinction between capital-embodied knowledge and learning is that the absorption of capital-embodied knowledge requires a deliberate effort of engineering activity through a detailed analysis of a system or component ("work backwards") to generate the information needed about methods of production, tolerances, materials, etc.; i.e. 'reverse engineering'. Learning, on the other hand, takes place in all cases where an individual is

involved in different activities but is not automatic. In the case of reverse engineering this would then result in a learning-effect for the benefit of further reverse engineering.

7.2 Empirical findings

In this section an overview will be given of the training and learning components in the SI programme. Findings from our 8 case studies will be presented in a summary form. To a limited extent, these findings are compared to data from other projects. Furthermore, an analysis will be provided of the different sources' contributions to the capability acquisition during different phases; in particular, the relative contribution of the SI programme. Finally, an estimation is provided of the value of the senior sisters' contribution to the junior sisters capability acquisition.

7.2.1 Training and learning periods

A summary of training and learning periods in our 8 case studies is given in table 7.1. It concerns the experience of a selected number of invididuals, today mainly in the positions of managing or production directors. Also other categories of personnel have been trained within the SI programme, but their training is, with a few exceptions, not studied in detail in the case descriptions. For the first generation SI, the first contacts with senior sisters were established in 1977 and the junior sisters were started between 1978 and 1980. The second generation SIs' initiation was in 1978 and the first companies were started in 1981.

The development of an SI project is divided into two phases. Phase I starts with the first organized training/learning activities and ends with a successful performance test or, in the case of foreign instructors remaining in Tanzania after this date, with the return of these instructors. Phase II is then started, i.e. starts from the point in time the Tanzanians themselves are managing their firms.

		Phase One				Phase Two					
	Industrial experience	Training abroad	Senior consultants in Tanzania	Phase One total time	End of phase One	Production experience before second training	Second training abroad	Senior consultants in Tanzania during phase two	Production exp. until Jan. 1983 (interview)	Total production exp. until July 1985	Comments
AMI											During phase One 5 more persons were trained in Sweden for a total of 40 months (foremen)
M.D.	n.a.	--	--	--	June	14	1.5	1	30	5 years	
P.D.	11 years	10	8	26	1980	38	5	4			
FAWIPMA											One more employee was trained for 8.5 months during phase Two
M.D.	0	9	2	19	May	46	8.5		31	5 years	
P.D.	0	9	2	19	1980	--	--				
G.A.	7 years	--	--	--		--	--				
KIMESHA											During phase Two one more person spent 1 month in Sweden
M.D.	13 years	0	3	3	June 1978	26	1	0	54	7 years	
NEM											At present (Sept. 1985) two employees are on training in Sweden for a new product line
M.D.	13 years	1	3	13	Feb.	12	1	1	46	6 years	
P.D.	10 years	1	3	13	1979	36	1	0			
Ma.D.	0	0	0	13		12	1	1			
UHANDISI											During phase One two other persons who have left the company were trained in Sweden for 1 month
M.D.	0	--	0	8	May	22	2	1	31	5 years	
P.F.	8 years	0	5	13	1980	22	2	1			
MAFOTCO											During phase One 5 more persons got training of a similar type (in total 113 months)
M.D.	0	23	33	70	June	-	-	-	-	0	
P.F.	17 years	22	33	70	1985						
PEMACCO											During phase One three operators were trained for 6 months each (in total 18 months)
M.D.	0	12	0	27	Nov.				13	4 years	
P.D.	5 years	12	14	27	1981						
I.D.	7 years	6	14	27							
TANLOCKS											At present (Sept. 1985) one person is on training in Sweden. The firm now partly has got a new management. (Managing director and marketing director have been replaced)
M.D.	0	10	0	24	Nov.				13	4 years	
P.D.	16 years	10	13	24	1981			8			
A.D.	7 years	10	13	24				8			
Ma.D.	0	7	0	24							

Table 7.1 Summary of training and learning periods in 8 case studies (time periods in months except where indicated)

M.D. = managing director
P.D. = production director
G.A. = general adviser
Ma.D. = marketing director
P.F. = production foreman
I.D. = industrial installation director
A.D. = assembly director

Worth noting from table 7.1 is that the SI entrepreneurs in general had considerable industrial experience before they entered into the SI programme. Several had more than 10 years experience and several had supervisory positions in their former employments.

The SI programme is characterized by training periods in Sweden. While during phase One the first generation projects had a training period of a few months, these periods in the later projects (second generation) were given longer duration, in some cases approaching 2 years. Delays in the construction of Tanzanian factory sheds is one example which led to this increase in training time. For instance, the MAFOTCO training was prolonged from 6 months, according to the contract, to almost 2 years as a result of this type of delay. On the other hand, we can also see that in those cases where the training period has been very short or zero, the SI entrepreneurs had considerable prior industrial experience.

There has also been a tendency for the senior consultants in the later SI projects to stay in Tanzania for longer periods, i.e. phase One has been prolonged. While phase One's mean time for the five 1st generation projects was 15 months, it was 40 months for the three 2nd generation projects. One reason is the general increase in the complexity of the projects. Furthermore, MAFOTCO is a special case as its phase One lasted 70 months. In this case the extension was due to the fact that the project was complex in itself (hot-forging). Also the fact that MAFOTCO is the heart for a number of firms, supplying these firms with semi-fabricated blanks for plyers, scissors, etc., might have had a minor influence on the length of the stay, because these firms were started in a sequential manner over a longer period of time.

All 1st generation SIs have entered phase II and they have all had supplementary training in Sweden during this phase. In general this training took place when they had 2-3 years of production experience, i.e. production under local management with opportunities for learning by doing, by managing and very essentially, by making their own mistakes. These courses in Sweden have in many cases been considerably shorter, 1-2 months, as compared to the first training periods. In a few cases the training was of longer duration, for example due to in one case, a new investment which included radically new technology/production.

Also during this second phase senior consultants have paid visits to Tanzania and provided supplementary training on the spot (in most cases consisting of several short visits of 1-4 weeks each). One of the 2nd generation firms, TANLOCKS has needed continued assistance (training and supervision), primarily as a result of production problems during phase II. At the time (January 83) when the final interviews concerning training programme/capabilities, were made in Tanzania, the 1st generation SI had 3-4 years of production experience and the 2nd generation had slightly more than one year's experience (except MAFOTCO who was in the first phase). Today the comparative figures are 6-8 years and almost 5 years respectively.

The SI programme continues to develop and today (Sept. 86) several of the 2nd generation SIs have employees being trained in Sweden. These continued training periods are a typical feature of the SI programme.

7.2.2 Summary of case studies

For each case a summary description of the process of capability acquisition is given below.

First generation SI projects

AMI The process of capability acquisition

The production manager had a stable base of practical experience and vocational training from Tanzanian industry.

The training in Sweden and instruction periods in Tanzania provided the production manager with opportunities to acquire production capabilities in the sense of creating a base for the running of a production unit, but other static capabilities (in the sense of our definition) were missing, for example in the field of general administration, marketing, calculation and other economic areas. Some marketing knowledge was later acquired through assistance from business contacts, outside the SI programme.

A step to overcome these weaknesses in the management composition of the firm was taken during the spring of 1980, when an experienced accountant was employed and later in June 1980 a new general manager was employed, which made it possible for the production manager to concentrate on the production process.

FAWIPMA The process of capability acquisition

The management group had no previous experience of this kind of production, but they had a technical education. The training in Sweden was directed towards providing mainly manual production skills, i.e. production capability. As there was no producing senior sister during phase I the opportunities to get an overview of a functioning Swedish small scale industry were limited. Hence, the opportunity to acquire administrative capabilities was missing. Among other things, capabilities in the areas of general administration, accountancy and marketing were missing.

The management team were aware of these weaknesses and hired an experienced 'general adviser', who as an extra benefit was given a promise of becoming a shareholder. This general adviser had considerable experience in accountancy, personnel management and marketing. Hence, the administrative capability of the firm was considerably strengthened from a source outside the SI programme.

During phase II a new investment was made in automatic machinery. For this contract a senior sister was appointed to provide training in a producing small scale industry in Sweden.

KIMESHA The process of capability acquisition

In the case of KIMESHA, the SI programme has contributed very little to the augmentation of capabilities. Instead, it provided an industrial shed, raw material, machines and equipment to an experienced manager who, for the most part, trained the work-force himself. Hence, the process of capability acquisition primarily took place before the SI project. Of course, the running of KIMESHA provides opportunities for acquiring capabilities as did the visit to Sweden during phase II as well as the contacts with the common facility workshop at the industrial estate. Nevertheless, these contributions are of a marginal nature.

The process of capability acquisition might have taken a completely different course if the managing director had not been recruited once the project had already been under way for a certain time. The owners at that time, however, realized the need for supplementing the management group. The managing director joined the company as a shareholder and production manager with general responsibility for the running of the whole business.

NEM The process of capability acquisition

At NEM the management group already had considerable industrial experience and business knowledge before they joined the SI programme. This prior knowledge and experience was a prerequisite for the short training (3 weeks) during phase I to be successful, when production capabilities were aquired. During phase II, a combination of learning-by-running one's own industry, frequent contacts with the senior sister and supplementary training have further developed the work force of NEM. Specifically, the skills in export marketing and product development have been increased. The training in Sweden in the skill of analysing the potentiality of a new market had an emphasis on increasing dynamic capabilities, e.g. diagnosing.

To a great extent, NEM's managers have themselves directed or taken the initiative concerning the training and knowledge development. While the SI programme has been an important source, other sources have also been of considerable importance during phase II, e.g. local consultants, firms from European countries and the technical college in Arusha.

UHANDISI The process of capability acquisition

UHANDISI initially had a management team with previous industrial and business experience. However, this team was later dismissed and the production was stopped for a number of months. Subsequently, the salesman at that time, became managing director and the production foreman, was put in charge of production. While the new managing director had additional selling experience from his previous employment, he had no general managerial experience. The production foreman had learned-by-doing for two years before the production was stopped but, had only to a limited extent been involved in the set-up of machinery and more advanced work tasks. The production process at UHANDISI is, however, relatively simple with only a few production steps and only a few employees.

Instructors from the senior sister spent very short periods in Tanzania during the re-startup period. The instructions were not sufficient and UHANDISI experienced several break-downs and destroyed tools during the period that followed. Finally, an in-plant training in

Sweden was provided for the managing director and the production foreman. This training was directed primarily towards providing production capabilities, but suffered from limited availability of instructors owing to the senior sister's preoccupation with moving into a new production plant.

The SI programme has provided some input into developing production capabilities. Other types of capabilities have not been provided and as the link to the senior sister is now broken, the junior sister is left with its relatively inexperienced management team that has not been provided with sufficient training from its senior sister.

Second generation SI projects

MAFOTCO The process of capability acquisition

The management group had no previous experience of the same type of industrial production (forging) although the managing director had teaching experience in blacksmithing in technical schools. The importance of former experience and background of the trainees was hence less in production capability. Several of the SI entrepreneurs had, however, a basic experience in supervision from their former employments.

The SI programme provided a 2 year training period in Sweden supplemented by an extended stay of a Swedish instructor in Tanzania for start-up training. The content of the training programme was primarily directed towards providing production capabilities including maintenance, tool-making, etc. The shortcomings of the training were most obvious in the area of administration and management, e.g. capabilities in calculations and in marketing. However, the training in Sweden differed significantly among the 8 MAFOTCO trainees depending on whether they were trained in a large scale unit or in a small scale industry.

Training in a Swedish small scale industry provided knowledge of a more general nature and an understanding of different activities in a small industrial firm; the prime reason for this being the potential overview of all operations. The opportunity to participate in all the different activities, also those of a dynamic character, proved to have a very heavy influence on attitudes towards the running of a small scale industry.

Training in the large scale unit was directed more towards training in very specific activities needed in a firm. However, for individuals with limited industrial experience it seems to have led to a difficulty in understanding the connected whole of a small scale industry and hence to a certain rigidity.

PEMACCO The process of capability acquisition

The management group had a very good theoretical background in technology as well as in management. The managers also had a certain experience of supervising at different levels. However, none had previous experience of a similiar type of production.

The training in Sweden was divided into two phases. In phase I, the managing and production directors were trained six months in advance of phase II and the arrival of another four trainees. In this way the second group received training under the shared supervision of the Tanzanian directors and the Swedish instructors.

The design of the training programme was in this case a learning process for the senior sister which simultaneously developed its capabilities within this area. The senior sister also benefited from the knowledge and experience of its Tanzanian trainees in matters concerning education. Since this first project, the senior sister has developed these training/technology transfer activities into a separate business unit, at present having 2-3 new projects in different countries. Furthermore, it offers various training programmes for technical officials in LDC support organizations in conjunction with Fide, the firm of consultants.

After some minor adjustments, as a result of the training being too elementary in theoretical aspects, the training programme functioned well. Also, different areas of management were to a greater extent included unlike most of the other SI projects. Here, the Tanzanian trainees had a considerable influence on the training programme's design. Another effect of this influence was that the trainees to a greater extent were trained for the right position than was the case in other SI projects, where for example, a marketing director was trained for more than a year in production matters, and so forth.

TANLOCKS The process of capability acquisition

The management group had limited industrial experience and in comparison with some other SI projects, less formal technical or commercial education. However, several of the managers had some experience of supervision and of administrative work. One manager had also run his own business before starting the sister industry.

The SI programme provided a 10 months training period in Sweden directed towards enhancing production capabilities in a more narrow sense, i.e. mainly a concentration on manual skill development. Other areas like management, marketing, production planning, calculations and maintenance were only considered to a very limited extent.

Hence, the only minor signs in the direction of training dynamic capabilities were: exposure to some other lock-systems, a certain limited training in fault diagnose when assembling as well as simulation of faults in some equipment. This Swedish training was later supplemented by a Swedish instructor assisting and training the entrepreneurs and workers in Tanzania.

During phase I the managers felt their knowledge of the specific industry to be too limited to be able to influence the training programme in a considerable way. During phase II, having made a number of mistakes, the SI entrepreneurs took the initiative in asking the Swedish instructor to return and he was employed directly by the junior sister.

7.2.3 Different sources' contributions to capability acquisition

This section's purpose is to analyse different sources' contributions to the capability acquisition during different phases. To better analyse the capability contributions, a scheme of classifications has been prepared (table 7.2). The intention is to identify the contribution in order to increase the technological and managerial capabilities. The degree of contribution is divided into three classes: i) no significant contribution, ii) contribution of static capability, i.e. mainly of a routine type, and iii) contribution of dynamic capability, i.e. inventive capability that is the technical basis for product and process development and/or entrepreneurial capability needed to mobilize the development of a business firm. The 9 possible combinations of contribution are represented in the scheme below. (Compare with the capability matrix in figure 6.1)

		MANAGEMENT		
		0	static	dynamic
	0	0	A	E
TECHNOLOGY	static	P	PA	PE
	dynamic	I	IA	IE

Table 7.2 Classification scheme of capability contributions

0 = no contribution
P = production capability (static)
I = inventive capability (dynamic)
A = administrative capability (static)
E = entrepreneurial capability (dynamic)
\- = no participation
n.a. = data not available

The analysis is based on the case descriptions. These data are summarized in table 7.3, which show different sources'/factors' capability contributions to the individual cases. The sources/factors are divided into 4 broad temporal phases, emanating from the tentative model of capability influencing factors. The temporal phases are: i) Background, ii) Phase One, iii) Learning-by-experience and iv) Supplementary training. The last two temporal phases relate to the time period which commenced when the entrepreneurs themselves started managing their firms without guidance from foreign consultants, i.e. Phase Two in our terminology.

	Background				Phase I				Phase II								
						1st training in Sweden							2nd training in Sweden				
	Family background	School	Industrial work experience	Courses	Investment planning	Training programme	Stay in industrial environment	Disembodied, literature, etc.	Production experience	Change activities	Communication with supplier	Courses, etc.	Investment planning	Training programme	Stay in industrial environment	Disembodied literature, etc.	Other sources
AMI																	
M.D.	n.a.	I	PA	n.a.	-	-	-	-	A	O	O	A	O	A	A	A	A
P.D.	0	P	PA	P	-	P	P	0	PA	I	P	0	PA	PA	I	A	A
FAWIPMA																	
M.D.	0	P	P	n.a.	-	P	0	0	PA	I	0	A	I	-	-	-	A
P.D.	0	P	0	n.a.	-	P	0	0	PA	I	0	A	I	P	PA	-	n.a.
G.A.	n.a.	E	A	n.a.	-	-	-	-	A	0	0	A	-	-	-	-	n.a.
KIMESHA																	
M.D.	E	I	PAIE	I	-	0	-	0	PAIE	I	0	A	E	P	P	0	I
NEM																	
M.D.	E	I	PAE	PA	-	P	P	P	PAIE	I	PA	A	IE	E	E	n.a.	IE
P.D.	0	P	PA	A	-	P	P	P	PAIE	I	P	0	IE	P	I	0	IE
Ma.D.	E	A	A	A	-	0	0	0	PAE	0	A	A	E	E	E	n.a.	E
UHANDISI																	
M.D.	0	0	A	A	-	-	-	-	A	0	0	A	-	P	P	PA	n.a.
P.P.	0	0	P	-	-	0	-	-	P	0	0	0	-	P	P	n.a.	n.a.
MAFOTCO																	
M.D.	0	P	0	n.a.	-	PA	PA	0	PA	-	P	-	-	-	-	-	A
P.F.	E	P	PA	n.a.	-	P	IA	0	P	-	-	-	-	-	-	-	n.a.
PEMACCO																	
M.D.	0	E	0	n.a.	PE	PE	P	PE	0	PE	A	IE	n.a.	-	-	-	n.a.
P.D.	0	I	PAIE	P	-	IA	IA	P	PAE	0	PA	A	IE	-	-	-	n.a.
I.D.	0	I	PAIE	0	-	P	P	P	PAE	0	PA	A	IE	-	-	-	n.a.
TANLOCKS																	
M.D.	0	n.a.	A	n.a.	-	P	P	0	PA	0	PA		-	-	-	-	0
P.D.	0	P	PA	0	-	P	P	0	PA	0	PA		-	-	-	-	0
A.D.	0	0	P	P	-	P	P	0	PA	0	0		-	-	-	-	0
Ma.D.	E	PA	AE	0	-	P	P	0	PA	0	0		-	-	-	-	0

Table 7.3 Different sources' contributions to the development of technological and managerial capabilities (The key to the classifications of capabilities can be found in Appendix 3)

The above classifications are for natural reasons coarse and a bit arbitrary. The meaning is of a somewhat different nature for the different sources. One example, is the classification of school-background where university level technical studies are considered to contribute to inventive capabilities while a technical high school is supposed to provide production capabilities. This assumption can of course be questioned. Nevertheless, our opinion is that this coarse classification provides a valuable basis for analysing the contribution of different sources. The key to the classification scheme can be found in Appendix 3.

If we take a closer look at the different phases and for each firm summarize the individuals' experiences, we get the following picture (see table 7.4).

	Background	Phase One	Missing capabilities
AMI	PIA	P	E
FAWIPMA	PAE	P	I
KIMESHA	PIAE	0	
NEM	PIAE	P	
UHANDISI	PA	0	IE
MAFOTCO	PAE	PIA	
PEMACCO	PIAE	PIAE	
TANLOCKS	PAE	P	I

Table 7.4 Summary of capability contribution of Background and Phase One
Source: Table 7.3. (For an explanation of symbols see table 7.2)

For the five first generation SI individuals, the contribution from phase One is limited to static capabilities, i.e. production and administrative capabilities. The fact that inventive and entrepreneurial capabilities are not missing in all cases is due to the selection procedure, i.e. experienced individuals became involved in the SI programme. The same situation exists for most 2nd generation projects but with the difference that phase One is improved. In the case of PEMACCO the contributions concerned inventive as well as entrepreneurial capabilities. If we look at table 7.3 at PEMACCO, we see that different individuals received different types of dynamic capabilities i.e. the training programmes were individually designed.

In table 7.5, the learning and training opportunities during phase Two are added. Except the SI firms also two MNCs are included in this table.

	Background and Phase One	Phase Two: Learning - by - experience	Phase Two: Training/ new investment	Other sources	Missing capabilities
AMI	PIA	PIA	PIA	0	E
FAWIPMA	PAE	PIA	PIA	A	
KIMESHA	PIAE	PIAE	PE	I	
NEM	PIAE	PIAE	PIE	IE	
UHANDISI	PA	PA	P		IE
MAFOTCO	PIAE	PA	-	0	
PEMACCO	PIAE	PAE	IE	n.a.	
TANLOCKS	PAE	PA	PA	0	I
PHILIPS	n.a.	PA	PIAE	n.a.	
GT	n.a.	PA	PA	n.a.	n.a.

Table 7.5 Summary of capability contribution for all phases
Source: Table 7.3. (For an explanation of symbols see table 7.2)

Learning-by-experiencing, i.e. managing one's own firm, provides excellent opportunities for acquiring capabilities (see table 7.6). Static capabilities are provided in all cases and dynamic capabilities are also frequently provided. All but one of the 1st generation projects have been involved in product development and some have in connection with their daily activities contemplated an extension of their firms. The second training/new investment has in most cases provided opportunities for acquiring dynamic capabilities, which is a clear difference as compared to phase One.

Those two cases where dynamic contributions of inventive capabilities are still missing, are the two companies with most technical problems and with no signs of product development.

A comparison with the second phase for the two MNCs, Philips and General Tyre which are included in table 7.5, shows that unlike several SI cases the MNCs do not provide dynamic capabilities during normal production periods, i.e. as learning-by-experiencing. In the case of Philips, the introduction of new products does not involve product development but process development, i.e. through total responsibility for the design of the new production line. However, this experience is limited to one single person at Philips, the production director. General Tyre, however, provides more internal and external training than Philips directed towards providing production and administrative capabilities in general.

Above, a rather crude picture of the different sources' contributions, has been provided. The factors/sources will be discussed in more detail in the discussion section.

7.2.4 Stocks of capabilities and major sources

A summary of the stock of capabilities in the junior sisters and the major sources of capability contribution is provided in table 7.6. The specific contributions of the senior sisters to the capability creation in the junior sisters are shown in more detail.

	Stock of capabilities 1	Major source 2	Senior sister's contribution Phase I 3	 Phase II 4	Senior sister's share of the contribution to the capability stock 5	The value of the senior sister's contribution 6 (1 x 5)
AMI	medium (60)	SI for production cap. Local managerial cap.	production cap.	production/adm. and some dynamic cap.	considerable (0.7)	42
FAWIPMA	medium (60)	SI for production cap. Local managerial cap.	production cap.	production/adm. cap.	considerable (0.7)	42
KIMESHA	high (80)	Skilled entrepreneurs from local firm	no contribution	production cap.	marginal (0.1)	8
NEM	very high (100)	Skilled entrepreneurs from local firm	production cap.	production/adm. and dynamic cap.	limited during phase I more during phase II (0.4)	40
UHANDISI	very low (20)	Local in-plant training	no participation	production cap.	low (0.2)	4
MAFOTCO	low (40)	SI	production/adm. and some dynamic cap.	phase II not yet started	high (0.9)	36
PEMACCO	very high (100)	SI and skilled entrepreneurs	production/adm. and dynamic cap.	production/adm. cap.	considerable (0.7)	70
TANLOCKS	low (40)	SI	production cap.	production/adm. cap.	considerable (0.7)	28

Table 7.6 The stock of capabilities and different sources' contributions

It should be observed that the above summary concerns the senior sisters' major contributions, i.e. primarily through the training programmes, start-up supervision and continued contacts. The SI programme as such, creates opportunities for the SI entrepreneurs to learn-by-doing, to learn-by-innovating and so forth, but these kinds of contributions are not included in table 7.6.

The senior sisters' contributions are considerable in several of the cases (column 5), but the level of the stock of capabilities varies between the cases (column 1). This calls for considering the determinants of the widely diverging performances, for example, the previous knowledge and experience of the trainees, which is further discussed in section 7.5.5, 'Selection of SI entrepreneurs'.

In order to illustrate the value of the senior sisters' contribution to the juniors' capability stocks, the assessments in the first and fifth columns in table 7.6 have been given numerical values. For the stock of capabilities in the first column a scale that starts from 0 and ends at 100 is used. This scale is constructed by giving the most qualified first generation junior sister the numerical value 100. The other junior sisters' stock of capabilities were then estimated in relation to this, on the scale from 0 - 100 (7:6). This estimation was made by the researcher on the basis of the analysis in Chapter Six and the case studies (Alänge 1986a) (7:7). In the fifth column, depicting the seniors' relative contribution, the following classification is used: 0 = no contribution, 0.1 = marginal, 0.2 = low, 0.7 = considerable, 0.9 = high and 1.0 = total contribution. The value of the senior sisters' contribution is provided in the sixth column, where the numerical values of the first and fifth columns have been multiplied. The possible values in this column are from zero to one hundred.

Column six shows that the value of the senior sister's contribution was largest in the case of PEMACCO, assisting with the acquiring of a very high stock of capabilities. The value of the senior sisters' contributions to AMI, FAWIPMA, NEM and MAFOTCO were about the same, albeit that the relative contribution in the case of NEM was considerably lower than in the other cases. This may be explained by the fact that the trainees of NEM had more education and experience at the start of their SI project than did the other SI entrepreneurs, and thus, were in a better position to benefit from the training and advice provided by their senior sister.

The contributions from UHANDISI's and KIMESHA's senior sisters were of the lowest value, slightly higher in the case of KIMESHA due to the capable SI entrepreneur's ability of utilizing even marginal relative contributions from the senior sister. Lastly, one word of caution. The values are based on our previous analyses but the numerical values are naturally a bit arbitrary. Nevertheless, column six illustrates the order of magnitude of the value of the senior sisters' contribution to the junior sisters' stocks of capabilities.

7.3 Factors influencing capability acquisition - an introduction to the discussion sections

Capability acquisition is influenced by a variety of sources and factors. An extended version of the model of the SI programme (figure 4.1) also including the environment external to the programme, will be used to describe the factors influencing capability acquisition (see figure 7.1).

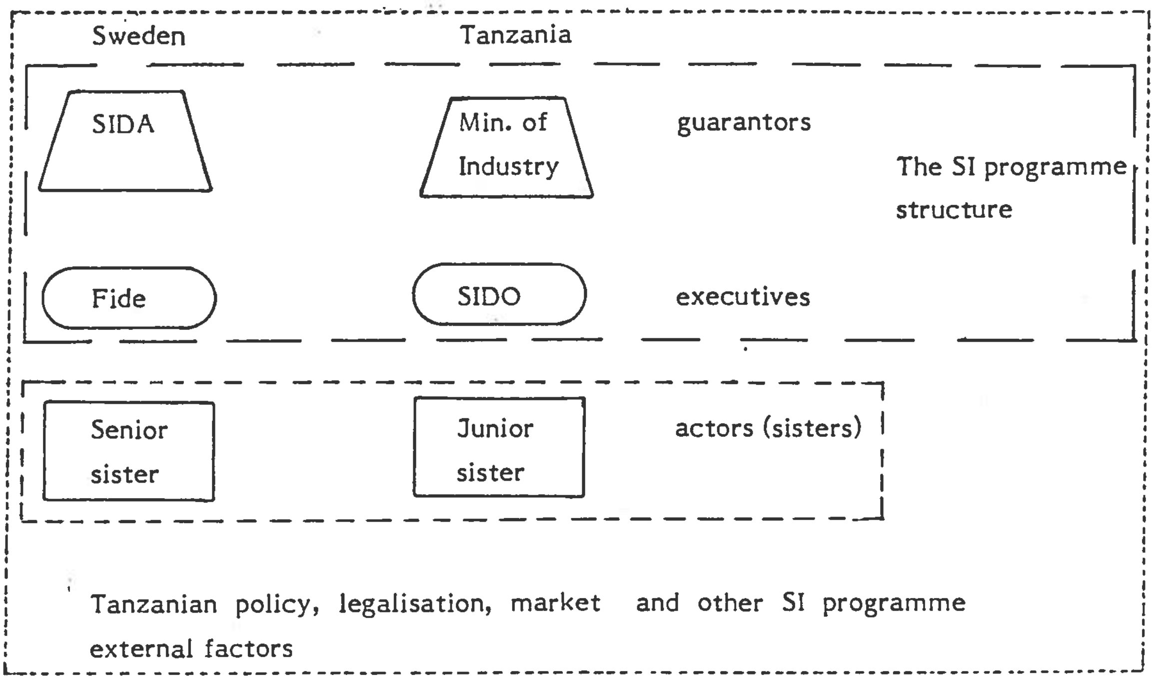


Figure 7.1 The factors that influence capability acquisition

Our focus is on the actors directly involved in the technology transfer process, in the junior and senior sister firms. These firms operate in environments which are influenced by a lot of factors. These include governmental policies and legal measures, as well as competitors on the local and international scenes. In section 7.4 a view is provided of the most influential external factors in the local context on the process of capability acquisition in the Tanzanian junior sister firms.

The SI programme's aim is to initiate, support and to some extent protect new infant industries. This is carried out through an institutional structure formed by the Tanzanian Ministry of Industry, SIDO headquarters and regional extensions and SIDO's Swedish consultant Fide, SIDA in Sweden and its local office in Dar es Salaam, together with some other hired firms of lawyers and consultants. The impact directly and indirectly on the capability formation of the SI programme as the body that stipulates the rules of the game, is discussed in section 7.5.

Finally, the design of training programmes and the influence of the specific character of the direct actors, the junior and senior sisters, is discussed in section 7.6. Their experiences, motivations and attitudes naturally have considerable influence on the result. This part of the discussion is based on a comparison between the sisters of the eight case projects, supplemented with some data from the training activities at Philips Pilot Plant in Utrecht.

7.4 Tanzanian policy and other external factors

The environment, in a broad sense, influences the initiation and development of industrial firms in a number of ways. First, it forms the opportunities for and barriers to entrepreneurship and business startups, e.g. through the operation of the capital market. Second, the stability in demand or lack of it, and availability of inputs affect the possibilities of learning through accumulation of experience. Through inducing the search for alternative sources of raw material, new products and markets, they influence the nature of capabilities acquired and the motivation for learning as such. Finally, society's provision of vocational training, educational and other services provides industrial firms with a base for their start as well as supplementary inputs for their continued development.

7.4.1 Opportunities for and barriers to entrepreneurship

Since the latter half of the 70s, Tanzania has been in favour of the development of private small and medium scale industrial firms, in order to provide the then planned indigenous steel industry with a market. One means to promote such a development was the establishment of the support institution SIDO. SIDO has had two major programmes for the establishment of small scale industries, the Indo-Tan programme (at about 30 small scale units) and the SI programme (30 small and medium scale units). SIDO has also had a hire-purchase scheme (for investments in machinery) to promote small scale industries in rural areas. In different foreign aid programmes, components directed towards the small scale industry sector have also been included, e.g. the US Aid financed AP/VDP programme to establish rural units in the Arusha region.

Among conditions important for motivating individuals for entrepreneurship have been: the traditions of entrepreneurship in the country; the declining standard of living for employed people; and in public organizations an incentive scheme which does not motivate entrepreneurial employees to stay (see section 5.4.2). Hence, there is a variety of factors in the environment that motivates individuals to start their own businesses. Factors frequently mentioned by SI entrepreneurs were job dissatisfaction, cost of living as compared to salaries and offer of opportunities to start one's own firm (see table 5.6).

However, the Tanzanian environment for small scale industry startups is in general characterized by limited possibilities of obtaining funds for investment and then especially the foreign exchange needed. This applies to the import of needed machinery and raw material as well as to financing, training and consultancy provided by foreign firms. The complex procedures for obtaining loans from Tanzanian commercial and development banks are also considered to be a barrier to startups, at least in the case of very small scale projects. The limited availability of funding and opportunities suggests a certain supply in the economy of capable entrepreneurs-to-be working as employees in existing industry and institutions.

7.4.2 Inducements and opportunities for learning

The nature of the environment influences the learning situation for infant firms. Changes in general policies concerning industry development have a natural impact, likewise changes in policies concerning foreign exchange allocations, importation, exchange rates, etc. One direct effect of a higher uncertainty is a tendency towards a more short-term planning horizon on the part of private firms, which might indicate a more frequent occurrence of social losses in investment in learning.

An economy dependent on large foreign aid organizations runs the risk of providing a less stable environment. Aid donors might destroy the local market for an infant because of demands "tied" on aid or at times by providing heavily subsidized products. This has been the case for other SI products, but not for any of the eight cases studied in more detail.

The deteriorated terms of trade and other economic problems on a national level have forced Tanzania to shift its policies regarding industrialization radically. The rationale behind the basic industry strategy and the focus on the development of an import product substituting steel using small scale industry became less obvious in the light of the early '80s. This has resulted in policy shifts towards export promotion, priority to certain industries and a freeze in the investments in new industrial capacity. Hence, the general environment influencing entrepreneurship in Tanzania has been characterized by changes in policies and a relatively high degree of uncertainty.

The increasing shortage of foreign currency in Tanzania during the early '80s led to a very low capacity utilization in industry (less than 30% 1982, according to Havnevik et. al 1985). Indeed, some firms were left without any raw material. The effect of this on learning and maturation was detrimental to Tanzanian industry. The low capacity utilization many times means that the production pace is kept on a low level to avoid complete close-down. This implies that the firms are never apt to strain their production systems towards the installed capacity maxima and hence, they will never get the opportunity of running the system at full production which is essential for the accumulated learning-by-production. Hence, except for the losses in underutilized production capacity there is also a loss in missed production experience (7:8).

However, scarcity of raw material and other inputs has other effects on learning as well. It stimulates the search for alternatives and new products and markets. This means that the motivation and the opportunities for acquiring different kinds of dynamic capabilities are increased, unless these kinds of activities are hampered by other policies like restrictions and licenses that guarantee temporary monopolies for other producers in the economy. In most junior firms the prevalent scarcity has induced a move towards new areas and a considerable acquisition of dynamic capabilities, inventive as well as entrepreneurial.

The specific dynamic capabilities acquired are valuable for coping with the situation of uncertainty created by the irregular availability of inputs. The social value would probably be somewhat less if certain macro economic changes took place, e.g. an increase in the supply of foreign currency. Nevertheless, it can be assumed that dynamic capabilities acquired to tackle one situation also facilitate the solution of other problems and opportunities (7:9).

The existence of intense competition (versus protection through a temporary monopoly) has a similar effect on learning as that of the scarcity of raw material. The stability behind a full order book and availability of raw material provide many opportunities for accumulation of production experience while intense competition forces a firm to act innovatively or die (7:10). The situation for the SI firms has partly been discussed in Chapter 6, e.g. in table 6.3 where driving forces and barriers to product development have been listed. For example, the intense competition in aluminium household ware and KIMESHA's disadvantage when it comes to larger volumes have made the firm concentrate on a niche strategy of developing new products that are not made by large volume producers.

In 1976-77, a policy change took place in Tanzania, and the government decided to support the development of private small and medium-sized industrial firms. The question is what influence ownership has on the process of capability acquisition and industrial development. There are some scattered findings that point in different directions. First, an employee does a "fair" job but may not put his whole soul and effort into the business, in comparison with an owner. Second, employees might leave the company in a few years time. However, this is not necessarily completely negative for the country, provided that the knowledge and skills are used in other activities, i.e. are diffused to other industrial undertakings (one's own firm or as an employee).

From our limited data it is hard to draw firm conclusions concerning the influence of ownership/employment on the process of capability acquisition. It might be that the continuation of an SI project, i.e. continued contacts and training, will be negatively influenced if there is no private ownership, as the general long-term interest in the business might be somewhat lower. However, it is not obvious that employment always means lower interest. Findings from our 20 SI projects indicate that personal factors have a strong influence and make ownership/employ ment a secondary factor. Furthermore, among the employed several have ideas of starting their own businesses in the future, which motivate them to acquire a wide range of capabilities.

A specific factor, regarding capability acquisition and entrepreneurship, is the structure of ownership in Tanzanian industry, where a large share of the private industry is owned and run by the Tanzanian minority group of Asian origin. This group has from the '50s onwards, to an increasing extent, entered the manufacturing sector from earlier functions mainly as intermediaries and shop owners (Forss 1985b and see MEIDA 1981a for a description of some companies' development). This implies that a large share of experienced entrepreneurs-to-be might be found within this group. On the other hand, the government has the aim to obtain a more even distribution of entrepreneurship in the country. In practical terms, this means that policies are primarily being directed towards promoting African entrepreneurship, i.e. supporting the start of private firms owned and managed by African Tanzanians. It can be presumed that this has at least two effects on entrepreneurship and capability acquisition. First, an underutilization of existing entrepreneurial talent in Asian owned firms, and second, a certain reluctance to transferring capabilities to African entrepreneurs-to-be, on the part of the Asian industrialists, who might see themselves as less favoured and in need of protecting their competitive positions. As can be seen in Chapter Nine (tables 9.6 - 9.12), a large share (40%) of the SI firms' competitors is owned by Tanzanians of Asian origin.

A few large Tanzanian companies have proved to be of great importance for providing the SI entreprenerus with industrial experience. Among these are, Williamson Diamonds, Tanganyika Planting Cooperation and General Tyre E.A. In particular, General Tyre, has been important as a provider of qualified entrepreneurs-to-be. One reason for this seems to be a well functioning internal course programme at General Tyre. However, the importance of these few large firms also reflects Tanzania's limited industrial sector. The supply of experienced entrepreneurs-to-be at present employed in other industries is not unlimited. The effect of leaving an employment on the present firms has also to be considered. The existing industries can only to a certain extent serve as training units for future entrepreneurs or otherwise the start of new firms might result in a social loss.

The availability in a society of entrepreneurs-to-be with sufficient background knowledge and experience is essential to industrial development. The supply of a skilled labour force or the availability of local training opportunities to upgrade the personnel is also important. The recent success examples of industrialization support this, e.g. Japan and South Korea, which both had well developed educational systems that supplied their infant industries with human resources. Tanzania has, for African conditions, a very well developed system of primary schools. There is also a limited number of technical secondary schools, vocational training schools and technical colleges. The technical faculty of the University of Dar es Salaam is of relatively recent origin, since university level technical education earlier took place at the University of Nairobi in Kenya. The technical college in Arusha has frequently been used by the SI entrepreneurs to upgrade the theoretical knowledge of their employees. The SI entrepreneurs themselves often have technical secondary or technical college education and a number have been to universities in Kenya and other more foreign countries.

7.5 The SI programme's role

The purpose of the SI programme is to initiate and support new industrial firms in Tanzania. This has been done in an environment characterized by a high degree of uncertainty and an uneven rate of development of the industrial sector and the infrastructure in general, i.e. the characteristics of a typical LDC. One basic function of the SI programme has thus been to create stability and a long-term perspective, enabling the involvement of Swedish small scale firms as technology suppliers to newly created Tanzanian firms.

The SI projects have been initiated and negotiated by the 'support structure' SIDO/Fide/SIDA. The length of the time from the first contact with a senior sister until the startup firm is an operating business in Tanzania has in general been short (average $2\frac{1}{2}$ years), indicating efficiency in the implementation (Löwbäck 1987a). The involvement of local Tanzanian firms in the projects has however been limited, except for building construction, which indicates a low degree of learning opportunities for firms outside the SI programme (externalities). Also, the SI entrepreneurs have missed out on learning opportunities during the planning and early implementation phases, while SIDO's personnel to a certain extent, have learned through involvement (see further section 7.5.2).

The SI programme creates the basic frame for the capability acquisition processes, while the direct actors, especially the senior sisters, make the detailed design of training programmes, etc. This frame concerns the way a project is to be accomplished and what components are to be included. This is effected through the common contract's structure and through the practices that have evolved in the work of SIDO/Fide/SIDA. Typically a project includes the following activities influencing learning:

- o The senior sister-to-be visits Tanzania to get a first hand view of the country and its specific conditions. Based on this experience, which many times is the first meeting with an LDC, the senior sister makes a proposal for plant design and plans a training programme.

- o SIDO selects the SI entrepreneurs-to-be. This selection is one of the most important factors for the outcome of subsequent training periods (see section 7.5.5).

- o SIDO/Fide/SIDA negotiate and influence the final design of the project, including the choice of production technique (see section 7.5.3).

- o The SI entrepreneurs go to Sweden for a training period in an industrial environment that in itself provides learning opportunities, but no regular training (see section 7.6.5).

- o Instructors from the senior sister spend some time in Tanzania for installation and start-up training of management and workers.

- o Through contracts stipulating a continuous support over a period of 5-10 years, a long-term impact on the junior's capability acquisition is added (see section 7.5.6).

The SI programme contributes to establishing legal and financial stability. The stability is obtained through the above-mentioned contracts and through some influence on what products are allowed to be imported (import licenses). The financial resources of the SI programme have also been a prerequisite of the projects to be started, as the availability of funds for small scale startups has been very limited in Tanzania. Specifically, this applies to the international training costs which have been considered as 'national costs', i.e. been given to the junior sisters free of charge. The created stability has enabled SIDO/Fide/SIDA to find both able SI entrepreneurs and Swedish small scale firms willing to 'transfer' their knowledge.

One aim of the SI programme has been to try to establish an environment conducive to entrepreneurship and cooperation between firms, similar to those existing in the small scale intensive areas of Sweden. This extends the capability concepts towards abilities essential for creating viable local networks. This aim has at least to some extent been fulfilled (see section 7.5.8). SIDO/Fide/SIDA is a communication link between the sister firms assisting in connecting them to other parties, which extends their networks. This is of importance especially during early 'infant' phases (see section 7.5.7 and 10.5).

Below, some of the effects of the SI programme on the process of capability acquisition are discussed in more detail.

7.5.1 Small scale firms versus MNCs as suppliers of technology

The advantages that MNCs have for transferring technology to subsidiaries/joint ventures have been emphasized in literature (7:11). However, it has also been pointed out that despite their long-term involvement, MNCs are reluctant to transfer knowledge of a top management nature (Peno 1975), and some other authors even claim that

MNCs do not really transfer technology (Zahlan 1978, Farrel 1979a). This view of technology-free transfer by MNCs might partly be understood in the light of MNCs' global strategies and their wish to keep certain knowledge areas as strategic assets. This wish also exists when the MNC has no ownership interests and supplies turnkey projects to local firms. If small scale industries, primarily with national IC markets, are suppliers of technology, less reluctance to supply "all" technology could be expected (7:12).

What are the limitations of using small scale industries as technology suppliers? One obvious restriction is the availability of qualified manpower to transfer static and dynamic capabilities. This was indicated in Alänge and Löwbäck (1981a) where it is shown that Swedish small scale industries experience a barrier to enter foreign markets because of the limited time available for the qualified personnel. One senior sister expressed this drastically, "We do not have time to spend, not even 10 hours to search for a project in Tanzania." The same shortage has also been found in other studies, e.g. Cooper (1985) who refers to experiences of small Benelux firms in transferring technology to India through 'technical collaboration agreements'.

> "... small firms face at least two major difficulties:
> (i) even though the information needed to choose a counterpart is in general no less for a small Benelux firm than for an MNC, the resources available to acquire that information are obviously much less for small firms.
>
> (ii) similarly, the costs in management time to negotiate a contract efficiently are not significantly different for a large firm than for a small one - but small supplier firms simply have much less management time available at much higher opportunity cost. This also greatly complicates control of a contract once it has been signed." (Cooper 1985, p. 2020)

Cooper also concludes that, "In consequence, smaller firms in Benelux (and also smaller Indian firms) enter agreements on the basis of much less information, have less capacity to provide support to counterparts in India and are much less able to control or even 'observe' the progress of their Indian counterparts than firms in the MNC group. They therefore run higher risks of various kinds of failure, and these are borne out by the higher rates of failure they actually experience." (Cooper 1985, p. 2020).

The scarcity of qualified personnel in small firms does not only influence the search and negotiation activities, but the transfer processes as well. In these cases, qualified personnel are not always available for training purposes and for answering the trainees' questions, as their services are needed in other areas of the supplier firms. In the SI programme the relative weaknesses in transferring dynamic capabilities might be a reflection of the limited availability of qualified personnel which could assist in these matters.

For most senior sisters the SI project was their first technology transfer project to an LDC, and in the majority of the cases also their first systems sale. Most firms planned and implemented the project by drawing on existing resources, especially concerning planning and design of the projects, which in general were done by senior managerial persons. For example, in the case of AMI a great part of the responsibility for the project was on the manager for the machining section of the senior sister.

He had his ordinary job and on top of this he had the responsibility for the SI project, which included the planning and design of the plant and the training programme as well as responsibility for the implementation of the project. In the case of repeated projects to LDCs it cannot be expected that this manager can be maintained in this additional role as well as in his regular job. The opportunity cost of using this experienced manager for LDC projects might hence be very high. For the direct training activities, especially in production capabilities, other people were available, who were not needed for other jobs at the same time, i.e. in those cases the opportunity costs were less. A similar situation of shortage of experienced supervisors existed in several of the other projects as well, e.g. for UHANDISI during the second training period in Sweden, when the senior sister's general manager and other qualified personnel were occupied with the start-up of their own new plant. The general manager himself had previously acted as instructor in Tanzania during UHANDISI's restart-up and was the person most knowledgable of the junior sister's needs.

Some of the senior sisters made special arrangements for the technology transfer process and established special departments or subsidiaries for this type of activities. For example, MAFOTCO's sister Gense and PEMACCO's sister BEVI both have qualified personnel especially assigned to run business units for technology transfer. These two cases have a perspective in common, that this is a new business idea. Both are also active today in several projects in different LDCs. However, this is a strategic choice of investing resources in a new business area, which for all senior sisters not is an alternative due to the lack of demand for their services or because of limited resources. Especially, it might be difficult for the very small companies involved in the SI programme, which saw the SI project as a one time affair.

In the SI cases the transfer of production capabilities has in general been successful. For this type of transfer, instructors and other people, who could provide answers to questions, have been available. One reason for this might be the age of the technology, since the projects in general use well established technologies and do not include the latest high-tech developments. According to Teece (1982), there is a great deal of uncodified information, the relevant 'art', existing among supervisors, engineers and operators. "As the age of the technology increases, more individuals in the firm have the opportunity to acquire this noncodified information, and hence are potentially available to assist in the transfer." (Teece 1982, p. 73).

Hence, there is a potential of finding enough qualified personnel for the transfer of production capabilities from small scale industries (7:13). In general, small scale senior firms' weaknesses have been most severe in the transfer of administrative and entrepreneurial capabilities, since qualified personnel, at least concerning entrepreneurial capabilities, seem to be in short supply.

Furthermore, many small scale industries do not have experience in teaching and training and especially, do not know techniques for transferring dynamic capabilities. This will in most cases be a limitation, as compared to more experienced MNCs, e.g. Philips, where they have developed and tested techniques for providing its subsidiaries with dynamic capabilities (see section 7.6.4). However, in the most advanced SI projects, dynamic components have been included in the training, whenever possible, which may call for SIDO/Fide/SIDA to assist the senior sisters in designing training programmes in the future.

Nevertheless, the above observations indicate that the processes of transferring the different types of capabilities (P, A, I and E) do not always go together and there are different possible ways of designing transfer activities. Dynamic components could be included by supporting the senior sisters but they could also be included through separate activities, courses and consultancy, especially concerning ways of approaching new markets, of finding new sources of supply, etc., which are primarily entrepreneurial activities. Much knowledge needed is industry- and firm-specific and when doing something new, normally a combination of inventive and entrepreneurial capabilities is needed, which favours the upgraded senior sister alternative. However, there is still a limit in the potential use of small scale firms as technology suppliers, due to the weakness inherent in their shortage of qualified personnel. This may call for a certain caution in using very small firms as suppliers.

In summary, MNCs' global market orientation and customary strategies of keeping certain knowledge areas as strategic assets might negatively influence the result of transfer processes. Small scale industries do not normally have global strategies but might on the other hand suffer form the disadvantage of scarcity of qualified people who can serve as instructors. This is especially evident in the area of transfer of dynamic capabilities, and it might be considered as an inherent weakness when using small producing industrial firms as technology suppliers.

7.5.2 Learning by involvement

Learning opportunities are provided during different phases of a technology transfer project. There is a potential for entrepreneurial capability acquisition through involvement in the early phases of planning and implementation of an SI project. Also during subsequent phases in the life of an industrial undertaking there are learning opportunities through participation in production, marketing, product development, etc.

The extent to which a person is involved in a process provides the potential for learning the activity in question. Here we will distinguish between two main activities, the execution of and the decision-making about certain activities in a technology transfer project. Such a project may be seen as consisting of a number of phases. In the SI programme the following phases can be distinguished.

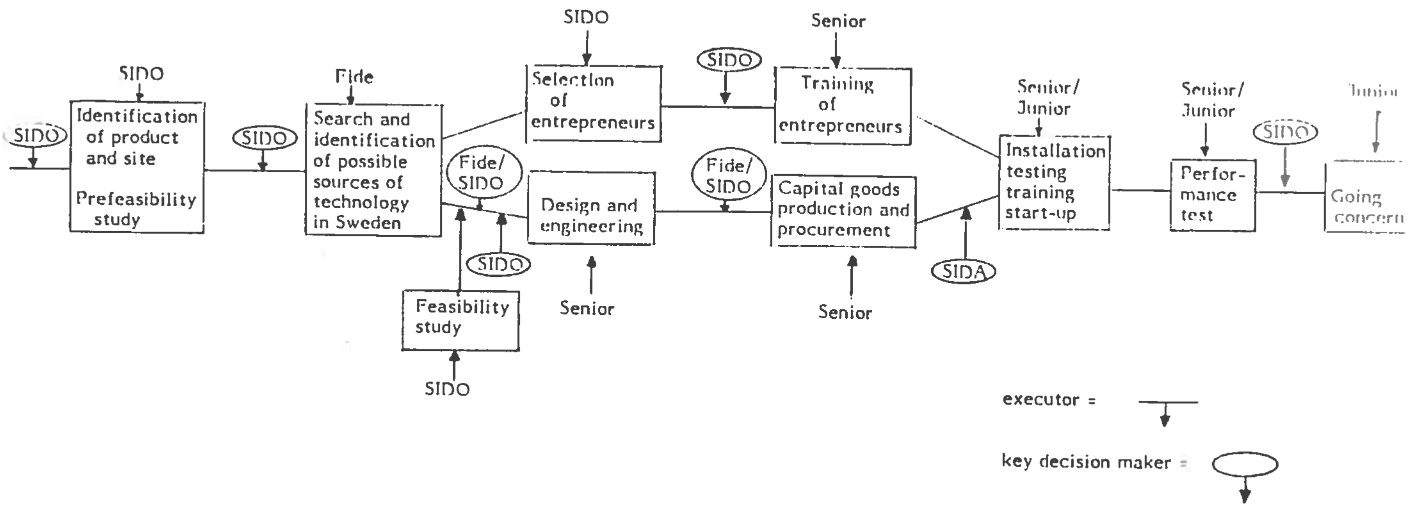
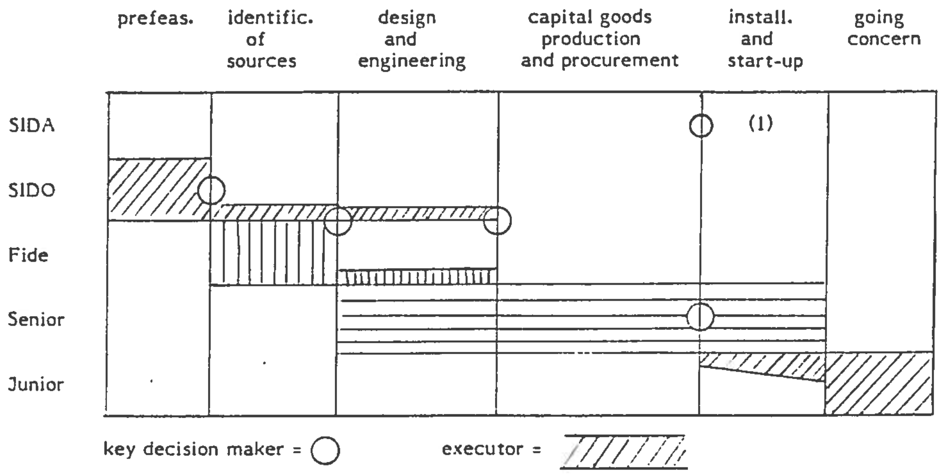


Figure 7.2 Involvement in the different phases of an SI project

The identification of which actors perform the different activities of execution and decision-making, provides a picture of the degree of involvement in the process and hence, an indication of the potential for learning. Figure 7.2 shows that the SI programme involves five actors* acting as decision-makers or executors: SIDO, Fide, senior-sister, SIDA and junior sister.

In the early phase of the project when the frames are set, only SIDO and Fide are involved. SIDA plays a background role as a 'guarantor' and facilitator, except concerning the testing and certificating of second-hand machinery, for which a consultant appointed by SIDA makes the evaluation. In the design and engineering activity, which gives the project its structure, the only additional party involved is the senior sister, leaving out the entrepreneurs in the junior sister. This means that during the essential planning and engineering phases of the project, the SI entrepreneurs are kept outside the work, giving them very small possibilities of influencing the design of their industry and even more importantly, completely preventing them from the potential learning that would be the outcome of an involvement during these phases. If we look at the new firm in a dynamic sense, this first transfer project should only be the beginning of a process of continuous technological change and procurement. The experience in carrying out activities in the first phase, would then be of great importance. However, this kind of experiences that enhances entrepreneurial capability is not imparted to the entrepreneurs by the SI projects, and only to a limited extent does SIDO gain experience acquired by its local staff during the process. This is partly due to the employment of expatriate experts in the SIDO organization, who made the evaluations and only to a limited extent, involved the local staff in this kind of activity.

Figure 7.3 below presents the proportions of involvement of the actors in the SI programme.



(1) concerning 2nd hand equipment, SIDA appoints an independent technical consultant, who makes an investigation of the machines concerned. If he considers the machine to be in a fair condition he writes a certificate, telling that the machine is reconditioned. If it is in a bad condition he stops the shipment of the machine in question.

Figure 7.3 Involvement in the carrying out of an SI project

---

*) The main actors involved are,
SIDO = Small Industries Development Organization (Tanzania)
Fide = Swedish firm of consultants that assists SIDO in its contacts with Swedish firms
SIDA = Swedish International Development Authority (aid agency)
Senior sister = The Swedish supplier firm
Junior sister = The Tanzanian receiver firm

The above situation describes the common pattern of involvement when new SI firms are started. In some cases, the junior sisters have later made new investments, sometimes major ones. In such cases the SI entrepreneurs' involvement in the planning/design/decision-making varies considerably between the different cases. Nevertheless, there are entrepreneurial learning opportunities during these later phases (see also table 7.3, under the heading 'investment planning', during phase One and phase Two).

7.5.3 Selection of product and production technique

An import substitution policy has governed SIDO's selection of suitable small industry projects for Tanzania. Primarily based on import statistics and estimations provided by some of the major importers, SIDO made a list of possible products for local production. With this list as a guide, Fide had the task of finding suitable Swedish firms as technology suppliers. Sometimes there was a modification of products, qualities and standards as a result of discussions between SIDO, Fide and potential technology suppliers.

The starting point has in most cases then, been neither the production technique nor the kind of capabilities needed for the future development of Tanzania but the selection of a product. This selection of a product and its qualities limits the available alternative production techniques, and this is further narrowed down by the limited availability of different solutions in Swedish small scale industry. If it has not been possible to find suitable firms, according to Fide's judgement, for the production of a specific product suggested by SIDO, this product has not been included in the SI programme. However, this judgement does not specifically consider the appropriateness regarding Tanzania's future capability needs.

The ease of making new products by using the transferred production equipment influences the learning opportunities. In some firms the machine-tools are multi-purpose and allow the fabrication of a great variety of new products, while in other firms the machinery is more specialized. In an environment characterized by a great deal of uncertainty, e.g. irregular supply of raw material, it has proved beneficial for the firms to have these more flexible machines. It is hard to reap the benefits of larger volumes when the raw material supply is irregular. Instead those firms that have been able to use locally available raw material of different qualities to make new kinds of products, have benefitted in several ways. First, they have been able to utilize a larger part of their production capacity. Second, they have been stimulated to innovate and make new products which have opened up new market segments. Third, these efforts of product development have resulted in very valuable learning-by-innovating, for both inventive and entrepreneurial capabilities.

A coarse judgement of the flexibility of the machinery in the eight cases studied, is provided below.

	Technique	Flexibility	Comment
AMI	metal foundry standard lathes	high	tool making capability is the limitation
FAWIPMA	hand looms and special machines for fencing wire	low	few production steps
KIMESHA	standard lathes	medium	high potentiality to make a variety of products in spinning technique, the limitation is volume
NEM	machinery for sheet metal work incl. presses	high	allows production of different kind of products simultanously
UHANDISI	specialized screw and rivet headers	low	few production steps
MAFOTCO	forging hammers	high	tool making capability is the limitation
PEMACCO	assembly and testing equipment for el. motor prod.	low	
TANLOCKS	presses, drills, some specialized machines	medium	some machines are multi-purpose

Table 7.7 The flexibility of the production technique

Table 7.7 illustrates how that the potential for making new products using existing production equipment varies. This is also partly reflected in the product development activities of the firms. The rank order of dynamic capabilities in the field of product development is: NEM, KIMESHA, AMI, FAWIPMA and UHANDISI (according to section 6.3.4). This indicates that the initially selected production technique has a certain influence on product development and the subsequent learning opportunities. However, as can be seen in this section and in the case descriptions (Alänge 1986a) the technique only limits or facilitates the available opportunities to a certain extent. For example, it has been shown that junior sisters with dynamic capabilities also know how to supplement the equipment to obtain necessary production capacity.

In summary, it has proven to be advantageous for the firms in an environment characterized by a considerable uncertainty to have a flexible production technique. However, this also means a lower degree of specialization and maybe a suboptimal selection of technique if referred to a stable environment. In LDCs, where the state takes an active part in the industrialization, it could be argued that the state should primarily aim at reducing the uncertainty of the environment. However, in many African LDCs it has been shown that the state is too weak in relation to external forces to be able to guarantee stability in the economic environment. This indicates that the flexibility factor ought to be considered when selecting production techniques for use in African LDCs, owing to both the influence on capacity utilization and on learning.

7.5.4 Monitoring training programmes

The existence of the support organizations, SIDO and SIDA, offers possibilities of assisting the small scale technology suppliers through supervision/monitoring of training programmes at Swedish firms or by providing initiatives for supplementary training in Sweden or Tanzania. In the early projects, the training was almost exclusively planned and carried out by the senior sisters. Since then, SIDO/SIDA have had a certain influence on the training design through their consultant Fide, who has developed competence in this area, but according to trainees and senior sisters, this influence has still been of a very limited nature. SIDO generally investigates in advance the background of the individuals selected as trainees and forwards a short note about this to the senior sister to facilitate the design of the training programme. This information is of a very general nature, but still provides some idea of former education and experience. SIDO has, through its training department, been more active concerning supplementary training in Tanzania.

During recent years, Fide has tested some new forms of training together with one of the senior sisters which has specialized in training for LDCs. Some supplementary training arranged by SIDO/Fide has taken place as well, e.g. an export marketing workshop in Arusha, Tanzania in 1981, where representatives from senior as well as from junior sisters participated. However, the senior sisters still receive rather limited assistance and hence the quality of the training programmes varies very much with the individual senior sister's abilities and experience. The basic idea of the SI programme is to utilize, as technology suppliers, small producing firms skilled in producing and developing a certain product, and to organize a small company around this product. These companies do not necessarily have knowledge and experience in both technology transfer and in arranging training programmes. Therefore, if this type of firm is to be utilized as technology suppliers in the future, they will need assistance in this field (see 7.5.1).

In summary, there are, at present, few measures being taken to compensate for the inherent weakness involved in using small scale firms as technology suppliers, although the SI structure offers some possibilities. By providing proper assistance in designing and monitoring the training programmes as well as by providing supplementary training activities, SIDO and SIDA may be able to increase the technology transfer efficiency of the SI projects.

7.5.5 Selection of SI entrepreneurs

Our empirical data indicate the necessity for selecting the right individuals to become SI entrepreneurs. It has proved very hard to start from scratch and train industrial firm managers, i.e. to enhance the capabilities of individuals without previous experience of industry and/or of supervising a group of workers.

In most SI cases, the individuals selected had sufficient background to be able to assimilate a training period in a Swedish industry. In a few cases, the individuals had a very limited experience of industry and of supervision, which besides difficulties during the training period, also resulted in difficulties in getting the junior sister to function satisfactorily. However, although the conditions were not too good in the beginning, some junior sisters have succeeded well, having made later recruitments to supplement the original management staff.

Nevertheless, our empirical findings lead to the conclusion that if the relatively expensive form of training (in Sweden) is to have a real effect (enhance the capabilities to a satisfactory level) the selection procedures must be able to select the right individuals. Otherwise, the risk of failure of the industrial project is considerable. It is doubtful whether training in Sweden can yield sufficient return if the education/experience of the trainee or group of trainees (see section 7.6.5) is not of a certain level. The development of qualified managers is a long-term process. The most successful managers in the SI cases all had a solid background, with their own experience of Tanzanian industry and, in many cases, with some experience of supervision on middle level in large companies. On the other hand, it seems that the education and industrial experience of another team of SI entrepreneurs were not sufficient at the time of their first training period in Sweden, which resulted in lower capability acquisition and later problems in running the junior sister without foreign assistance.

The selection of SI entrepreneurs in Tanzania took place through advertisments and formal applications by individuals. Based on these applications (formal school and work certificates), some individuals were selected for interview, i.e. the procedures were very similar to those that take place when hiring a manager for employment (see section 10.1 and 10.2). In Tanzania it was possible to identify capable persons in this way, one strong influencing factor being the limited availability of other business alternatives for these individuals. A modified selection procedure might consist of two steps; first, to select several entrepreneurs for very small-scale projects, and second, to select the most capable individuals from this first group for projects of the SI size. However, in the case of the Tanzania projects, there would then have been a risk that the most experienced SI entrepreneurs might never have left their employment since the incentive to start a very small industry might be too weak in comparison with their employment ties.

In summary, the selection of individuals with sufficient industrial background is essential for the success of a technology transfer of the SI type. In most cases in Tanzania, capable SI entrepreneurs-to-be were found through a selection procedure similar to the proceedings that take place when employing a manager, i.e. formal application and interview. Several SI entrepreneurs had gained experience by employment at middle management level at larger MNCs.

7.5.6 Long-term cooperation

To start a new industrial firm in an LDC with a labour force with limited industrial experience, requires a radical training and change process. The need for continuous support during a longer period of time is almost a rule and this has also been acknowledged by policy makers in LDCs who have come to the conclusion of favouring joint venture agreements, as the technology supplier, as a shareholder, is expected to show a more sincere interest in the operation of the new firm after start-up.

In some studies, a long-term relation with a foreign technology supplier has been considered as a technological dependency, and has even been used as an indicator of technological weaknesses. However, this assumption is not necessarily true, as it depends as well, on who controls the transfer and what activities the recipient takes. For example, the most successful junior sisters all keep close contacts and have over time been able to acquire new capability components from their senior sisters. The acquisition of new capabilities requires conscious efforts and the continued development of an infant industry typically involves combined local technological development and foreign imports of technology (Dahlman et al. 1985) (7:14).

One of the most essential qualities of the SI programme is the ambition to develop a long-term support system for the new junior sisters. This long-term support is obtained through a contractual agreement in which the technology supplier (senior sister) agrees to assist the junior sister during a long period of time (5-10 years). The cooperation between the firms takes place without any ownership ties, in contrast to joint-ventures and subsidiaries. The senior sister does not monitor the junior sister continuously, but the junior sister has the opportunity to request and receive advice and assistance when needed. Furthermore, yearly meetings after start-up are stipulated for the duration of the contract. These meetings have proved to be of considerable value for the junior sisters.

In most of the SI projects, this cooperation after the start-up phase has worked according to expectations. While the contract serves as the basis of the relationship, experience proves that it is critical to have a business interest in common. Conceivable examples are: that the senior sister continues to supply raw material and components, having business activities in common in the African market, sharing expectations of supplementary technology sales, and sharing the benefits from export of products produced by the junior sister. In some cases cooperation has developed far beyond the original contractual agreement, e.g. including a joint-venture agreement involving SWEDFUND. In another case also beyond the SIDO/SIDA support organizations, development has taken place towards a purely commercial relationship, where export from the junior to the senior sister is the essential element.

In these cases, although the relationships were established in mutual commercial interest, personal knowledge and trust between the parties are essential ingredients. The social relationship between the SI entrepreneurs and a limited number of Swedes from each senior sister seems to be of vital importance. This is in accordance with other research findings, e.g. Håkansson and Johansson (1982) and Johannisson (1985). Johannisson (1985) highlights the importance of social relations and social networks for business relations in the small scale intensive areas of Sweden. However, Håkansson and Johansson put relatively less emphasis on the importance of social relationships.

In a few cases, cooperation has not been satisfactory. In one case, this was due to the senior sister's bankruptcy. In another case, early communicative problems should perhaps have lead to the cancellation of that project in an earlier phase. Finally in one case, the problems arose when the senior sister got new owners with a different and more short-sighted business attitude. Nevertheless, the conclusion is that the SI programme in general has functioned well in its task of continuously, during a long period of time, supporting new industrial firms in an LDC, through small scale industries from an IC as technology-providers. Continuity is obtained by having the same senior sister during all phases, i.e. although different specialists might be involved to solve different problems, continuity is maintained by one firm.

The structure of contacts between a junior sister and other parties is described by figure 7.4 and two different ways of development over time are described in figures 7.5 and 7.6.

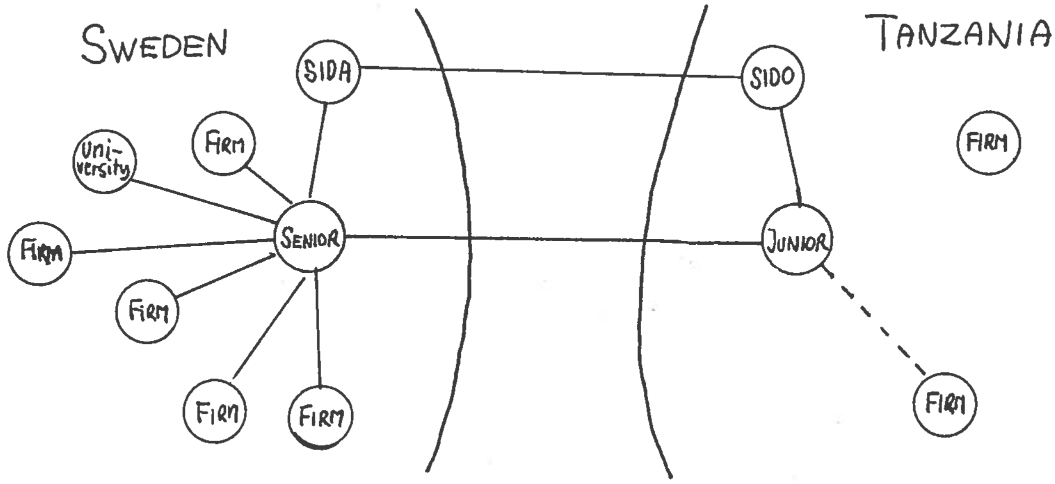


Figure 7.4 The structure (network) of actors at the start of an SI project

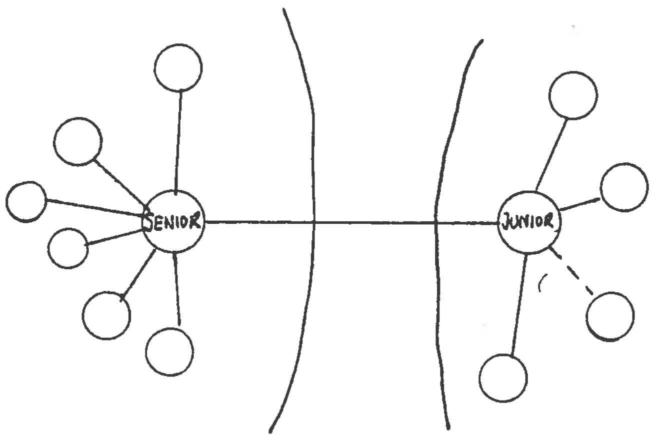


Figure 7.5 The senior sister as an integrated part of the network

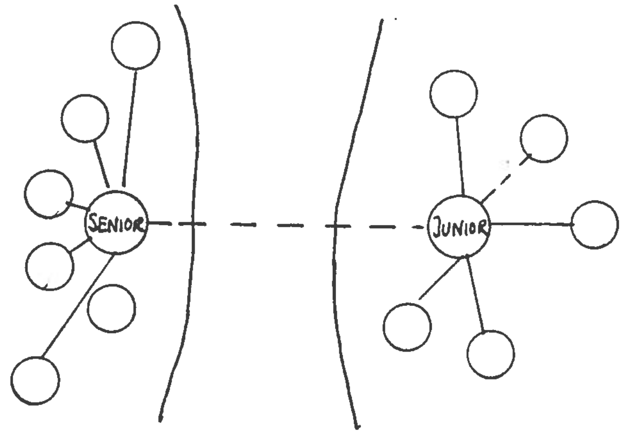


Figure 7.6 No or occasional contacts between junior and senior firms

In the first case (figure 7.5) the senior sister continues to be an important business partner and/or capability source in the "local" network. In the second case (figure 7.6) the senior sister is only contacted occasionally, if at all. Instead, local industries and institutions are the most important network participants. Customers, suppliers, entrepreneurs within the industrial community, technical colleges and trade schools, etc., might be important sources for the future development of an SI firm.

If we look at the development of the SI programme at the present point in time, 7 years after its commencement, we get the following picture (including most first and second generation projects, 16 out of the total of 25). The date given refers to the end of phase I or the day of the performance test (see table 7.8).

Model A		Model B	
(Business contacts or other close contacts)		(Sporadic or no contacts)	
AMI	(June 80)	ACCO[1)]	(May 78)
FAWIPMA	(March 80)	C & AI	(May 79)
HIMA	(April 81)	GIFCO	(May 80)
KIMESHA	(June 78)	MPI	(June 82)
MAFOTCO[3)]	(June 85)	Meru Wood	(June 78)
Mbeya Clogs	(Feb. 82)	TANLOCKS[2)]	(May 81)
MOCCO	(May 81)	UHANDISI	(May 80)
NEM	(Feb. 79)		
PEMACCO	(Nov. 81)		

Table 7.8 Contacts between junior and senior sisters, 7 years after the commencement of the SI programme (September 1985)

In the majority of the cases, there are stable contacts between the senior and junior sisters. All the very successful junior sisters in terms of product and business development (and in capability acquisition) are to be found in group A, with close contacts with their senior sisters. In group B, with sporadic or no contacts, mainly less successful junior sisters can be found. This indicates a certain correlation between success and a lasting link to the senior sister. This holds true at least during the early phase of company development. However, it could as well be argued that the lasting link is a function of a more able junior sister. On the other hand, when looking in more detail at the reason for the break-down of the contact, this seems in most cases to depend on the senior sisters.

Hence, this study shows a positive relationship between 'dependency' (here a stable relation to an IC firm) and performance in terms of local capability acquisition and local product and business development. This is an unexpected finding if we relate it to the extensive literature on LDCs' dependency and underdevelopment (Frank 1967, Bhagavan 1979). However, there are different kinds of dependency (7:15). One important factor is the technology supplier's degree of global strategy. A supplier without a global strategy or one who has a product market far from the receiver's market is probably more willing to transfer "all" his knowledge to the receiving company, than is, for example, an MNC. Moreover, the effects of 'dependency' have to be considered in a dynamic perspective, i.e. in reference to the firms' infancy and maturation phases.

Notes:

1 ACCO, Arusha has had two different sisters and at present there are some contacts with a third company, the senior sister of MOCCO, Moshi.

2 TANLOCKS has no contacts with its original senior sister, but has established contacts with a new Swedish company in 1986.

3 MAFOTCO's senior sister Gense has 3 more SI projects in Moshi, Tanzania, started in between Feb. 1982 and Aut. 1984. Gense still has close contacts with these junior sisters; HAMAX, KISCICO and MOTO.

In some other cases the conditions for developing a stable relationship have been missing and the contacts have been occasional or broken. The reasons for this seem to a great extent depend on the senior sister side, e.g. insufficient interest or bankruptcy. Hence, the choice of senior sister ought to take into account economic stability and other factors of importance for long-term cooperation. (In those cases where it seems favourable to buy equipment from closed-down industries, it might be wise to consider the involvement of a more stable senior sister at an early stage.)

In summary, based on a 7 years' perspective, the senior sisters still play important roles for the junior sisters. The more successful junior sisters still have close contacts with their senior sisters. For a closer long-term cooperation to take place, the existence of business opportunities for both sisters has been shown to be of the utmost importance. In those cases where supplementary investments have been made in junior firms, the senior sisters have been involved.

Hence, the aspect of long-term cooperation is partly well taken care of by the SI programme. This should be compared with other available forms of support to new industrial firms in LDCs, for example, with conventional support with experts/consultants through the UN or other foreign aid organizations. Furthermore, comparison will be made with joint ventures and wholly owned subsidiaries; and finally with two forms of contractual agreement: i.e. management contracts and licensing. Of course, some information and assistance can come from other sources, such as customer firms and suppliers, but this kind of assistance will not be discussed here.

Experts employed in aid projects, normally have 2-year contracts, sometimes with one or two years' extension. Then a new expert might be employed if the project needs continued support, but there is no overlap between the two experts, as the first normally already has returned home when the second arrives. This kind of organization often results in discontinuity and inferior results. The only kind of "expert" assistance where overlap sometimes exists is, according to the authors' knowledge, provided by some private organizations, but these organizations, if involved in industry, are primarily concerned with rural industries. A specific advantage of industrial firms as compared to single experts, in supplying assistance to new firms is that a firm has specialists in different fields. Furthermore, a firm with the same production as the new recipient firm will naturally have certain advantages as compared to a general technical expert.

Joint ventures and wholly owned subsidiaries, on the other hand, provide long-term cooperation and are bound to the new LDC firm through ownership. General business conditions are of decisive importance for cooperation here as well. Ties of ownership are stronger than contractual agreements, but our empirical data show, the assistance to the junior sisters has continued on a long-term basis in the majority of cases. (See table 7.8 for a picture of contacts between sisters 7 years after the commencement of the SI programme).

In the case of the SI programme, small scale industries are technology suppliers to new LDC firms. As has been shown in an earlier study (Alänge and Löwbäck 1981a), the existence of a supporting structure (SIDA/SIDO/Fide) was a prerequisite for the Swedish small scale industries to become involved in technology transfer projects to an LDC.

Through the SI programme, the senior sisters embarked on a "risk-free" route towards cooperation with an LDC small scale firm. In some cases this cooperation has led to the formation of joint venture agreements for new industrial undertakings. However, as a first project in an LDC, a joint venture agreement was not a real alternative for these small scale industries. They did not have the time, knowledge or opportunities to take a substantial risk and hence the alternatives were to enter into the SI programme or to keep on with the "normal" business in the northern European market. Hence, the SI programme was seen as the only viable way for the Swedish small scale firms to become involved in international technology transfer to Africa, at the same time it was regarded as an introductory ticket to further commercial cooperation in joint ventures, etc.

As the management area has been the source of substantial problems in LDC industry the 'management contract' has been developed as a specific mode of technology transfer. In some instances there is a combination of joint venture and management contract. However, this combination is regarded as a joint venture here. Management contracts are of a given duration (usually around 3-5 years), but a practice has evolved whereby the duration quite often is prolonged at the expiration of the contract. The hired management is supposed to fill the double function of managing the firm and training local staff to take over the management of the firm at the expiration date.

Ideally, this might provide a substantial technology transfer, as the hired management is present during the entire contracted time. However, it has been claimed, based on empirical evidence, that the technology transfer might be very limited owing to the somewhat contradictory business idea of "making oneself dispensable" through the upgrading of local management (Coulson 1976). There have been special difficulties when subsidiaries have been nationalized and management contracts could be seen as a defensive move (Ellison 1976). According to Sharma (1981), "... objectives other than the transfer of technology and skills frequently seem to dominate the conclusion of such contracts." He also points out that, "This is true not merely from foreign firms' point of view but also for the local firms and their owners." (p. 233). Furthermore, some firms specializing in management contracting might not have access to the proprietary technology that is needed and this might have to be acquired separately (Gabriel 1967). This weakness is similar to the situation for the general technical expert, although the management contracts generally guarantee a longer period of cooperation than 2 years through the contract established between firms.

Licensing is a market transaction where proprietary technology is sold. For many firms licensing might be a 'second best' alternative to direct foreign investment (because of small markets, host country policies, etc.), and in some cases the incentive to carry out an effective transfer might be very limited. According to Davies (1977), many licensing agreements in India involved little more than the transfer of drawings and samples of the product. In other cases, licensing has been a very effective means of technology transfer, e.g. during Japan's industrial development. However, besides the transferrer's motive, the absorptive capacity of the transferee firm is of importance. As Balasubramanyam (1973, p. 17) expresses this referring to the slightly wider concept of "technical collaboration agreements":

"The suitability of a particular type of transfer mechanism may depend on the stage of development of the host economy. Technical collaboration agreements may be a viable mechanism of economies that have developed indigenous sources of supply and a core of technical personnel who can convert, restructure, and adapt the imported knowledge."

In summary, project continuity and long-term cooperation/assistance is valuable for industrial development This is provided by subsidiaries and joint ventures through ownership links and, to a somewhat lesser extent, by the SI programme and management contracts through contractual agreements. The common use of "2-year" experts, on the other hand, frequently results in discontinuity and short-sighted activities. Pure licensing, another form of contractual agreement, seems to offer limited benefits for an LDC without sufficient absorptive capacity, although it might be an important source when there exists a certain industrial capability. Management contracts and "2-year expert" arrangements might suffer from the disadvantage of not having access to proprietary technology needed, while the other modes by definition possess this knowledge. Furthermore, for the firm providing management services, the wish to stay as hired management might counteract the goal of rapidly upgrading local management.

7.5.7 Long-distance communication

Empirical experience from a large number of cases concerning support organizations' roles in the process of establishing small scale industries in Sweden points to the following four success factors, according to Hult (1984):

1. The process takes place at different levels simultaneously, i.e. the support organizations must have long-term influence on the individual entrepreneur as well as on actors in the environment.

2. Vicinity to the support system is essential, i.e. the startups business ought to be located in the same district.

3. Continuity in contacts, i.e. the entrepreneur must know where to go when needed.

4. Competence of the advisors, including the essential function of linking the entrepreneur to the market network, which in Sweden has been shown to be one of the most important success/failure factors.

There are certain differences between conditions in Sweden and Tanzania, but an analysis of how well these factors are taken care of by the SI programme might provide some insight. While two of the success factors (the first and third) are reasonably well taken care of by the SI programme, the second factor, the vicinity between entrepreneur and support system, as well as the fourth factor, linking the entrepreneur to the market network, are less optimal. Vicinity, defined by the frequency of personal contacts in the neighbourhood, hardly exists between junior and senior sisters. SIDO, the estate manager, and the Common Facility Workshop (including Swedish experts) might, to a certain extent, provide support from the closest neighbourhood. However, a specific kind of vicinity between junior and senior sister is developed through a common knowledge base, especially concerning industry-specific and firm-specific knowledge.

Nevertheless, the geographical distance between Tanzania and Sweden is considerable, and if the contact/training cooperation is to function satisfactorily after the start-up phase, good communications are essential.

The SI programme's contractual agreement stipulates meeting in person at least once a year for the duration of the contract. These visits have proved to be very valuable for the SI firms, be it visits by SI entrepreneurs to Sweden or Swedes to Tanzania. In comparison, Philips has a special task group of specialists from Holland who travel around the world to assist different production units when needed. Furthermore, when specific changes are planned in a plant, such as starting a new production line, the responsible manager is called to Holland for specific training.

Other ways SI firms keep in contact are by telephone or telex. Apparently, access to a telex is very favourable for the frequency of contacts. Furthermore, a systematic firm-specific coding of different operations and components facilitates communication, e.g., in one case, a "common language" was developed by the use of identical files in Sweden and Tanzania describing each work operation and component by picture, text and identification number.

In this way, the SI entrepreneur knows quite well where to go when certain problems arise and in combination with the continuity in several year-long contacts, the mental distance (= psychic distance in the words of Johansson and Vahlne 1977, see note 7:16) is reduced, i.e. the second and third success factors are taken care of to a certain degree despite the considerable geographical and inter-country mental distance. This finding that the distance might be reduced owing to well-established relationships between firms, has been observed in other studies. "Within the framework of established international buyer-seller relationships there is not necessarily a correspondence between the inter-country psychic distance and the distance or closeness which characterizes the inter-firm relationship" (Hallén and Wiedersheim-Paul 1979, p. 67). However, there are areas where the senior sister is not the best to turn to, and in such cases very much depends on the abilities of SIDO to solve the problems directly or to give advice where to turn.

The fourth factor, linking the entrepreneur to the market network, is quite often not a major function the Swedish small scale industry can provide. While the senior sister might have good knowledge of general marketing and be valuable in the area of export marketing, their knowledge of LDC markets frequently is too limited. Not even a superior communication system would solve this problem, while on the other hand a well-functioning communication system (e.g. telex) might facilitate a valuable cooperation between the sister companies over certain export markets. Furthermore, recent developments in the area of 'information technology' might open up totally new perspectives of communication and cooperation.

In summary, the SI programme has a weakness in the lack of geographical vicinity between the sister companies. Hence, well-functioning communication systems are very essential to counteract this geographical distance, e.g. regular personal visits, rapid technical systems such as telephone and telex, and well-designed communication routines and systematizations. However, the senior sisters' closeness to the European market is an advantage for the junior sisters, which get a link into an international network through them.

7.5.8 Creating an entrepreneurial environment

One important purpose of the SI programme was to create an entrepreneurial environment within the industrial estates similar to the one existing among Swedish small scale industries. A characteristic of an entrepreneurial environment is the informal information exchange conducive to technological and managerial change. In Sweden, this informal information exchange between small scale entrepreneurs and cooperation within the community have a long tradition, especially in the county of Småland from which most senior sisters were recruited. A typical information center could be the local café in the village, where the entrepreneurs meet almost every day to have a cup of coffee and a chat. These informal contacts led to the initiation of the diffusion of: new techniques, the application of previously used production processes to new products in other small scale industries, and knowledge of new potential markets, etc. In this small scale industry area, this kind of informal contact has been of tremendous importance for industrial development. (Frej 1981, Wendelberg 1982). This kind of informal contact has also been shown to be of great importance in the development of high-technology industry in areas like the Silicon Valley in the US (Vedin 1980, Rogers 1980, p. 21). The importance of creating linkages has also been emphasized in policy documents concerning industrialization in Tanzania (Rweyemamu 1975).

In the SI programme, many factors contributed to influencing the SI entrepreneurs to establish contacts and cooperation. One important factor involved Fide firm of consultants, who since the very first SI project, have been advocates of the development of an entrepreneurial environment similar to the one from which Fide itself has grown; i.e. the small scale industry environment in Småland. First, the trainees themselves obtained insight and were told about this structure during visits to Småland. Second, when in training in Sweden at different firms, the SI entrepreneurs were also called together by Fide to certain collective training activities, and hence got to know each other in this kind of situation, before returning to Tanzania. It should be added that several SI entrepreneurs knew each other previously. Third, during the stay in Tanzania, some of the Swedish instructors proposed cooperation between different SI industries, e.g. to make a new product by utilizing different companies' resources.

Fourth, more organic links were established by the choice of industries, i.e. the selection of products or services serving as inputs to other industries, for example, the establishment of a surface treatment firm and a tool making shop. In one case, almost all industries were built around a central forging unit that was to supply the other firms with semi-fabricated blanks for their products. In this case, it might be a part of the truth that this opportunity was created by coincidence, when one Swedish firm approached by Fide happened to have a medium scale toolmaking plant, including a forging department, that was about to be closed down. The machinery from this single plant was then used to start several new small specialized firms in Tanzania, with the forging firm as a separate unit and a cutlery firm, a scissors firm, etc. However, this idea of linking different units in the production chain was a central objective expressed already in the guidelines for the SI programme (Sandkull et al. 1976). As mentioned above, Tanzania has stressed the importance of linkages in policy documents, but there was no planned practical course of events. Rather, the linked structure of the industrial estate in Moshi was a coincidence, according to a SIDO official.

Fifth, all SI industries are placed in industrial estates which have as an inherent feature certain common facilities, such as workshop, cafeteria, etc., that also contribute to the creation of an entrepreneurial environment. Sixth, training activities after startup bring SI entrepreneurs from different firms together in common activities, e.g. an export marketing workshop.

The entrepreneurial environment at Arusha Industrial Estate is described below, five years after the start of the first SI projects at this estate, which was the first one to start. The communication structure and linkages are of a formal as well as an informal nature. An association of SI entrepreneurs has been active for some years. In the early phase, this was a forum for questions concerning the industrial estate, but it has gradually developed into various areas of interest. According to the present chairman, two important activities are: organizing courses and functioning as a body to turn to for individual SI entrepreneurs in case of dissension among the partners in one SI firm. Another important activity is cooperation in export marketing, an idea, which has been materialized and was originally raised in this forum. The cooperation works in the following way: an SI entrepreneur planning to go abroad to seek business contacts for export (an exhibition, trade fair, etc.) will bring samples and information brochures from the other SI firms with him and look for potential customers for them as well. For example, Zambia, Rwanda and Burundi have been approached in this way. Another type of a more formal cooperation takes place between firms on purely commercial grounds, i.e. one firm produces inputs for another SI firm. This type of cooperation takes place between several companies (see Alänge 1986a, the case descriptions). Finally, more informal contacts outside of working hours also exist, such as the hunting team in which SI entrepreneurs from more than half of the SI firms in Arusha participate. As mentioned above, several SI entrepreneurs knew each other previously and many had been to the same technical high school but it is our impression that their identity in common as SI entrepreneurs may have strengthened their group affiliation.

It might be argued that this creation of an entrepreneurial environment through the SI programme has a tendency to lead to the development of an isolated island, that is, contacts and cooperation primarily take place within the industrial estate. This largely resembles the case of the Indian community, which also has few external contacts. However, although the cooperation and contacts are most frequent within the estate, at least some of the SI entrepreneurs have good contacts with external firms and institutions.

Are there any specific features of the SI programme that help to create an entrepreneurial environment? We do not believe that the SI programme is the only way to create this type of cooperation, but there are a few factors that, taken together, provide a strong influence that contribute to the creation of an entrepreneurial environment. First, the experience shared which training in a foreign country provides. Second, several common courses in Sweden and, later on, in Tanzania. Third, an opportunity of seeing role models in Sweden, i.e. Swedish small scale entrepreneurs who cooperate closely with each other. Fourth, through the industrial estate design a number of firms of the same age as entrepreneurs with similar experience are brought together. This is very different from technology transfer from a single MNC such as Philips, who, although the LDC plant might be of considerable size, still only consists of one firm. Fifth, an organic linkage between the industries within the estate, i.e. the products and production processes are selected by supporting organizations with a national perspective.

7.5.9 Concluding remarks concerning the SI programme's role

The SI programme has an inherent weakness in its use of small scale producing firms as technology suppliers, since these firms have a scarcity of qualified personnel. This has implications for the junior sisters' capability acquisition, especially in the area of entrepreneurial capabilities but also concerning administrative and inventive capabilities.

However, the capability acquisition has been unnecessarily affected in a negative way by the absence of learning opportunities for the SI entrepreneurs during the initial planning, negotiation and design phases. Furthermore, the support structure, SIDO and SIDA, only involved itself to a limited extent and did not assist the senior sisters in the design and realization of the Swedish in-plant training programmes. This resulted in large variation in training efficiency among the SI projects. Also, the selection of production techniques with low flexibility hindered some junior firms, and facilitated other junior sisters' developing new products and using new materials as well as learning-by-innovating.

Some factors have been central to the success of SI projects. The selection of experienced SI entrepreneurs or group of SI entrepreneurs has been a prerequisite for a qualified capability acquisition and resulting development of the SI firm, its products and markets. Furthermore, the more successful junior firms have a stable relationship and have often further developed the link to their senior sisters. This link is beneficial for acquiring dynamic capabilities and for obtaining contact with an export market. The initial contract lays the foundation for the cooperation, but a necessary condition for long-term cooperation is a common business interest, e.g. the senior sister selling components for the junior sister's production.

Finally, we found that the SI programme had successfully contributed to establishing linkages and social contacts which formed a working network among the local firms. The geographical and cultural distance has not been a severe obstacle, as demonstrated by the fact that the link to the senior sister had the function of connecting the local firm to an international network that compensates for weaknesses in the local network.

7.6 The direct actors and the training programmes

The broader environment and the SI programme provide the framework of conduct within which the different SI firms can act within this framework there has been a considerable degree of freedom for the senior sister to design their training programmes. Hence, there are variations in the processes of capability acquisition between the SI projects. In the following section the major findings, regarding these processes, are discussed.

The variance in the performances of the junior sisters indicate the importance of having managerial as well as technological capabilities. Dynamic capabilities are essential for the further development of an infant industry. As has been shown in the case descriptions (Alänge 1986a) and in the empirical section of this chapter, the process of capability acquisition is complex. There is a variety of sources influencing the individuals' capability acquisition during different phases of their lives. It is also important to have a perspective that goes beyond the activities of the present project when estimating the effects of an international technology transfer project. Capability acquisition is a long-term process and the individuals' background knowledge and experience have a decisive impact on the success of a project. Essential contributions might come from different sources for different individuals as was shown in table 7.3. In this table, major capability sources for the individuals in our eight case studies are shown, and divided into: family, school, work experience and courses outside the formal school system.

It is also important to note that the motivation and attitude towards technology transfer, teaching and learning, strongly influence the capability acquisition. An attitude favourable to learning on the part of the senior sister has been shown to be of value as the training programmes might be improved when the senior learns-by-conducting-training. The SI entrepreneurs' motivation for starting their own businesses is discussed in section 7.6.1. Here, also the senior sisters' interest in developing a long-term cooperation and technology transfer link is analysed.

Finally, the training programme itself with its stipulated period of training in the Swedish firms, has also been a major determinant of capability acquisition. Based on the case descriptions, the experience gained from the different training programme designs will be discussed in the following sections. The length and sequencing of the training programmes are on the agenda in 7.6.2 and essential problematic knowledge areas in African industry are discussed in 7.6.3. The following two sections, 7.6.4 and 7.6.5, are about factors influencing learning by experiencing an industrial environment. Here, it concerns the experience from staying in a Swedish small scale industry and in a specific small scale training unit, model industry, established especially for training purposes. Finally, section 7.6.6 provides some comments about ways of organizing training for dynamic capabilities.

7.6.1 Motivation

The senior sisters' direct motivation for training and transferring their knowledge or the junior sisters' motivation for acquiring capabilities have not been studied. Rather, the motives for the Swedes to involve themselves in an SI project and the motives for the Tanzanians to become SI entrepreneurs have been examined. The differences in motives between the cases, as shown in table 7.9, will be contrasted to the outcome of the capability acquisition process. It should be made clear though, that the data presented does not permit any generalizations, although there are some interesting hints.

	JUNIOR SISTERS		SENIOR SISTERS	
	Conditions	Motives	Primary motives	Secondary motives
AMI	no specific	Want to be self-reliant Not to work for people	Sales of components, finished products and raw material PR in LDCs	Experience of LDCs and of systems sales Aiding an LDC Make a profit
FAWIPMA	no specific	Want to be self-reliant	n.a.	n.a.
KIMESHA	One's own firm previously	Testing my own ability and work for myself	n.a.	n.a.
NEM	One's own firm previously	Testing my own ability and work for myself Want to be self-reliant	Sales of components, finished products and raw material Experience of LDCs	PR in Sweden and in LDCs Experience of systems sales Future importation from the junior Stimulate the personnel
UHANDISI	n.a.	n.a.	Make a profit Experience of LDCs and of systems sales PR in LDCs	Sales of one's own old production equipment Furure importation from the junior Stimulate the personnel Aiding an LDC
MAFOTCO	Role models	Material advantages	Make a profit Sales of one's own old production equipment	Importation from the junior[1)]
PEMACCO	Role models	Testing my own ability and work for myself	Sales of components Experience of LDCs and systems sales	Make a profit
TANLOCKS	One's own firm previously Role models and mentor	Material advantages	Future importation from the junior	Make a profit PR in Sweden Sales of components and finished products Stimulate the personnel

Table 7.9 Junior and senior sisters' motives
Sources: Alänge (1986b), Alänge and Löwbäck (1986)

The three junior sisters who expressed the motive "to test my own ability and work for myself" are the three with the highest stock of capabilities (see table 7.6). The SI entrepreneurs in these firms had already considerable skills and experience before the commencement of the SI programme. Two of them consequently, had small businesses at the same time as they were employed. However, they were also able to acquire new capabilities, as this group especially, succeeded in acquiring dynamic capabilities during their training periods in Sweden. The two junior sisters stressing material incentives are the ones with lowest capability stocks. The remaining firms are those firms where the SI entrepreneurs expressed a general motive for being self-reliant and not being employed. The stress was particularly on avoiding regulation and having other people as employers. As is shown in table 7.9, all second generation firms mentioned the importance of having SI entrepreneurs in the earlier started projects as role models, in one case it was also explicit that one of the early SI entrepreneurs advised the newcomer to start, i.e. had the role of a mentor.

One possible assumption is that the motives reflect the individual's knowledge and experience and especially his prior commitment to the idea of having his own industrial firm. If this is right and motives of a more inherent nature, i.e. to test one's own ability, are related to a more advanced thinking concerning developing an industrial firm, then an investigation of motives could contribute to the selection of suitable individuals (if at all entrepreneurs should be selected in the way they are in the SI programme). However, this can only be a part of a more thorough examination.

The motives of the senior sister vary considerably and in all cases there are more than one motive. The analysis of the senior sisters' motives primarily concerns the possibilities of establishing a stable link through which capabilities can be acquired by the junior sisters. In Alänge and Löwbäck (1986) a division is made between short-term and long-term motives. The sale of components, finished products and raw materials were all considered as short-term motives. Acquiring experience in LDCs or systems sales, or being able to import from junior sisters were classified as long-term motives. However, if we look at 'sales of components' in the column for primary motives in table 7.9, we see that at least in the present time perspective (5-8 years since start) this motive has contributed to establishing stable business relations between the junior and senior firms. This suggests that this motive has a long-term effect on business relations and hence also on the potential for junior sisters to acquire capabilities through the international link to Sweden.

Another motive mentioned is 'to get experience in LDCs or in systems sales' and this motive was classified as long-term in Alänge and Löwbäck (1986). The motive is long-term in the respect that it indicates that the senior sister is interested in a new business area, but it does not necessarily mean that the link to the junior sister will be stable over time. There should be a certain interest from a senior sister with this aim, since the best way of selling on this market is to be able to show previous successful projects and hence, there should be an interest in keeping the contacts and further assisting the junior sister. However, motives and strategies might change over the years, which for example is reflected in the case of UHANDISI. In this particular case, the senior sister initially put considerable emphasis on developing this kind of business area but later changed its mind and at present does not have any further contacts with its junior sister, eventhough this firm is in need of continued support.

In general, the 'sales of one's own production equipment' and the single motive 'to make profit' reflect more short-term interests. The motive being able to 'import from junior sister' could have a long-term effect, and if accomplished, it naturally means that the senior sister has a continued interest in the junior sister's further developing its capabilities. There is one case where this was a secondary motive, but where it was agreed upon in the first contract, that the senior sister would import products from the junior sister. In this case, MAFOTCO, there is a continuous, very close contact between senior and junior, which is further strengthened by the fact that the senior sister also has several other projects in Tanzania (7:17). In other cases, where being able to import was mentioned as a motive, but as no agreement was made and other things intervened in the Swedish companies, no importation has been started by those firms that expressed this as a motive.

In summary, the discussion of the sisters' motives concerns the juniors' potential for acquiring capabilities and the seniors' interest in maintaining contacts with the junior sister. It was found that in those cases where the junior sisters had high capabilities and acquired dynamic capabilities in their contact with Sweden, they also expressed the motive 'to test my own ability and work for myself'. Furthermore, those senior sisters that had the motive 'to sell components' have developed stable business relations with their junior sisters, which enables the juniors to acquire further capabilities through their link to Sweden.

7.6.2 Structure of training programmes

In combination with an individual's background and environmental factors, the structure of the training programme has a significant influence on the outcome of a learning process. The variables considered here are: length, sequence and composition of the training programme.

In general the training periods within the SI projects are of considerably longer duration than those in the comparative cases (Philips and General Tyre). However, there are exceptions but in those cases the selection of SI entrepreneurs with considerable industrial experience was a precondition for success. The general tendency in the development of the SI programme has been towards training periods of longer duration in the later projects. In some cases the training period has approached 2 years. While the first generation SI had a mean training time of 5 months, the second generation had an average of 13 months. In part, this can be justified in terms of an increase in the complexity of the projects started, and partly it is a reflection of delays in the construction of factory buildings in Tanzania. However, our empirical findings suggest that the efficiency of long training times might be low in comparison with a step-wise approach providing a period of learning-by-doing in between the training steps.

The long stay in Sweden, a foreign social environment in some cases leading to homesickness, and the lack of direct learning opportunities in Tanzanian environment during this long time period, indicate a somewhat suboptimal training design. In the SI programme, the negative effects of a long stay abroad has been partly counteracted by letting trainees in later projects have a short break to visit home for some weeks. A comparison with training practices in MNCs also shows that the SI programme's training times are of longer duration. For instance, Philips never exceeds training times of 3 months in its Pilot Plant in Utrecht. The comparison is valid although the training time in the SI programme concerns start-up of new firms and the comparative training times of Philips, concern product line extensions. Unlike the SI programme, the start-up of Philips' as well as General Tyre's Tanzanian units were managed by experienced teams of expatriate in-house managers and not by local people without previous experience of the particular industry. However, in the SI programme the start-up is carried out under close supervision of people from the senior sister.

The length of a training programme is of importance but also the sequence of the training, needs to be considered. An example of this may be a training programme design using a step-wise fashion. One purpose might be to minimize start-up losses through a gradual start-up process, commencing from the output side, with step-wise training backwards in the production chain. AMI shows an example of this kind of step-wise start-up: the assembly section was started, using imported valve components, 6 months before the machining section which in its turn was followed by the foundry section. In this way the subsequent production steps (foundry-machining-assembly) were prepared in advance to minimize start-up problems, and hence, the personnel was trained step-wise, in this case involving different people for each section.

Another purpose refers to a wish to increase the training efficiency and to utilize the advantages of a step-wise learning process. Several researchers, in the field of LDC firm development, have elucidated that the development of technical knowledge occurs step-by-step. (Kim 1976, Stewart 1979, Wallender 1979). The step-wise approach to training was not explicitly formulated at the start of the SI programme. However, the contractual design, which stipulates a continuing assistance to the new junior sister during 5-10 years' time, provides a basis for this kind of training. For example, in the SI contracts it was mentioned that yearly personal contacts should take place between the sisters, in Sweden or in Tanzania.

	Length of training		
	First	Second	Purpose of second training
AMI			
P.D.	10 months	5 months	Supplementary training including some minor new areas
foreman	9 months	2½ months	Supplementary training
FAWIPMA			
M.D.	9 months	8½ months	New investment involving new technology
KIMESHA			
M.D.	-	1 month	Study tour
NEM			
M.D.	1 month	1 month	Export marketing
P.D.	1 month	1 month	New product line
UHANDISI			
M.D.	-	2 months	Basic production training, because of new management; the former managing and production directors replaced (who got the initial training)
foreman	-	2 months	

Table 7.10 Step-wise training in Sweden

The first generation SI individuals (see table 7.10) have all had a second period of training in Sweden, after the start-up phase. In several cases this training has taken place in connection with investments in new machinery and in an extended product range. Supplementary training with the primary aim of increasing the capability to manage the existing production unit has taken place as well. Here, UHANDISI is a relevant case, where the general and production managers who had originally received training in Sweden were replaced by a new management, who received their basic training in Sweden more than 3 years after the initial start-up phase.

A clear finding from our case studies is that this second period provides vital learning opportunities beyond the mere training programme. An SI entrepreneur with some years of production experience, will know his short-comings and what is beneficial for the junior sister to know. Hence, he can actively search for information and observe how the senior sister accomplishes certain tasks. For example, this way of learning has in some cases provided important input for product development in Tanzania.

The step-wise approach to training with a second training period in Sweden, is further strengthened by regular visits by senior sister employees to Tanzania. These visits provide direct in-plant feed-back and supplementary training directed towards solving current problems with production, quality-control, maintenance, etc. This has been a very important follow-up activity in order to increase the technological and managerial capability.

When an LDC firm in a new industry is started through an international technology transfer project there are reasons to believe that a certain sequence in the training content, etc. is more effective than other transfer designs. Above, we have argued for a step-wise approach with training/learning/training/learning periods. Furthermore, the specific content of each period should concentrate on different aspects of entrepreneurship.

The early SI projects were all concentrated on developing production skills initially. Other areas such as administration, marketing and product development were only superficially touched upon in the training programmes. The need for knowledge in other areas became clear quite early, through actual problems with planning, costing and marketing. These areas were partly covered through later training efforts. The problems experienced with the early projects have, through a learning process on the part of the support organizations involved, at least partly influenced the design of the later training programmes. These later programmes put more emphasis on managerial aspects. Also, training in export marketing was introduced when environmental factors made the original import-substitution policy less fruitful. The area of product modification and development has not been on the agenda in the training programmes. Nevertheless, certain pieces of knowledge in this field have been acquired from the senior sisters, especially through the second training period in Sweden and during the senior sisters' visits to Tanzania.

Hence, the sequence in the SI programme can broadly be described as: production/production technique - administration/marketing - export-marketing -(product-development). The idea behind this approach was to establish a firm foundation of production capability and to start the new firm on this basis. Then other knowledge would gradually be developed, maybe in a similar way that Swedish small scale firms used to be developed in the small scale firm intensive region named Småland. The difference, however, is that this region was rich in role models and other small scale businesses who's practices and administrations were easy to imitate. We believe that the idea of initially establishing a firm base of production capability is right (7:18), but that this capability has to include managerial aspects from the start, as the art of developing an industrial business does include more than just pure production skills (7:19).

One way to create this broader base is to select a management team with broader background from the start (not only pure technical background) and/or to design training programmes somewhat differently for different management. In some of the more successful SI projects we see this broader management base (see also 6.3.5).

7.6.3 Directed training

It might appear to be self-evident that the training programmes are designed to cover those areas which have provided the most serious difficulties in LDC industry, e.g. production planning and inventory control, maintenance and management. However, this is not always the case. In the SI programme, the initial training was primarily directed at providing production skills, although earlier experience from LDCs have shown that other areas quite often are more critical.

Kilby (1973) points out that, "It is in the domain of internal coordination and control that the formation of human competencies has proved most difficult." He continues, "In manufacturing, persistent shortcomings in these capabilities have been a principal cause of underutilization of factory capacity and limited adoption of technological improvements." Here, Kilby distinguishes between three types of "human work performance": 'specific technical skills', 'internal organizational activities of control and coordination' and 'activities related to external market transactions'.

When it comes to the creation of 'specific technical skills', Kilby states that it turns out to be less of a problem than was originally predicted. In this connection, he makes the interesting remark that several studies indicate that, "... formal technical training plays a quantitatively minor role, and experience and on-the-job training are the main vehicles for implanting new skills." According to Kilby, several studies also show that 'activities related to external market transactions' rarely have been a major obstacle to the development of an industry in a developing country. Some of the junior sisters were, however, affected by market problems in the initial phase (Alänge et al. 1981).

With his study of four management contracts, as a basis Gabriel (1967) writes that, "... training should, from the very beginning, start from the 'top' rather than concentrate on the 'bottom'. The development of local managers must be the first imperative." (p. 200). He continues, "In contrast, training in specialized production skills (equipment maintenance and operation, accounting, etc.) can be handled equally well under local management ... once a local management exists ..." (p. 202).

Other authors agree that production problems previously thought to be due to unqualified labour are in fact due to faulty management. "Many entrepreneurs lack experience in labour relations, training methods, organization of work flow, and the use of simple jigs and other production aids, and therefore simply do not know how to use their labour force effectively." (Schädler 1968, p. 40).

According to Wallender (1979), there is a great need of general managerial knowledge in developing country industries. In his study of 67 developing country industries in five countries, (Brazil, Kenya, South Korea, Peru, and Tanzania) he found that there was a tendency to concentrate on "... acquiring engineering or specialized production knowledge rather than the more general managerial know-how so essential to planning and diagnosis." (p. 45) He underlines the fact that "... in the Third World, a major obstacle to improved technology transfer is lack of managerial capability to diagnose the need for technology" (p. 39). An important fact indicated by the study was that "... program combining general management development and system-specific change are more likely to bring about a change in the capabilities of the firm and hence result in a successful transfer of technology." (p. 46).

Maintenance is a well-known trouble area in developing country industries. In a recent study of six Tanzanian industries (Kanawaty and Thorsrud, 1981), maintenance activity was indentified as one of the most important problem areas, and according to this study, there was a need for changing the organization in one of these industries. For example, one of the studied companies "identified its major problem as poor maintenance planning and coordination and lack of teamwork".

Although primarily concerned with providing production skills, the SI programme focused on some other areas as well. The detailed contracts stipulated that specific maintenance manuals should be given to the junior sister. The result is that the SI firms have maintenance manuals and that especially preventive maintenance is better taken care of here than in other Tanzanian industries. However, problems still exist in maintenance (Alänge 1986a) which might indicate that manuals and pre-planned maintenance routines provide a mechanical/static knowledge, if not supplemented with dynamic elements, e.g. training in design of maintenance routines and in the importance and profitability of preventive maintenance. The latter concern the very important component of changing attitudes towards maintenance.

As the technology supplier for each new project is a Swedish small scale industry lacking experience in LDCs, it is important that the support organizations accumulate knowledge of successful designs of the SI kind of technology transfer projects. Based on experience from the first SI projects, the training has gradually been more influenced by the public support organization, i.e. SIDO and their agent Fide. Export marketing, cost-calculations, etc. have been further penetrated by the support organizations but the total influence has still been very limited, according to the 2nd generation senior sisters (see 7.5.4).

A comparison with training provided by the MNCs, Philips and General Tyre, shows that these organizations both have more developed training organizations. In particular, General Tyre has a variety of courses for its employees in different positions. Some courses take place in the US, some in Tanzania in or outside of the plant's training school. However, a comparison with General Tyre is bound to be a bit distorted as this industry is about 20 times larger than the largest SI industry (in number of employees). Nevertheless, an MNC like General Tyre has a certain advantage because of experience gained from many projects in several LDCs over the years, and because of the fact that it is the same technology that is transferred each time.

In summary, it is essential to direct the training efforts to cover known trouble areas in LDCs' industry, e.g. general management, maintenance and internal organizational activities of control and coordination. This was not the case in the initial SI projects, except for certain areas like maintenance, where detailed instructions were printed in the contracts. Having learnt from the early projects' weaknesses, the support organizations can now influence the design of training programmes to a greater extent. Still, there are reasons to believe that an even more systematic influence would be valuable, because normally a Swedish small scale industry without previous experience of LDCs acts as technology supplier for each new SI project. In this respect, MNCs enjoy a certain advantage, in that they normally have accumulated experience from various LDCs, within the same firm. In the SI programme, this accumulation rests to a great extent, with parties not directly involved in the technology transfer activities.

7.6.4 Experience in the Swedish industrial environment

A training period in a Swedish industry was included in the SI projects. Besides purely technical training, the trainees were provided with opportunities to experience and to get acquainted with the Swedish industrial environment. The idea behind this was that this stay in a Swedish industry would enhance the administrative and entrepreneurial capabilities of the trainees. Our empirical data shows that the stay in Sweden had considerable effect in some cases, whereas the effect in other cases was limited. There seem to be a number of influencing factors accounting for this difference in effect.

The size of the firm and the possibility of obtaining a view in perspective of both production and other operations at the Swedish firm have proved to be of considerable importance for a valuable stay in Sweden. A considerable difference in opinion, as to how to operate a small industrial firm, became evident among the trainees from the same junior sister, between those trained in large scale and those trained in small scale firms. These findings indicate that if a stay in a Swedish industrial environment is to be effective as a means of enhancing capabilities needed in a small scale industry, it should take place in small scale firms or in divisions/workshops where a broad perspective is possible, at least during the early phases of company development. The effect of a stay in large scale units is often a more "atomistic" understanding of the industrial firm's function. The individuals are provided with specialized knowledge and skills through the training programmes, but a more general industrial knowledge that might be acquired during the stay in the smaller scale industrial environment is not acquired. This might even result in the training itself yielding less, as has been shown in other studies where it has been found that perspective and a "holistic" (as opposed to "atomistic") approach to learning yield returns in the speed and quality of learning (see further 7.6.6) (Nilsson 1979).

A significant difference between small scale and large scale industries, is the established work routines. Quite often, very small industries do not have specific routines (explicit or documented) for communication and documentation, as the work is done by one specific person. When a company becomes larger, the need for developing well-functioning routines arises. As the junior sisters are of a certain size (10-80 employees) and are expected to enter a growth process, there is also a need for these firms to establish suitable work routines. This limits the usefulness of very small firms as training units, as routines for communication and documentation might not exist (7:20). However, work routines in large scale industries might be too complicated to transfer, and thus, it might be argued that the optimal size of a training unit is about the same size as the junior sister. In at least one SI project where the Swedish senior sister was considerably larger than its junior sister, it emerged that the reporting system used in Sweden was totally irrelevant for the Tanzanian firm. Instead, a translated version of an older reporting system that the senior sister had used many years ago was introduced in Tanzania. However, this meant that the Tanzanian trainees never had the chance of experiencing this system put into practice in Sweden. The result in this case was that the system has only been partially utilized and has never functioned very well. It might be added that factors other than size might influence a decision concerning information and documentation routines, e.g. the general technological level of the country.

While the size of the firm indicates the potential effect of a stay in an industrial environment, the involvement in different activities and the opportunities to observe procedures determine the actual effect. Involvement in different planning, problem-solving, and decision-making situations has proved especially valuable in SI projects.

The opportunity to have someone in Swedish industry explain things that seem hard to understand through observation alone is essential. In some cases, the trainees had difficulties in obtaining access to knowledgeable persons in the senior firms, especially regarding questions concerning management and marketing, and hence the effect of the stay in a functioning industry was less than optimal. However, this may partly be an effect of the weakness inherent in using small scale firms as suppliers (see 7.5.1).

The discussion above primarily concerns the early phases in the development of a new SI firm. Thus it is essential, especially during the first training period before start-up, to use an industry where it is possible to obtain perspective as a training unit. It will be different later on when the SI entrepreneurs have some experience in managing their own small scale industries and have some knowledge of what capabilities are missing. At this later stage, a study of the environment in larger industrial units might be of value, as the more experienced trainee has an increased capacity to grasp what is going on in a larger and more complex unit. Of course, the trainee's background might have been acquired from other sources than the SI programme. Nevertheless, to be able to benefit effectively from a stay in a large scale industry and enhance one's capability to master a small scale industry, a certain previous knowledge of the basic functions of a small scale firm is desirable.

In summary, a stay in a Swedish industrial environment might in itself provide excellent opportunities for learning. However, the effect depends on the Swedish firm's ability provide to provide a broad perspective and on its having suitable and transferable information and documentation routines, i.e., presumably a unit of a size similar to that of the junior sister. Furthermore, the trainee's involvement in different activities as well as his access to knowledgeable persons in the Swedish firm are of great importance. Last but not least, previous experience and education determine the individual trainee's abilities to benefit from a stay in a Swedish industrial environment.

7.6.5 Training in model industries

It is not always possible to find an industrial environment among existing IC production units that provides the opportunity to obtain a broad perspective and is comparable with the LDC small scale industry to be started in terms of size, etc. If no suitable units exist, one solution is to create a specific model industry where the operations and environment of a small scale industry are simulated.

Some companies have observed the problems and weaknesses that arise when personnel are trained in a large scale industrial plant to run a small scale business in an LDC. For instance, the MNC Philips started an LDC training and development centre in Holland as early as in 1962, organized like a small scale industry (Philips Pilot Plant). One of the Swedish senior sisters, BEVI, (PEMACCO's sister) proceeded in a similar way, by establishing a small scale production workshop for training purposes.

Philips Pilot Plant was established in Utrecht at some distance from Philips Hq. in Eindhoven. It is built as a modern industry, with a production workshop and a development and training department in close connection. The production technique used is developed at the Pilot Plant and adapted to low production volumes and conditions found in LDCs. Hence, one of the purposes with the Pilot Plant is to adapt Philips' products to low volume production in LDCs. The other purpose is to train people from LDCs to start up local production units. Trainees on management level spend some time at the Pilot Plant and are mainly trained through a case study technique where the activity of the trainee is essential (see 7.6.6). This training has a clear dynamic direction in the sense of our definition of 'dynamic capabilities'.

BEVI Model industry was set up in an empty shed where Bevi earlier had had some production. The same machinery that was later sent to Tanzania was used and the same type of production that would start in Tanzania was started for training purposes. Here, the junior's managing and production directors spent six months working under supervision on the shop floor to learn all manual skills, and this training was supplemented with theoretical training. Then, another four trainees arrived in Sweden, and they were trained in the model industry for another six months under the shared supervision of the junior's directors and instructors from the senior sister (see figure 7.7). In this way the training provided a combination of production and administrative capabilities. Also, some dynamic aspect of training were included.

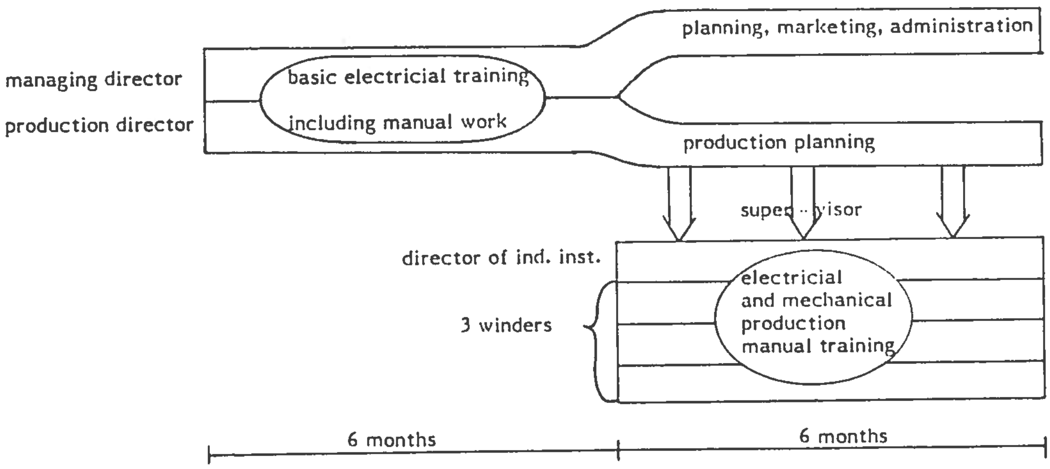


Figure 7.7 The structure of PEMACCO's training in Sweden
Source: Alänge 1986a

An advantage of using a model industry as compared to a normal small scale industry is that the environment can be controlled and all activities can be directed towards training. For example, environmental influences existing only in the LDC might easily by simulated. A disadvantage is that the model industry is always somewhat artificial. In the real world, a large amount of problems and events must be coped with, but in the model industry the training is concentrated on certain areas, and might not provide the wide variety of events that trainees in a normal industry would face. With reference to our cases, there are reasons to believe that the training in a real world small scale industry that is influenced by market demands on time, quality, volumes, etc., has certain advantages, especially in terms of enhancing aspects of dynamic capabilities.

In the model industry, it is easier to simulate some types of "unforeseen" events, especially those events that occur more seldom in the real world. For example, at Philips, a defect on a soldering machine thermostat was simulated in one training programme. Nevertheless, there is a risk that the model industry will provide a more static knowledge. Philips has partly solved this problem by having a certain share of the European production of TV-sets at the Pilot Plant, i.e. there exists a market demand that puts a certain pressure on delivery time, etc., and hence provides a more similar situation to real life business in a small scale industry.

In the case of Philips, the Pilot Plant was also started because the technique for mass production in Europe was totally different from the technique needed for small volume production in LDCs. Hence, another advantage with a model industry is that it might provide opportunities for training a technique that is different from the existing technique in the IC. Still, by placing the model industry within reach of the parent plant in the IC, there is a possibility of utilizing specialists from this unit as teachers/supervisors.

Model industries are often costly to establish and hard to justify if there only are plans for a single technology transfer project. The idea might be more suitable for repeated projects or in those cases where the technique to be transferred totally differs from the technique used in the IC. Otherwise, the aim must be to find suitable small scale production units that could serve as training facilities.

7.6.6 Some dynamic aspects on training

Recent research in industrial learning has shown the superiority of learning in entire units instead of in parts or in the words of Svensson (1977), holistic and atomistic learning respectively (7:21).

While some earlier research has analysed the learning of manual work (7:22), our study is also concerned with the extent to which holistic learning takes place when it comes to learning a task as complex as managing an industry. In the case of the SI programme, the questions raised included: were there any attempts to achieve a uniform training structure according to a holistic approach? Has there been any change of training design over time?

The answer to the above questions is that there has been no uniform approach to training in the SI programme. The common denominator has been an emphasis on developing production capability but the design of the training programme has been left to the individual senior sister. As the sisters' experience and approaches vary, the training programmes differ considerably, expecially in terms of involving managerial and more dynamic aspects of capability.

The SI approach as such, involving a training time at a Swedish industry producing the same product as the new junior firm, has a certain holistic direction. However, in practice this emphasis varies considerably between the cases. Those cases providing a view in perspective through training in model industry or in a unit of a size similar to the junior firm; e.g. PEMACCO/BEVI and MAFOTCO/Barva Hammarsmide, are excellent examples of a holistic approach. However, apart from the general SI idea of training in a similar type of Swedish industry and some senior sisters' design of training, there has been no general awareness and explicit purpose of a holistic training design. Our belief is that a holistic training direction would improve the training efficiency, especially valuable to managerial training but also important for broadening the industrial knowledge and performance all over the shop floor.

The first generation SI entrepreneurs all pointed out the insufficiency of the management training. Gradually, more elements of management training have been included in some of the later SI projects. However, there are few examples of dynamic management training among the SI projects. One exception though is the PEMACCO/BEVI project where the training programme emphasized the planning and thinking of alternative development routes. This is an example of training aimed at increasing the entrepreneurial capability.

Philips has many years of technology transfer experience and has gradually improved and developed its transfer procedures. Philips' training emphasizes certain dynamic capability aspects that the SI projects have not as yet introduced. Philips has developed a very efficient way of enhancing dynamic capabilities for direct application in the home country of the trainee. When a new product family is going to be introduced or if a new department is going to be established in the local plant, the local manager who will be responsible for the operations, is called to go to Pilot Plant in Utrecht for training. This training takes place during a very short intensive period of time (1 week to 3 months), a normal time being 6 weeks.

Philips' approach is a case study technique where the local manager (trainee) himself creates a "tailor-made" reference package, which he can utilize back home as a reference book. After a general introduction, the trainee receives a work task that he himself shall solve by utilizing his own experience and knowledge about local conditions in combination with the knowledge he can find at Pilot Plant.

In a typical case the trainee receives the task to find all the relevant information needed concerning the product, components, technique, etc. The next step is to design the production line and to make the required calculations concerning the number of workers needed, the type of training needed, the test procedures to be used, etc. as well as to plan organizational and communicational matters. Also included in the training task is the procurement of equipment, installation of a production line and test production at Pilot Plant with the trainee fully in charge of every step. Later, the equipment is shipped to its LDC destination where the trained local manager will take responsibility for the installation and start-up. While the trainee is at the Pilot Plant, all personnel are available to assist in answering his questions, but normally he has to take the initiative and search for the information himself. However, as the trainee has to present his results in verbal as well as in written form at the Pilot Plant, a certain guidance and supervision takes place. Normally, study visits to other plants producing the same type of product are included in the training. The trainee writes short summaries of his experience from these study visits. The aim is to put emphasis on knowledge for direct use in the trainee's home country.

Through this case study technique, the training becomes holistic and comprehensive and the self-initiated activity makes the training efficient and dynamic. Also, it is easy to control the knowledge level and to find the areas where more training is needed, through a direct check of the written case study. According to the experience in Tanzania as well as in other LDCs, this training method has been shown to work quite well. However, the Philips way of training makes it necessary for the trainee to have considerable prior knowledge. He must have a good technical background and knowledge about local conditions to be able to reach the high training goals within the short training time provided.

In the SI projects, the trainees have been encouraged to take notes and according to some trainees, these notes have been valuable for their work in Tanzania. However, these notes have not provided the same comprehensiveness as the Philips case studies. Hence, we believe that this is an area where improvements are possible within the SI programme.

In summary, a promising way of training dynamic capabilities is to utilize a case study method, where the trainee himself writes the whole case. When a new product line is to be introduced, the local manager who will be responsible for the operation is given the task of planning and simulating the whole process in a controlled environment, which later facilitates the implementation and start-up of the new operation under its local management. However, again this form of training necessitates that the trainee already has a firm base of knowledge and experience.

The SI approach as such, involving in-plant training in a small scale producing firm, has a certain holistic direction i.e. it provides the trainee with a broad perspective and is not only focusing on his specific work task. However, in practice this holistic direction varies between the cases, e.g. it is influenced by the size of the training unit.

7.7 Conclusions

Capability acquisition is a complex, long-term process and there are several sources that are influential during different time periods. Hence, a technology transfer project can neither be seen as separate from the participating individuals' previous knowledge and experience nor can it be seen in isolation from the impact of sources in the surrounding environment.

Both production and administrative capabilities are needed to run an industrial firm; while dynamic capabilities are needed, i.e. inventive and entrepreneurial capabilities, to further the development of the firm. There are many different ways of acquiring these capabilities. Typically it occurs through a combination of training and learning. All types of capabilities are needed in a mature firm and they can to some extent be acquired separately. An international technology transfer project of the SI type does not necessarily contribute anything more than production capabilities. The acquiring of administrative and dynamic capabilities requires that such components are included in training programmes and other activities, and/or calls for specific efforts by the recipients.

Tanzania has a well-developed primary school system, but as yet a more limited availability of technical education. The district towns where most SI firms are situated have technical schools, whose services have been utilized by junior sisters to upgrade their personnel. A few large Tanzanian companies have made important contributions to provide the SI entrepreneurs with industrial experience. The general industrial sector is however of a limited size. A large share of the industry is owned and managed by Tanzanians from the minority group of Asian origin. The diffusion of capabilities from this group to the African Tanzanians has been limited.

The environment in most LDCs is characterized by a high degree of uncertainty and frequent changes in government policies, which is also true in Tanzania. The deteriorating Tanzanian economy and the dependence on foreign aid organizations have contributed to these policy shifts. In turn, the frequent shifts in policy might result in a more short-term focus on the investment in learning.

In Tanzania there are limited opportunities for obtaining funding and foreign exchange needed for the start-up of industrial firms. The economic crisis has at the same time resulted in a severe shortage of foreign exchange and in a very low capacity utilization in industry. The low capacity utilization in existing firms is detrimental to learning by accumulated production experience. On the other hand, it stimulates the search for alternatives and the development of new products and markets.

Regarding the role of the SI programme the following was found:

Given the ultimate goal of transferring technology to the LDC, there are certain built-in contradictions that might influence the efficiency of the different modes of technology transfer. For the firm providing management services, the wish to stay as hired management might counteract the goal of rapidly upgrading local management. Furthermore, MNCs' global markets and customary strategies of keeping certain knowledge areas as strategic assets might negatively influence the result of transfer processes. Small scale industries do not normally have global strategies but might on the other hand suffer from their disadvantage of having a paucity of qualified people who can serve as instructors. This is especially evident when transfering dynamic capabilities, and can be considered as an inherent weakness when using small producing industrial firms as technology suppliers. The process of acquiring capabilities was also found to be negatively affected by a number of other factors:

First, during the initial planning and engineering phases of a new SI project, the SI entrepreneurs are not yet involved, giving them limited possibilities to influence the design of their plant and preventing them from the potential learning by involvement. If we look at the new firm in a dynamic sense, this first transfer project should only be the beginning of a process of continuous technological change and procurement. Unfortunately, the type of learning that enhances entrepreneurial capability, is not provided to the entrepreneurs by the SI projects, and only to a limited extent does SIDO's local staff accumulate experience. However, there are a number of entrepreneurial learning opportunities for the SI entrepreneurs during the later phases of the SI project. It has been evident, for instance, that in several cases the junior sisters have made new investments, and have been involved in various planning/design/decision making situations.

Second, SIDO selects, by the assistance of the senior sisters and Fide, the products and the production technique for the SI projects. This initially selected production technique has a certain influence on product development and the subsequent learning opportunities. Some of the junior sisters have very flexible machinery allowing the production of various new products made by different raw materials, whereas other junior sisters' production equipment is far more specialized. This is reflected not only in differences in capacity utilization but also in the frequency of product innovation.

Some factors have been central to the success of SI projects:

First, the selection of individuals with sufficient industrial background is essential for the success of a technology transfer of the SI type. In most cases in Tanzania, capable SI entrepreneurs-to-be were found through a selection procedure similar to the proceedings that take place when employing a manager, i.e. formal application and interview. Several of the SI entrepreneurs had gained their experience when they were employed at middle management levels at large MNCs.

Second, project continuity and long-term cooperation/assistance are invaluable for industrial development. This is created by subsidiaries or joint ventures through ownership links and, to a somewhat lesser extent, by the SI programme and management contracts through contractual agreements. In seven years' perspective, the senior sisters still play important roles for the junior sisters. The more successful junior sisters still have close contacts with their senior sisters. The existence of business opportunities for both sisters has been shown to be of the utmost importance for this cooperation. The common use of "2-year" experts, on the other hand, frequently results in discontinuity and short-sighted activities. Pure licensing, another form of contractual agreement, seems to offer limited benefits for an LDC without sufficient absorptive capacity, although it might be an important source when a certain industrial capability exists. Management contracts and "2-year expert" arrangements might suffer from the disadvantage of not having access to proprietary technology needed, while the other modes by definition possess this knowledge.

A general positive effect of the SI programme has been the creation of an environment where the SI entrepreneurs have good and frequent contacts with each other. In Arusha, the first industrial estate, a local entrepreneurial network has developed, centered around the Association of entrepreneurs and the local hunting team. We do not believe that the SI programme is the only way to create this type of cooperation, but there are a few factors that, taken together, provide a strong influence that contribute to the creation of an entrepreneurial environment. First, the common experiences training in a foreign country like Sweden provides. Second, several common courses taken in Sweden and, later on, in Tanzania. Third, an opportunity of seeing role models in Sweden, i.e. Swedish small scale firm entrepreneurs who are cooperating closely with each other. Fourth, through the industrial estate design, a number of firms of the same age with entrepreneurs of similar experience and of about the same age are brought together. This is very different from technology transfer from a single MNC like Philips, which, although the LDC plant might be of considerable size, still only consists of one firm. Fifth, an organic linkage between the industries within the estate; i.e. the products and production processes are selected by supporting organizations with a national perspective.

The geographical vicinity between the sister companies can be viewed as both a problem and a benefit. Well-functioning communication systems are very essential in order to counteract the geographical distance, e.g. regular personal visits, rapid technical systems like telephone and telex, and well-designed communication routines and systems.

However, the senior sisters' closeness to the European market is an advantage for the junior sisters, which are provided a link into an international network.

Regarding the direct actors the following was found to be of importance:

The discussion of the sisters' motives concerns the juniors' potential for acquiring capabilities and the seniors interest in maintaining contacts with the junior sister. It was found that in those cases where the junior sisters had high capabilities and acquired dynamic capabilities in their contact with Sweden, they also expressed the motive 'to test my own ability and work for myself'. Furthermore, those senior sisters that had the motive 'to sell components' have developed stable business relations with their junior sisters, which enables the juniors to acquire further capabilities through their link to Sweden.

Most junior sisters have had a second period of training in Sweden, after the start-up phase. A clear finding from our case studies is that this second period provides vital learning opportunities beyond the mere training programme. An SI entrepreneur, after a number of years of experience in production, has come to learn his short-comings and what would be good for the junior sister to know. Hence, he can actively search for information and observe how the senior sister accomplishes certain tasks. For example, this way of learning has in some cases provided important input for product development in Tanzania.

The step-wise approach of training is further strengthened by regular visits by senior sister employees in Tanzania. These visits provide direct feed-back in-plant and supplementary training directed on solving current problems with production, quality-control, maintenance, etc. This has been a very important follow-up activity in respect to increasing the technological and managerial capabilities.

There has been no uniform approach to training in the SI programme. The common denominator has been an emphasis on developing production capability but the design of the training programme has been left to the individual senior sister. Since their experiences and approaches vary, the training programmes differ considerably, especially when involving managerial and more dynamic capabilities.

It is essential to direct the training efforts to cover known trouble areas in LDCs' industry, e.g. general management, maintenance and internal organizational activities of control and coordination. This was not the case in the initial SI projects, except for certain areas like maintenance, where detailed instructions were printed in the contracts. Having learnt from the early projects' weaknesses, the support organizations can now influence the design of training programmes to a greater extent. Still, there are reasons to believe that an even more systematic influence would be valuable, because normally a Swedish small scale industry without previous experience of LDCs acts as technology supplier for each new SI project. In this respect, MNCs enjoy a certain advantage, in that they normally have accumulated experience from various LDCs, within the same firm. In the SI programme, this accumulation rests to a great extent, with parties not directly involved in the technology transfer activities.

The stay in the Swedish industrial environment has in itself provided excellent opportunities for learning. However, the effect has depended on the Swedish firm's ability to have a broad perspective and to have suitable and transferable information and documentation routines, i.e. presumably a unit of a size similar to that of the junior sister. Furthermore, the trainee's involvement in different activities as well as his access to knowledgeable persons in the Swedish firm are critical. Last but not least, previous experience and education determine the individual trainee's abilities to benefit from a stay in a Swedish industrial environment.

It is not always possible to find an industrial environment among existing IC production units that provides opportunities to obtain a broad perspective and is comparable with the LDC small scale industry to be started in terms of size, etc. If no suitable units exist, one solution is to create a specific model industry where the operations and environment of a small scale industry are simulated. However, model industries are often costly to establish and are hard to justify if there are only plans for a single technology transfer project. The idea might be more suitable for repeated projects or in those cases where the technique to be transferred totally differs from the technique used in the IC. Otherwise, the aim must be to find suitable small scale production units that could serve as training facilities.

The SI approach as such, involving a training time at a Swedish industry producing the same product as the new junior firm, provides a certain holistic direction. However, apart from this and some senior sisters' design of training, there has been no general awareness and explicit purpose of a holistic training design. Our belief is that a holistic training direction would improve the training efficiency, especially being valuable for managerial training but also important for broadening the industrial knowledge and performance all over the shop floor.

A promising way of training dynamic capabilities is to utilize a case study method, where the trainee himself writes the whole case. When a new product line, etc. is to be introduced, the local manager who will be responsible for the operation is given the task of planning and simulating the whole process in a controlled environment, which later facilitates the implementation and start-up of the new operation under its local management. However, this form of training necessitates a prior base of knowledge and experience on the part of the trainee.

CHAPTER EIGHT

DIFFUSION OF CAPABILITIES

8.1 Introduction

8.1.1 Problem background

For Tanzania as a country, the importation of technology in one project is hoped to be the start for the subsequent diffusion of this technology to other parts of the country. Thus, there is reason to study the diffusion of knowledge to other industries and institutions. In this part of the study, we have collected some data concerning diffusion of production capabilities within the SI firms. This diffusion provides the potential for future spread effects through employees leaving for other jobs or starting their own businesses. The question of internal diffusion is related to work organization, which in turn is linked to the type of management. It can be described in terms of specialization and work rotation. We have also made a study of some of the ways capabilities may diffuse externally. These include: individuals leaving the SI firms, parallel industrial activity, subcontracting linkages and directed diffusion. For a summary of potential ways of diffusion, see figure 3.6 in Chapter Three.

8.1.2 Research questions

Relevant questions are: Is there any reason to believe that the SI projects will serve as starting points for further diffusion of technology? What is the management policy of specialization and work rotation? How many people in which positions have left the SI firms and what is their present occupation?

8.1.3 Concepts

Our focus is on the diffusion of technological and managerial capabilities into Tanzanian society. A general definition of diffusion is provided by Rogers (1983) as "... the process by which an innovation is communicated through certain channels over time among the members of a social system." (p. 5). With Rogers' wide definition of innovation as "... an idea, practice, or object that is perceived as new by an individual or other unit of adoption ...", (p. 11) we can thus include diffusion of new capabilities in the concept.

8.2 The SI programme and capability diffusion - empirical findings

8.2.1 Diffusion inside an SI firm

In the pilot study (Alänge and Löwbäck 1981b), we used an instrument that provided a picture of what the various workers, foremen and managers knew and mastered in one of the 1st generation SI projects, NEM in Arusha. As a first step, all work steps in the production process were identified and graded according to degree of difficulty on a three-point scale. This was supplemented with the estimated time necessary to learn each work step (see table 8.1). All employees were then listed according to which work steps they could carry out and which work operations they could set up. All these estimations were made by the firm's production manager.

Workplace/machinery	SKILL			
	operation		setting	
	skill needed	training time	skill needed	training time
1. Power shears stage 1 sheet cutting stage 2	2	2 weeks	2	
2. Press brake side bending	2	2 weeks	3	1 year
3. Ex-centerpress (S) side punching	2	2 weeks	3	1 year
4. Ex-centerpress stage 1 hole punching stage 2	2	2 weeks	3	1 year
5. Spot welder	2	1.5 week	3	6 months
6. Pretreatment eq. (tri)	1	1 day	2	2 months
7. Spraybox	2	1 year	2	1 year
8. Oven	1	1 day	2	1 month
Assembly line				
9. Step 1 Screwed shell complete	2	6 months	3	
10. Step 2 L-bars complete	2	6 months	3	
11. Step 3 Mounting rail complete	2	6 months	3	
12. Step 4 E-bars complete	2	6 months	3	
13. Step 5 N-bar stage 1	2	6 months	3	
assembly stage 2	2	6 months	3	
14. Step 6 Fuse line complete	2	6 months	3	
15. Step 7 Final assembly	2	6 months	3	
16. Step 8 Fuse packing packing of fuse carriers	2	6 months	3	
17. Step 9 Mounting of cover M packing	2	6 months	3	

Skill needed: 1 = unskilled 2 = semi-skilled 3 = skilled

Table 8.1 Skill needed to operate and set
Source: Alänge and Löwbäck (1981b)

In this firm, the management had an outspoken policy of further educating and training their employees in order to reach greater flexibility and to make the employees grow with the company. This is confirmed by table 8.2, which shows that the individuals in most cases knew several of the prevalent operation tasks in 1980. The setting up of tools and work places was conducted by a more limited group of people. However, worth noticing is that the industry only had been in production for one and a half year at the time of the investigation. The policy of further education is moreover confirmed by the firm's paying for 9 of 11 workers to attend electrical and mechanical evening courses at the Arusha Technical College. This shows that, a potential for future diffusion existed in 1980, in the case of NEM.

In January 1983, the same type of estimation was made in the same firm and by the same production manager. During the 2½ years that had elapsed, 5 persons had left, among them the previous foreman. Instead, nine new persons had been employed, among them two storekeepers and two persons especially assigned to quality control.

Name	Operation 1980	Operation 1983	Set-up 1980	Set-up 1983	Quality Control 1980	Quality Control 1983
M.D.	all	all	all	all	all	all
Ma.D.	some ideas	n.a.	-	-	-	-
P.D.	all	all	all	all	all	all
T.D.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Storekeeper						
A	new	9-17	-	-	-	-
B	new	-	-	-	-	-
C	1-4	left	-	-	-	-
Foremen						
A	1-5	1-17	1-5	1,2,6,9-17 (3-5,7)	yes	a little
B	1-8	left	1-8	left	yes	left
Supervisor						
C	1,2,6-8	1,2,5 (3,4,7,9-17)	-	1,2,5 (3,4)	-	very little
Workers						
A	1-5	3,4,16,17 (1,2)	1	3,4 (2)	-	very little
B	1-4,6-8	1-4,9-17	6-8	-	-	very little
C	2,5	1,2,5,(7)	-	-	-	very little
D	new	1,2,(3-4)	-	-	-	-
E	new	2,(3-4) gas welding	-	-	-	-
F	new	(9-17)	-	-	-	-
G	new	(9-17)	-	-	-	-
H	3,9-17	1,9-17 (3-5)				
I	9-17	1,9-17 (3,4)	-	-	-	-
J	new	in training	-	-	-	-
K	(1),5,9-17	left	-	-	some	left
L	3,9-14,16-17	left	-	-	-	-
M	n.a.	left	n.a.	n.a.	-	-
Quality control						
A	new	very little	-	-	new	yes
B	new	very little	-	-	new	yes

Key: The figures refer to the work steps the employees mastered. This includes what work operations they could carry out and what work operations they could set-up. Also their knowledge in quality control is indicated
( ) = some skill, - = no skill, new = employed after 1980, n.a. = data not available

Source: Interviews with the production manager in 1980 and 1983

Table 8.2 The diffusion of production skills - a comparison between July 1980 and January 1983

There is very clear evidence that among the personnel that has stayed, the number of operations managed has increased. Two female operators that in 1980 were working almost exclusively in the assembly section, also manage the power shear and have some knowledge of how to operate the press-brake, the ex-center presses and the spot welders in 1983. The previous assistant foreman, now foreman, managed to operate all operations and also knew more about set up, e.g. operation and set up in the assembly section than he did in 1980.

If we examine the quality control capabilities we find that although the foreman was classified as mastering quality control in 1980, he only knows "a little" in 1983. However, this probably reflects the increased emphasis and higher demand that NEM puts on quality control. Among other things NEM has introduced a new organization with personnel specializing in quality control.

The newcomers have also been trained in the operation of various machines. Hence, the general impression is that the skills are further diffused within the organization. However, this type of measurement mainly concerns manual skills and set-up. Other production capabilities like planning, scheduling, etc., are not considered in this analysis.

As could be seen in the detailed analysis of NEM in table 8.2, a certain diffusion of capabilities took place within that firm. If we look, on a more superficial level, at the other SI firms, the occurrence of work rotation can provide a hint of the internal diffusion process (see table 8.3).

Company	Extent of work rotation
AMI	work rotation in the foundry
FAWIPMA	limited work rotation
KIMESHA	rotation between spinning and assembly
NEM	work rotation
UHANDISI	limited differences in work tasks

Table 8.3 Work rotation within the SI firms

In the SI firms studied, 3 out of 5 have a clear policy of work rotation, which provides the employees with broader experience. In some cases, it has consisted of letting employees change to easier jobs to avoid fatigue at demanding jobs. However, in one case frequent rotation has inhibited efficient production, according to the senior sister. Nevertheless, the frequent occurence of work rotation indicates that capabilities are internally diffused.

Hence, there may be a trade-off in the area of learning, i.e. the choice between learning a job in-depth through specialization or covering a broader area more superficially through the rotation among different work tasks. Here, previous experience and knowledge is of considerable importance for the individuals ability to acquire capabilities in broader areas, in sufficient depth.

8.2.2 People that have left SI firms

One of the most efficient ways of transferring technology is through the movement of people. Hence, the number of persons that have left the SI firms and their present occupations are of interest. First, we will look at the whole group of entrepreneurs that have been trained in Sweden, and then we will study some firms in detail, i.e. both SI entrepreneurs and other employees.

The data in table 8.4 concerning the whole group of SI entrepreneurs are from Forss (1985a). He found that of a total of 109 persons trained in Sweden, 85% remained in the post they were trained for in 1985. Of the 17 persons who had left the SI firms, 5 had work that was related, i.e. they had use for their training in Sweden.

	Persons trained	Remaining in post trained for	Have left the post	
			has related work	different job
Entrepreneurs				
Mbeya	19	14	2	3
Moshi	52	46	-	6
Arusha	39	33	3	3
total	109	93	5	12

Table 8.4 SI entrepreneurs' employment after returning from Swedish training
Source: Forss 1985a

This means that at least 90% of the SI entrepreneurs have use for their training, although 5% do not benefit the SI firm but have instead diffused knowledge into Tanzanian society. Forss makes a comparison with some other training programmes, e.g. "UNIDO has followed up the employment of traineees returning from fellowship and various in-plant training programmes. It was found that within nine months after their return, 80% had left the jobs they were trained for. The study did not indicate whether they still had use for the skills they were trained in." (p. 10). Forss' comparisons indicate that the direct effect of the SI programme's training is high as compared to other programmes. However, if we look at an SI project in a time perspective, it is not only the first training period in Sweden that is of value for capability acquisition, but maybe, to an even greater extent the subsequent learning opportunities involved in running the junior sister. Hence, it is also of interest to study other employees than the SI entrepreneurs.

Interviews (in 1983) at six SI firms in Arusha show that 32 individuals had left these firms since the start in 1978-79 (see table 8.5). About 50% had been dismissed for a variety of reasons; misconduct, theft, absenteeism, laziness and embezzlement. The rest had left on their own initiative for many reasons. Some of the manual work tasks were considered to be too hard, e.g. hand loom weaving. Some had got another job. None had left for another industrial job or to start his/her own company voluntarily. In the cases where this happened, the individuals had been dismissed from their SI firm.

Company	Empl. that have left	Present job	Reason for leaving
AMI	2 foundry workers	n.a.	Dismissed
	2 workers in machining section	n.a.	One left and one dismissed
FAWIPMA	3 workers from hand weaving section and one from fencing machine	3 are not working with weaving One is operating a competitor's fencing machine	Hard work at hand looms One dismissed
GIFCO	9 foundry workers	One is working in an Indian foundry (hand forming)	4 persons left by own, and 5 persons were dismissed
KIMESHA	3 workers	All are working in other industries but not with spinning	Left by own or dismissed
NEM	6 workers one foreman one secretary	One worker in industry, one is a primary school teacher, one in Kenya, one works at a broadcasting section and the foreman is a farmer	The secretary was on short-term contract Left by own or dismissed
UHANDISI	general manager production manager helper packaging lady	The managers started a work-shop for metal-fabrication, repair, el. windning	Dismissed

Table 8.5 Employees that have left SI firms in Arusha and their present jobs (1983)

At least one fourth of the former SI employees work in new industrial firms. It can be assumed that they have some use for the capabilities acquired in the SI firms, although only a few are doing an "identical" job. It is only possible to see a direct use of skills and knowledge acquired at the junior firm in a few cases. In one case, the movement of a worker created a competitor as the new employer, together with the worker, was able to copy the SI firm's machine and production process.

The NEM case provides more details of the skills that the persons that have left were provided while working at the SI firm (see table 8.6).

Occupation	Operate*	Set	QC	Present occupation
Foreman, machinery	1-8	1-8	yes	farmer
Operator, assembly	(1)9-17	-	some	at a broad-casting station
Store keeper	1-4	-		left, maybe temporarly
Operator, assembly	3,9-14 16-17	-	-	n.a.
Operator, assembly	n.a.	n.a.	n.a.	operator at MOCCO, Moshi

Table 8.6 Skill level and present occupation of the persons that have left NEM.
(*The figures indicating skill level are explained in table 8.1)

The foreman who was skilled and had considerable industrial experience is not using it anymore. Instead he is working as a farmer in his home village. One of the female operators is working in another SI firm in Moshi, at an unknown job. The other two persons do not work in an industry at present, although one of them might return. Hence, there are no cases of spin-off and it seems that the acquired skills are only utilized to a limited extent in industrial enterprises.

8.2.3 Parallel industrial activity

In section 5.4.2 d, it was mentioned that most employed people must also have a 'mradi', a little side activity which brings in a little extra money. This is also quite frequent among the SI entrepreneurs and the employees in SI firms. Often this can also be seen as examples of entrepreneurial activities. If the means or knowledge have been acquired through the SI programme, it can be seen as a further national benefit of the programme, but as externalities to the SI firm. Forss (1985a) found that many of the SI entrepreneurs had side activities such as welding shops or electrical installation activities. 34% of the SI entrepreneurs said that they had a mradi.

8.2.4 Linkages within the SI community

The linkages and the contact network to other firms and institutions in Tanzanian society are important roads for capability diffusion. In this section, just one short comment will be made on the direct linkages between SI firms in terms of subcontracting (see table 8.7).

	Linkages
AMI	Subcontractor to NEM
FAWIPMA	No linkages
KIMESHA	Subcontractor to NEM and inputs from several SI firms
NEM	Linkages to several SI firms
UHANDISI	Subcontractor to NEM and KIMESHA
MAFOTCO	Linkages to all SI firms in Moshi
PEMACCO	Linkages to firms inside and outside the SI programme
TANLOCKS	No linkages

Table 8.7 Subcontracting linkages between SI firm

It can be seen from this limited material that most firms have some sort of subcontracting relationship with other SI firms, in some cases to a minor extent (AMI), while in others the volume is higher (KIMESHA, MAFOTCO). Both 'no linkages' firms utilize, to some extent, surface treatment firms at the industrial estate, but they do not have a regular subcontracting relationship with any of the other firms.

8.3 Discussion

There are no examples of direct spin-off firms. This could be an indication of missing capabilities or missing motivation. It is, however, more probable that this reflects the limited opportunities for starting industrial firms in Tanzania. It is very hard to obtain financing, especially the foreign currency needed for import of machinery, necessary raw material, etc. It may, to a certain extent, also be a reflection of the conditions at the SI firms, e.g. a workforce that, at least for the time being, is motivated to remain at the firms. However, it should be pointed out that it might take more time before effects in terms of spin-offs show up, reflecting the need to acquiring knowledge and experiences as well as an understanding of business before startup.

If the experiences from one case, NEM, concerning the diffusion of capabilities within the firm are representative, there is reason to believe that the SI firms will cultivate an experienced, skilled work force. At

NEM factors like set up and quality control were diffused, as well as a more theoretical understanding of the products, among other ways, through evening courses. The possibilities for broadening experience through learning depend to a large extent on the involvement of the employees in different activities. The frequent occurence of work rotation in the SI firm indicates that the employees in general are provided learning opportunities. As all SI firms are relatively small, it is possible to obtain a view in perspective of the industry. According to Cooper (1984), small size incubator firms tend to have a higher spin-off rate. We have also seen that the early SI entrepreneurs have been important role models for the other SI entrepreneurs. Perhaps this is still a big step for the employees, but if some SI firm employees succeed at starting their own viable companies they could be a new important kind of role models for other employees. However, once again, this has to be viewed in a time perspective and, in relation to the availability of finance, machines, etc.

The employees that have left SI firms have, to a certain extent, occupations where they have use for their acquired capabilities. However, there are few who have direct use for their knowledge in an "identical" or similar production. One reason might be that there are still few persons that have left and many of these were dismissed due to absenteeism, laziness, etc., which might indicate that they did not fully master their work tasks in the SI firm.

The wide variety of "mradis", indicate that there is a considerable 'entrepreneurial spirit' among SI entrepreneurs and their employees. However, most of these are to be considered as side activities even in the future, because of constraints in terms of finance and machines. Many of these mradis are of a simple nature and do not let the individual make full use of his capabilities, which was shown to be a strong motivational factor for the SI entrepreneurs to start their own firm. Hence, the motivation to develop the mradis further might be limited.

What is missing are opportunities for potential entrepreneurs to start industrial firms, other than of a backyard type. There are two principal ways for this to become reality. One is to create conditions for entrepreneurs to obtain of financing, foreign currency, technology and raw material needed, and letting the 'market' decide further development. Another is to aim at making more consistent use of the technology imported through the SI projects, by directly planning and implementing the further diffusion of this technology.

As early as at the start of the SI programme there were discussions of promoting further diffusion of the technology. One indication of this was the way the contracts were written, in which the technology (know-how and training) became the property of SIDO (and not the individual SI firms), and, thus was paid for by SIDO and considered as a 'national cost'. However, in practise, the knowledge was acquired by individuals in the SI firm and further developed within these firms through learning. It almost impossible to make any successful efforts at further technology diffusion without the positive attitude of the SI entreprenurs. One such programme was presented in 1986 and is at present being discussed and considered for implementation (Carlsson 1986).

In this programme, various forms of cooperation are proposed, e.g. a joint ownership of the new undertakings (junior daughters). A further possibility is the involvement of the senior sister as well, in order to support certain aspects of the diffusion/technology transfer process.

8.4 Conclusions

The detailed analysis of capability diffusion within one SI firm and the supplementary study of the occurence of work rotation in other junior firms indicate that the personnel are provided learning opportunities. This may in the future appear as spin-offs and diffusion from the junior sister. However, the diffusion of capabilities from the SI firms has as yet been rather limited. Those individuals that have left have made only limited direct use of the knowledge and experience acquired at the SI firms. There are few who have left and among those many have been dismissed, which might indicate that they were less skilled. On the other hand, there are also examples of direct transfer of technology through the movement of people. Furthermore, there is a continous diffusion through the spread of information and the function of the SI entrepreneurs as role models. Subcontracting linkages between the junior sisters are also frequent indicating a diffusion among this group of firms.

Several of the SI entrepreneurs and employees have mradis, i.e. side activities of limited scope, which indicate a certain entrepreneurial spirit. 'Mradi entrepreneurship' is important for survival and has become an intrinsic part of the African entrepreneurship tradition. However, there are significant problems in releasing or transforming mradis into main business activities. Perhaps there is a certain potential here.

There are no industrial firm spin-offs from the SI firms as yet. The short time period since start of the SI programme might be part of the explanation but the major influencing factor is probably lack of opportunities. Primarily this is due to difficulties in obtaining foreign exchange for import of machinery and needed raw material.

CHAPTER NINE

COSTS AND BENEFITS OF THE SISTER INDUSTRY PROJECTS

9.1 Introduction

9.1.1 Problem background

One basic benefit of participating in an international technology transfer, from the point of view of an LDC recipient, is to develop local capabilities within a certain area. Ideally, some of the newly acquired skills and knowledge could then diffuse to other industries in the LDC. Given this scenario, it might then be possible to start new firms from local capabilities, originally imported into the country through an international technology transfer project.

However, there are many occasions when new industries are established through international technology transfer projects when the required knowledge, or at least substantial parts, already exist in the LDC. This kind of 'double' import might reduce the potential benefits considerably.

There are of course many reasons why this kind of 'double' import occurs. Among these are: imperfect knowledge of local firms, geographical and cultural distances within the LDC, a bias toward selecting foreign suppliers reinforced by the funding foreign aid agencies, the absence of firm-specific knowledge, oligopolistic competition reinforced by trademarks, and costs for local knowledge. Furthermore, in Tanzania, a large proportion of the local capabilities is held by the minority group of Asian origin. This may in fact help to explain why international projects are preferred by Tanzania, since this minority group's willingness to share knowledge (on which their own business is based) with African Tanzanians has been low.

9.1.2 Research questions

The aim of this chapter is to analyse the SI projects in terms of their cost and in relation to the benefits they provide to capability build-up in the junior sisters. Benefits will not only be defined at the firm level but also in relation to Tanzania as a country. Hence, an additional aim will be to investigate whether the projects within the SI programme illustrate situations where 'double' import of capabilities exist, and if so, to shed some light on the reason for this.

9.1.3 Costs and benefits

The price of imported technology can be seen as consisting of a monetary price and a 'price' that is paid in terms of relinquished control over the subsequent operations of the importing firm (Bell and Hoffman 1981). Direct costs like royalties and licence fees are relatively simple to identify while difficulties arise when it comes to estimations of indirect costs, such as overpricing of intermediary goods, repatriated profits of subsidiaries and joint ventures, etc. Other costs that are not easily measured are those of restricted clauses and the type of costs that are attributable to benefits relinquished, such as transfer of wrong technology or non-transfer of technology (Cooper and Sercovitch 1970, UNCTAD 1972). Several studies have elucidated the effects and costs of restrictive clauses (Vaitsos 1974, UNCTAD 1975).

The price is generally set through a bargaining process. The marginal cost of using or selling an already developed technology is seen to be almost zero for the owner. On the other hand, the marginal cost for developing one's own technology is very high for the purchaser, and hence the price he is willing to pay is high. Thus, the price settled upon through the bargaining process may vary within wide limits (Vaitsos 1973). Furthermore, technological dependence makes a high price likely (Stewart 1977, p. 126). These findings have led to a heavy emphasis on strengthening the bargaining capacity, and there is evidence that such efforts have given substantial returns (Vaitsos 1974). However, recently this one-sided emphasis on bargaining capabilities has been questioned. A well-developed technological capability increases the possibilities for evaluating projects, and thus the possible price variations are strongly limited. Hence, the relative importance of bargaining capabilities decreases (Bell and Hoffman 1981, pp. 209-215). Also, the assumption that the marginal cost for the supplier is low has been contradicted. The results of Teece's (1976) study indicated that, "... substantial resources must be utilized not only to transmit technical information but also to ensure its successful absorption." and, "Accordingly, it is entirely inappropriate to regard technology as something that, once acquired by one firm, can be made available to others at zero social cost." (p. 100). However, Teece also found that the cost of transfer decreases radically when the same technology is transferred repeatedly, i.e. there are considerable learning effects involved.

Several strategy propositions for development using the successful industrialization of Japan as an example have been put forward (Morse 1975, Bhagavan 1979). This type of strategy assumes substantial opportunities for learning. The fear has been expressed that the developing countries will not be able to acquire this type of learning due to technological dependence. These missing learning opportunities can be seen as long-term dynamic costs of technology import and, "may well be much more important than the financial (direct and indirect) costs of buying technology" (Vaitsos and Lall 1978, p. 13). The knowledge of this type of cost is, however, very limited. Propositions have been made for calculating the costs that arise through local involvement, i.e. learning opportunities (UNCTAD 1972, pp. 18-19).

Most authors agree that it is very hard to quantify the benefits of learning. Some authors are of the view that these benefits are relatively small and accrue many years after the project initiation, and hence can be ignored when discounted to present value. Niklasson (1983) has made a cost-benefit analysis of four sister industry projects, using this assumption, primarily basing his decision on Little and Mirrless (1974) who state that, "... the present value of such training is usually likely to be small compared with other project items." (p. 336). Other authors are however of another opinion and estimate them to be of considerable importance (e.g. Pierce 1971) and that this importance might be further increased by taking into consideration, "... the combined and aggregate effect of several investments over a certain period of time ..." and, "It is quite possible moreover, that interdependences exist which make the benefits of a whole system greater ..." (Gustavsson 1981, p. 53).

The feasibility of making a cost-benefit analysis of training is dependent on the following three variables: the level of trainees, the type of training and the level of evaluation. According to Reddy (1979, p. 54):

> "If a scale of feasibility is devised, then the national level training programmes designed to impart specific skills for operators or workers would be most feasible for cost-benefit analysis. Enterprise level programmes for managers designed to impart conceptual or behavioural skills may be least feasible on the scale."

According to Reddy (1979) there are different ways of conducting a cost-benefit analysis, one being the 'contingency approach'. By this is meant that there is no attempt to put money values on intangibles by establishing a 'surrogate price' through a survey approach or through the observation of behaviour of economic agents. Instead the costs and benefits possible to quantify are supplemented by a list of the unquantifiable effects.

9.2 Empirical findings

First, the foreign aid financed costs of the SI programme are presented. Second, the costs of the eight case projects are presented on a more detailed level. Finally, the capability contribution of the case projects is estimated by a comparative analysis with the junior sisters' competitors.

9.2.1 Costs of the SI programme

In total, 30 different industrial units have been started through the SI programme and 704 persons were employed as of April 1986. During these 9 years, there have been initial investments as well as supplementary investments in the SI programme. These supplementary investments have included investments designed to add to capacity as well as those which extended the product range. These investments have been primarily financed through Swedish development aid to Tanzania. To a certain extent, Tanzania has covered local costs, e.g. the cost of constructing industrial buildings and costs of SIDO's support activities. The Swedish-financed part of the total investment amounts to 145 million SEK (this includes: hardware 73 M SEK, know-how 7 M SEK, training in Sweden 16 M SEK, training in Tanzania 14 M SEK and cost of Swedish consultants 10 M SEK, all at current costs, M = million).

During the period September 1977 - August 1985, a total of 125 persons have been trained in Sweden for a total of 1041 man-months (see note 9:1).

Year	Number of programmes	Total cost for all programmes (SEK)	Number of months for all programmes	Monthly cost* (SEK)
1977	4	99.000	7.4	13.316
1978	18	1.499.400	142.6	10.512
1979	22	2.987.600	273.9	10.908
1980	20	2.063.468	143.6	14.370
1981	20	2.439.637	176.4	13.830
1982	20	2.739.800	139.2	19.680
1983	7	761.562	34.4	22.133
1984	16	1.942.225	108.1	17.968
1985	6	443.583	15.4	28.876
	133	14.976.275 SEK	1041 months	

Table 9.1 Time and costs of in-plant training programmes in Swedish firms
Source: Fide
(* see note 9:2)

Table 9.1 shows the number and scope of the training programmes arranged in-plant, in Sweden, as well as their costs expressed in current prices (9:3). The total cost, for the 133 programmes involving 125 individuals, has been 15 M SEK (9:4). The average monthly cost of these training programmes amounts to 14.386 SEK. The duration of the programmes varies from a few weeks to around 2 years. Due to the fact that some individuals have had more than one training period in Sweden, and to supplementary investments, the average training time rises to 7.8 months, at a mean cost of 112.600 SEK per programme (in current prices). In 1985 the average cost for in-plant training in Swedish firms was 28.900 SEK per man-month.

The empirical data on costs are based only upon those costs visible through the Swedish aid financing. Costs resulting from the international transaction as well as local costs will be defined as "other costs" and will be reviewed in the discussion section. These "other costs", have been incurred primarily due to: the work of the supporting organization SIDO, the use of scarce human resources in Tanzania and the use of capital resources that could have been invested in alternative projects (and could have yielded other benefits).

9.2.2 Costs of the eight case projects

In the eight projects studied, large differences in the total costs (from 0.6 M SEK to 10.7 M SEK (18 times larger)) and in the distribution of the different cost components are very apparent (see table 9.2). Some of these differences are a reflection of the different technologies, training needs, etc.

	Total project cost	Machinery hardware	Know-how	Training Sweden	Training Tanzania	Consultant Fide
AMI	6102	3132	1450	306	1114	100
FAWIPMA	2083	1091	216	440	283*	53*
KIMESHA	595	365	-	51	161*	15*
NEM	2551	1775	-	117	594*	65*
UHANDISI	1209	599	150	69	336	54
MAFOTCO	10727	6514	700	1481	1699	333
PEMACCO	2439	689	563	445	706	37
TANLOCKS	5552	3110	865	338	1097*	142*
	31258	17277	3944	3247	5990	799

Table 9.2 Investment and technology transfer costs in the SI projects (June 30, 1985) (in thousand SEK, excluding local costs)
Source: Fide
*Adjusted figures, see note 9:5

A break-down of total costs into the cost per employee provides the following picture:

	Total project cost	Number of employees	Project cost per employee
AMI	6.1 M	35	174.343
FAWIPMA	2.1 M	17	122.529
KIMESHA	0.6 M	23	25.870
NEM	2.6 M	59	43.237
UHANDISI	1.2 M	8	151.125
MAFOTCO	10.7 M	32	335.219
PEMACCO	2.4 M	22	110.863
TANLOCKS	5.6 M	26	213.538

Table 9.3 SI project cost per employee (in SEK)
Source: Fide

If we exclude the hardware component from the total cost, we get an estimation of the cost for capability acquisition (see table 9.4).

	Total cost for capability acq.	Project cost of cap. acq. per employee
AMI	3.0 M	84.857
FAWIPMA	1.0 M	58.353
KIMESHA	0.2 M	9.913
NEM	0.8 M	13.153
UHANDISI	0.6 M	76.250
MAFOTCO	4.2 M	131.656
PEMACCO	1.8 M	79.545
TANLOCKS	2.4 M	93.923

Table 9.4 SI project cost of capability acquisition per employee (in SEK)
Source: Fide

A break-down of the total costs for Swedish in-plant training into cost per training programme, provides the following picture: (The programmes have taken place between 1977 and 1985)

	Total cost of in-plant training in Sweden	Number of programmes	Cost per programme	No. of month	Monthly cost
AMI	617.741	8	77.218	57.5	10.750
FAWIPMA	500.009	4	125.005	36.3	13.793
KIMESHA (9:5)	200.136	2	100.068	1.4	138.275
NEM	175.826	6	29.304	6.1	28.737
UHANDISI	102.544	4	25.636	6.4	16.060
MAFOTCO	2.147.513	9	238.613	177.6	12.092
PEMACCO	538.438	6	89.740	46.0	11.717
TANLOCKS	626.714	6	104.452	48.4	12.949

Table 9.5 Monthly cost of in-plant training in Sweden (in SEK)
Source: Fide

In table 9.5, only costs for Swedish in-plant training which have been paid for by Swedish aid are included. Training provided on a commercial basis for further extensions of projects, e.g. the costs for NEM's production manager's 2nd training in Sweden, is not included, as this was paid for by the company. The costs for shorter commercial visits to Sweden are not included either, as they have been covered by the junior firms themselves.

9.2.3 The junior sisters and their Tanzanian competitors

Below, an estimation of the contribution of capabilities to Tanzania is presented for each junior sister (9:7).

AMI - capability contribution to Tanzania

We look at the Arusha region as a starting point. Some small service foundries already existed with an intermittent production process. These foundries were all owned by Tanzanians of Asian origin and most equipment was locally made in Tanzania.

On a national level, it is reasonable to assume that a number of units similar to the above-mentioned exist, but with limited production. In TISCO (1981) and MEIDA (1981b), 7 different metal foundries can be found (see table 9.6). In MEIDA (1981b), metal foundries were found in a machine tool factory in Mangúla and in an engineering firm in DSM but neither of them were working as a production unit in the same sense as AMI, i.e. making relatively large series of a small number of product variants. The only one with the same production character is the ferrous foundry in Arusha, GIFCO, which is a project within the SI programme.

Company	Location	No. of empl.	Ownership	Product	Production capacity	Capacity utiliz.	Production process	Geographical market
AMI	Arusha	35	Parastatal	Gunmetal Al-casting	60 ton/year	50%	machine mould mass prod.	country wide Arusha
Arusha Foundry	Arusha	na	na	Al-casting	na	na	hand mould	na
GIFCO	Arusha	35	African	Ferrous	860 ton/year	40%	machine mould mass prod.	country wide
Jandu Plumbers	Arusha	218	Asian	Ferrous Al-casting	na	na	hand mould	na
Mang'ula Mechanic Machine Tools	Mang'ula	na	Parastatal	Ferrous Non-ferrous	1,5 ton/hr/charge 100 kg crucible	na	Fabrication & repair work	na
Narrow Fabrics & Metal Works	DSM	na	na	water taps	na	na	na	na
National Engineering	DSM	na	Parastatal	Ferrous Non-ferrous	5000 ton/year	na	Jobbing firm, no standard prod. semi automatic	na
Railway Foundry	DSM	ns	Parastatal	Ferrous Non-ferrous	na	na	Repair work	railways

Sources: MEIDA (1981), TISCO (1981) and interviews with AMI in January and November 1983.

Table 9.6 AMI and its competitors

As there are no other metal foundries of the same character in the country, the AMI project provides a contribution to capabilities. This is especially so in the area of production capabilities. In the area of administrative capabilities, the project has benefited more from local sources.

FAWIPMA - capability contribution to Tanzania

There were some firms in the country already producing both chain link fencing wire and mosquito wire when FAWIPMA was started in 1980 (see table 9.7).

Of the present competitors, two have started their production after FAWIPMA was started. Kilimanjaro Nails in Arusha has copied the FAWIPMA machine for fencing wire and has employed a former FAWIPMA worker for the production. Hence, there has been a direct diffusion from FAWIPMA. At the time of our interviews, Steel Rolling Mill in Tanga had not yet started their production.

Company	Location	No. of empl.	Ownership	Product	Production capacity	Capacity utiliz.	Production process	Geographical market
FAWIPMA	Arusha	17	African	fence wire mosquito net	400 T[1)]	21% (1982)	semi-automat. manual	country wide
JEJE Industries	DSM	na	na	fence wire	540 T	0% (1981)	na	na
Kilimanjaro Nails	Arusha	30	Asian	fence wire	300 T	na	semi-automat (copied FAWIPMA)	Arusha, DSM
Rehmanji	DSM	20	Asian	fence wire mosquito net	300 T 300 T	23% (1981) 2% (1981)	automatic 2 automatic	coast areas
Steel Rolling Mill	Tanga	1000	Parastatal	fence wire	1800 T	start 1983	3 automatic	country wide
Tanzania Wire Products	DSM	40	Asian	fence wire	150 T[2)]	13% (1981)	automatic	country wide
Wire Industries	DSM	35	Asian	fence wire	1500 T	4% (1980)	automatic	country wide

1) The capacity for FAWIPMA in tons was estimated for 3000 roles á 133kg each.

2) This capacity is according to MEIDA (1981). FAWIPMAś estimate was at about 9000 roles á year, i.e. 1200 tons.

Sources: MEIDA (1981), TISCO (1981) and interviews with FAWIPMA in january 1983

Table 9.7 FAWIPMA and its competitors

Four of the competitors were in production at least as early as 1979 (the earliest year about which the MEIDA directory provides information). They probably had started production of this type, at least the fencing wire production, when the decision to import technology for FAWIPMA was made. This indicates that the contribution of capabilities to Tanzania is very low since the capability to make fencing wire was already present in the country.

It might be that Rehmanji Ltd., the only competitor making mosquito nets, started production in 1981, one year after FAWIPMA. Concerning coffee tray wire, which also is made by FAWIPMA, the directories do not provide any information. This kind of production may contribute to capability, but our data does not permit any firm conclusion. However, the initial hand-loom technology does not provide products of a high quality and the capability contribution to the relatively advanced small industry sector of the SI type, is thus limited. (9:8) However, FAWIPMA has later made investments in automatic looms, i.e. the same type of technology as the competitor (Rehmanji). Furthermore, the contribution of administrative capabilities from the SI project was limited. Instead, local sources contributed in this area.

At the time of the FAWIPMA investment decision, all competitors had Tanzanian owners from the Asian minority. This might be part of the explanation for the decision to import technology from abroad instead of utilizing local capabilities to train people for new firms. It could be explained in terms of an effort to increase competition on the Tanzanian market, but it is also an effect of the aim to enhance the African Tanzanians' share of the industrial business.

KIMESHA - capability contribution to Tanzania

In the Arusha region, there are no other industries producing aluminium household utensils. However, there is production of plastic household utensils, using other kinds of capabilities.

There are several firms producing the same kind of products in other parts of Tanzania (see table 9.8). Normally, these firms use another technique, called pressing, due to economies of scale. However, the spinning technique was known and used to a certain extent, at least at Metal Products in DSM, where the managing director worked before joining KIMESHA. Hence, the technique as such did not provide any contribution of capabilities. Instead, it is to be considered merely as an extension of production capacity, and should be evaluated as such. It should be pointed out once again that this project did not involve any training in Sweden and was thus less costly. Instead, training capacity in Tanzania was utilized (at Metal Products Ltd.).

The SI programme's contribution to the managerial capability stock of KIMESHA has been almost negligible. The managing director obtained his capabilities on his own from previous sources.

Company	Location	No. of empl.	Ownership	Product	Production capacity	Capacity utiliz.	Production process	Geographical market
KIMESHA	Arusha	23	African	sufrias,etc basins	40 tons/y	100%	spinning welding	DSM,Tanga,Arusha Musoma, Moshi
COTEX Metal & Machinery	DSM	2000	Foreign	melamin table ware	high, if raw mat.	33%	compression moulding	na
DSM Cottage Ind.	DSM	100	Asian	sufrias	240 tons/y	na	presses	Northern and eastern
Jays Metal Products	Mwanza	100	Asian	sufrias	320 tons/y	na	presses	Mwanza,West lake
Metal Products	DSM	200	Foreign	sufrias, tamblas frying pans, etc	4710 tons/y	35%	12 presses à 4000 items/d (also spinning)	Country wide
Runume Aluminium W.	Songea	10	Asian	sufrias	very low	na	presses	Southern zone
Tanganyika Enamel Ware Factory	DSM	50	Asian	enamel pots, sufrias	6000 items	8%	enamel pressing	Country wide
Tanzania Cutlery Manufacturers Co.	DSM	na	Asian	sufrias	na	na	presses	DSM
Zanzibar Small Scale Industries	Zanzibar	50	African	heavy Al-ware anodizing	800 tons/y	na	anodizing presses	Zanzibar and Tanganyika

Sources: MEIDA 1981, TISCO 1981 and interview with KIMESHA in January 1983

Table 9.8 KIMESHA and its competitors

NEM - capability contribution to Tanzania

According to the TISCO directory, there is only one company in the country making fuse boards besides NEM. The directory does not indicate whether this production was started before the SI project. However, several of the operations, relatively simple sheet metal work, existed in several workshops around the country (see table 9.9). In the case of fluorescent fittings, there was another firm that had planned to start production and had a prototype ready, but received no allocations of foreign currency for the imported components.

Company	Location	No. of empl.	Ownership	Product	Production capacity	Capacity utiliz.	Production process	Geograph. market
NEM	Arusha	29	African	fuse boards fluoroscent fitt. el. switch cases	60 000 units 30 000 units na	33 %	Sheet metal work and assembly	Tanzania and export
Cotex Metal and Machinery	DSM	2000	Foreign	el. distribution lines fittings	350 000 units	21 %	na	na
Electrical Equipment Assembly	DSM	na	na	fuse boards el. switch cases	na	na	na	na
Electric Works	DSM	na	na	el. switch cases	na	na	na	na
PAL Electric Manufacturers	DSM	35	Asian	fluoroscent fitt. el. switch cases	na na	0 %	Sheet metal work and assembly	DSM

Sources: MEIDA 1981, TISCO 1981 and interviews with NEM in January 1983 and PAL Electric Manufacturers in December 1982

Table 9.9 NEM and its competitors

Hence, the technology already existed in Tanzania, although the firm-specific knowledge of making fuse boards according to Swedish standards was unknown in Tanzania. The capabilities gain to Tanzania was limited in this project, especially as so a large share of technological and managerial capabilities came to the company through the selection of its management team.

UHANDISI - capability contribution to Tanzania

When UHANDISI was started in 1978 there was already some production (Tanzania Wire Products) of wood screws and rivets in Tanzania. COTEX probably extended into this kind of production in 1980-81, according to the production volumes in the MEIDA directory. The machinery used is of the same type in most units, i.e. cold forming (see table 9.10).

Company	Location	No. of empl.	Ownership	Product	Annual production capacity	Capacity utiliz.	Production process	Geographical market
UHANDISI	Arusha	8	African	wood screws rivets	9 M units 11 M units	30 %	cold-forming	DSM, Arusha
Bolt Industry	Arusha	na	African	bolts & nuts rivets	na	na	na	na
COTEX Metal & Machinery	DSM	2000	Foreign	wood screws steel rivets	36 M units 14 M units	0 % 20 %	cold-forming, electro plat.	DSM, Zanzibar
Dodoma District Development Corp.	Dodoma	na	DDC	screws rivets	na	na	na	na
Fit Tight & Bolts	DSM	na	na	screws	na	na	na	na
Tanzania Wire Products	DSM	40	Asian	wood screws	40 tons (13 M units)	75 %	cold-forming	na

Sources: MEIDA (1981), TISCO (1981) and interviews with UHANDISI in January 1983

Table 9.10 UHANDISI and its competitors

The start of UHANDISI can be seen in a regional perspective as a way of developing the capabilities needed within the African community, considering that the main competitor in 1978 was run by Tanzanians of Asian origin. Nevertheless, the technological and managerial capabilities needed could already be found in the country, and hence the contribution was limited and primarily an extension of the production capacity regionally.

MAFOTCO - capability contribution to Tanzania

There are no other forging plants in the Kilimanjaro region. In Arusha, Themi Farm Implements used to produce ploughshares as a response to market shortages. However, their technique was inferior for this kind of product and production has now been discontinued.

There are some forging plants in Tanzania, such as Mangúla Mechanical Machine Tools, Ubungo Farm Implements (UFI) and Zana Za Kilimo. UFI is a direct competitor in the area of ploughshares, and was already in production before MAFOTCO planned to start. Hence, there was some knowledge of forging in the country prior to the SI project's start (see table 9.11).

Company	Location	No. of empl.	Ownership	Product	Annual production capacity	Capacity utiliz.	Production process	Geographical market
MAFOTCO	Moshi	12*	African	plough shares forged blanks	20 000 units 150 ton	na	drop hammer	Moshi, Arusha
Jackson Ogayo Black Smith	Musoma	na	na	plough parts	very low	na	na	local
Mang'ula Mechanical Machine Tools	Mang'ula	na	Parastatal	forgings	350 ton	na	pneumatic hammer	na
Themi Farm Implements	Arusha	20	African	plough shares	low	discontinued in 1983	lathe	Arusha
Ubungo Farm Implements	DSM	800	Parastatal	plough shares	280 ton	67 %	hot forging lines	Country wide
Zana Za Kilimu	Mbeya	200	Parastatal	na	na	started in 1982	hot forging lines	Southern regions

* = 12 empl. at start-up period. The number will be around 40 empl. at full production, according to the managing director

Sources: MEIDA 1981 and interviews with MAFOTCO in January 1983, Themi Farm Implements in December 1982 and Bångens & Tholfsson 1986

Table 9.11 MAFOTCO and its competitors

However, MAFOTCO is the base for several other SI projects that make different hot-forged products from blanks made at MAFOTCO, including scissors, knives and spanners of a higher quality than previously produced in Tanzania. Hence, it is not possible to judge MAFOTCO by itself. The combination of SI projects in Moshi provided different product-specific production capabilities although the forging technique as such existed previously in Tanzania. The contribution of administrative capabilities was more limited in this SI project.

PEMACCO - capability contribution to Tanzania

According to our knowledge, PEMACCO is the only firm in Tanzania that makes electrical motors. Its function as a service workshop for rewinding and renovating electrical motors and generators is not new for the country, as there already were some minor winding and repair shops. However, PEMACCO is a company of a very different size and quality. Hence, the contribution of production capabilities has been substantial. The mangement selected had considerable prior experience, but nevertheless, this SI project also provided entrepreneurial capabilities.

TANLOCKS - capability contribution to Tanzania

According to MEIDA (1981b), there were two small companies making padlocks in the country, one in Ujamaa village in Lindi and a DSM-based firm. These firms probably have very limited markets and probably do not make the same type of high-quality brass padlocks that TANLOCKS makes. The only evidence of competition that we have seen at retailers have been Chinese or other foreign-made locks of a quality inferior to the TANLOCKS type. No other producer of mortice locks (door locks) was found in the directories (see table 9.12).

Company	Location	No. of empl.	Ownership	Product	Annual production capacity	Capacity utiliz.	Production process	Geographical market
Tanlocks	Moshi	26	African	padlocks mortice locks	100 000 units 40 000 units	23 % 0 %	Machining, assembly	Country wide
The lay Apostolate Council	DSM	na	na	padlocks	na	na	na	na
Mkutungoe Ujamaa Village	Lindi	na	Ujamaa village	Padlocks	very low	na	na	local

Sources: MEIDA (1981) and interviews with Tanlocks in January 1983

Table 9.12 TANLOCKS and its competitors

Hence, if successful, the transfer project would provide qualified capabilities in high-precision metal processing industry. However, at the time of our data collection (Dec. 82), this was not fully accomplished.

9.3 Discussion

First, the determination of costs for the SI projects are discussed and then, an evaluation is provided of the size and character of the SI projects' benefits. Lastly, the benefits are discussed in relation to the costs.

9.3.1 Determination of costs for the SI projects

Other research (Teece 1976) has shown that considerable costs are involved in technology transfer. The SI projects, is no exception, as the costs for capability acquisition have been substantial. According to table 9.4, these vary between 230.000 SEK and 4.2 M SEK per junior sister. If we only consider the Swedish in-plant training, these costs vary between 100.000 SEK and 2.150.000 SEK. The question remains if these costs are reasonable.

In this section, the criteria and procedures for selecting the technology supplier is discussed, with special reference to its influence on the price. The specific procedures for deciding the price of hardware is also described. Lastly, there is a comparison with the costs of other kinds of international training programmes as well as a discussion of the relevance of this type of comparison.

The selection of Swedish suppliers has been criticized because it is done without different potential suppliers competing (Niklasson 1983). One reason for this might be that the number of potential suppliers in Sweden is not large in each industry. In several cases, however, almost all producers of a certain product have been approached, e.g. cutlery producers. Another reason might be limitations in Fide's capacity to approach all potential suppliers. However, part of the explanation is that a long-term technology transfer project is more than just a simple one-time business negotiation. Other judgements are made (or should have been made) concerning the senior sisters' economic stability, long-term interest and suitability for technology transfer. The purpose has thus been to negotiate an agreement that provides the supplier with a profit hopefully sufficient to motivate a long-term involvement in the project (9:19). A condition for a good long-term relationship is that a business relation develops by which both parties benefit. This type of appraisal makes very high demands on the capabilities of the negotiators, i.e. on the experiences and abilities of SIDO, its consultant Fide and other assisting firms of consultants.

There are two ways to settle the price of hardware at a fair level. For new machines and equipment, the invoice price is used with a slight percentage increase. For second-hand equipment, SIDA has appointed a separate firm of machine consultants that makes an independent evaluation of the proposed machinery. These consultants have sometimes not approved the machinery proposed by the senior sister and this has then resulted in the replacement or repair of inferior machines. Their evaluation of the machinery has formed the basis for setting the price, which hence has been market-related in Sweden. The second-hand market for machine tools in Sweden has undergone a certain increase over the last ten years. According to our information, this may partly be due to the increased purchase of such machines by different LDCs. Nevertheless, hardware costs in the SI programme are controlled, but the prices can still be considered quite good for fully depreciated machinery. Especially as some senior sisters were not fully aware of the existence of this second-hand market for their machinery prior to the SI project.

In summary, the total price paid by SIDO has not been very low but it has been kept within certain limits by the SI programme's control system. However, a substantial profit margin might have been a prerequisite for the senior sisters' involvement in technology transfer to Tanzania.

This study makes comparisons with other forms of international capability transfer projects only to a limited extent . However, the costs of in-plant training in Swedish firms can be compared with the costs for some other international training programmes (9:10). According to Forss (1985a), referring to information from UNIDO, the real cost for training in Western Europe, USA and Canada "... is likely to be around US$ 5.000 (SEK 40.000) per man-month ..." (p. 36). According to our table 9.1, the monthly cost for the Swedish in-plant training was 28.876 SEK, thus considerably cheaper then the UNIDO cost.

Forss (1985a) also offers some data on training programmes carried out in Tanzania, as a further comparison. A UNDP 23 week course for 20 participants had a monthly cost of 9.460 SEK in 1981. The comparative cost from our table 9.1 is 13.830 SEK, i.e. 46% more expensive. On the other hand, larger Swedish MNCs offering specialized courses in connection with delivery, service and maintenance of their products, show a cost of 25.000 SEK per man-month in 1985. The SI in-plant training is only slightly more costly 28.876 SEK, (15.5%).

In his study (1985a), Forss draws the conclusion that the Swedish programmes are expensive (9:11), and that manpower development in general is expensive. We agree to a certain extent, as there is a substantial cost involved in arranging international training programmes. However, it is not possible to directly state that something is expensive without relating it to the effects and impact of the training (9:11).

Furthermore, it is not so meaningful to compare costs of general training programmes with in-plant training for a specific industrial project like the SIs, as each training programme is unique. Hence, it is essential to look not only at the costs but also to consider the specific benefits to be able to judge if a programme is expensive or not.

In the next section we turn to the benefits and in the concluding section 9.3.3, the benefits are discussed in relation to costs.

9.3.2 Evaluation of the size and character of the benefits

The investment decisions concerning selection of SI projects have to be analysed with due regard to the prevalent knowledge and trends in 1977-1978, when the SI programme was initiated. Because Tanzania's economic environment underwent a major change, it is also of interest to view the contributions of capabilities and production capacity in the light of Tanzania's economic development during the post-1978 era. The primary factor influencing the ex ante analysis in relation to the ex post analysis is a drastic decline in capacity utilization in Tanzanian industry.

In 1976 and 1977, when the outline of the SI programme was made and the first SI projects were initiated, the industrial sector showed a relatively positive trend. After some troublesome years in the mid-70s, the annual increase of value added in the manufacturing sector was 6.4% and 5.8% in 1976 and 1977 respectively (see table 9.13). One contributing factor was the 'coffee boom' that had improved the balance of payment situation, which also influenced the availability of foreign currency for raw material import for the manufacturing sector.

Year	Annual change in value added (%)	Share of manufact. in GDP (%)
1972	+8.4	10.0
1973	+4.5	10.1
1974	+1.4	10.0
1975	+0.3	9.5
1976	+6.4	9.5
1977	+5.8	9.4
1978	+3.3	9.2
1979	-2.1	8.5
1980	-13.2	7.1
1981	-28.2	5.8

Table 9.13 Trends in value added in manufacturing 1972-1981
Source: Wangwe 1983

At the time when the products and technology were selected for the 8 SI cases studied, the Long Term Industrial Plan (1975-1995) was the most influential policy (see section 4.2.2 for a further description). The Long Term Plan emphasized the role of metal processing industry as an initial step in the basic industry strategy that would lead to the establishment of a local steel industry. The guidelines were, however, relatively general, which made them less useful as a direct guide for micro level decision making. In practice, almost any kind of industrial firm could be seen as belonging to the group given priority. The eight SI cases may all be considered as projects that fulfill the demands of the Long Term Plan.

	PRODUCT	BASIC INDUSTRY	BASIC NEED	SPARE PARTS FOR SPECIFIC AREAS	LOCAL RAW MATERIAL
AMI	valves	metal processing construction material	construction water	water	no
FAWIPMA	fencing wire mosquito net	metal processing	health service	no	no
KIMESHA	aluminium utensils	metal processing	no	no	yes
NEM	fuse boards	metal processing construction material	construction	no	no
UHANDISI	screws and rivets	metal processing construction material	construction	construction and transport	no
MAFOTCO	forged blanks plough shares	metal processing	no	agriculture	no
PEMACCO	electrical motors	metal processing	no	industry	no
TANLOCKS	mortice locks padlocks	metal processing construction material	construction	no	no

Table 9.14 The national development goals and the SI projects

As can be seen in table 9.14, many of the criteria for priority are fulfilled by the SI firms. The main exception is the use of local raw material, where only KIMESHA buys raw material locally (although the raw material, aluminium circles, is bought from Aluminium Africa, who import the aluminium before processing it). On the other hand, the start of the priority-status metal processing industry unavoidably means import of raw material (9:13).

Thus, the national development goals were expressed in such a general way that they do not work as direct guidelines on the level of project selection. This means that all the projects selected in the SI programme could be seen as belonging to the priority group. If these criteria were used for evaluation, all SI projects would be considered successful.

If, on the other hand, the analysis takes into consideration the present economic crisis, the evaluation will differ. The combined Tanzanian investments in industrial capacity since the late 1970s seem, in light of the economic crisis, to have been a waste of resources, from a macro-economic standpoint. According to Skarstein and Wangwe (1985), the capacity utilization in the manufacturing industry fell from 78% in (1970) to 69% in (1978) to 36% in (1981) and finally to 27% in (1982) (9:14). Havnevik et al. (1985) conclude that, "... the 10.000 million Shs invested in manufacturing industry during 1977 to 1980 to a large extent represented a waste of resources because the additional productive capacities were obviously not taken into use." (p. 300)

The capacity utilization is not known for all of our case projects' competitors. However, a rough estimation based on tables 9.6 - 9.12 provides the following capacity utilization for the competitors. The SI's capacity utilization is not included in the value for the competitors. (See table 9.15 and 9.16)

	Capacity utilization	
	Junior sister	Competitors
FAWIPMA	21%	5.5%
KIMESHA	100%	30%
NEM	33%	20%
UHANDISI	30%	20%
MAFOTCO	n.a.	70%

Table 9.15 Capacity utilization
Source: Table 9.6 - 9.12

Referring to the above and the general situation, it seems like the average capacity utilization in the industries where the SI projects take part is about the same as in the manufacturing sector in total. However, the differences are great among the SI projects' industries. In the case of forging, the capacity utilization is very high (MAFOTCO), especially as compared to fencing wire and wire mesh (FAWIPMA). This probably reflects the fact that the forging units produce input for agriculture, which is the sector given most priority in the crisis economy (9:15).

The low capacity utilization is primarily an effect of many firms competing for a restricted supply of foreign currency for raw material import. In this situation, a new investment which requires foreign exchange has a very high opportunity cost since it is necessarily associated with lower capacity utilization in existing industry. The alternative is always to use the foreign currency to buy raw material for the existing industry. The lack of foreign exchange may also hinder full utilization of the new investment. Hence, the assumed net benefits of an investment may turn into a net loss for the country if macro-economic conditions, such as the supply of foreign currency, change.

The SI projects have only succeeded in obtaining allocations of foreign currency through the common application procedures to the Bank of Tanzania a few times. Instead, the capacity utilizations of the SI projects are a direct result of import support financed by Swedish foreign aid. Given the high opportunity cost of this foreign exchange during this specific period of economic crisis in Tanzania, it appears that the SI projects, like most other investments since 1977, did not generally make a positive contribution. However, each project has to be considered in detail before a final evaluation is made. For example, MAFOTCO earns foreign currency by making blanks for knives, which are exported, and PEMACCO's contribution through service and repair of electric motors might still contribute to the Tanzanian economy. However, this kind of effects are not studied in detail in this analysis .

In summary, if we make an ex post analysis in the light of the present economic crisis, it would have been less justified to start several of the projects within the SI programme today due to a high opportunity cost of the foreign exchange component of the project costs. A better alternative, in several cases, would have been to use it to ensure a high utilization of the capacity of already existing plants. However, even today, it might have been justified to start those projects that are competitive on the export market and those producing products of specific merit value, such as electrical motor repair and service, which probably would have resulted in a net saving in foreign currency. Other projects without specific influence on foreign currency or on capacity utilization in other industries would be less justified given the extremely low capacity utilization in Tanzanian industry at present. If, on the other hand, we regard the projects in the perspective of the prevailing policy (the 20-year Long Term Industrial Plan), at the time of the projects' initiation, the situation looks different. In that case, given the economic trends at the time of the formulation of the Long Term Plan, the investments in the SI projects seem to be justified.

The above discussion is on a relatively general level; below we study each of the eight case projects in more detail.

9.3.3 Costs in relation to benefits

A conventional way of analysing the social contributions of projects is through social cost-benefit analysis (9:16).

Niklasson (1983) made a social cost-benefit analysis of four early SI projects. He considered the direct economic effects of the projects in relation to the alternative of importing the products. He found that KIMESHA probably made a positive contribution to Tanzania, while AMI did not. The reason for AMI's negative outcome, according to Niklasson, was primarily the high investment costs in relation to the low price of imported products. Niklasson based his analysis on traditional economic theory and did not consider any long-term effects such as learning or the creation of entrepreneurship. Niklasson made an assumption that this type of long-term effects would be the same in a project which shows a positive social value and in one that has a negative value, and hence, he assumed that the relevant goal was to identify the project which yielded a positive value according to traditional economic theory. The present analysis, is on the other hand, not a social cost-benefit analysis of the above type. Instead, we are especially concerned with these long-term effects as we believe that these effects are of specific importance for the industrial development of a country, and that they may vary considerably between different projects (9:17).

The long-term benefits of technology transfer are of primary interest in this study. Hence, the analysis concerns the senior sister's contribution to enhance the capabilities within the junior sister, the diffusion of capabilities and the linkage and network effects of the individual projects. These benefits can then be discussed in relation to the costs paid by Swedish aid money. We also need to consider, however, the opportunity cost of the managerial resources as well as of the foreign exchange component of the projects. A summary table of the costs and benefits of the SI projects calculated in this way is provided below (table 9.16), but since the benefits are of different types and occur at different moments in time we have provided a detailed discussion of each of our eight case projects.

	Senior Sister's contribution to the junior's acquisition of capabilities				Type of contribution for Tanzania	Capacity utilization		Opportunity cost of the		Linkages	Capability acquisition cost (M SEK)
	Static		Dynamic			in the junior sister	in the industry	foreign exchange component*	SI entrepreneurs		
	Prod.	Adm.	Inv.	Ent.							
AMI	High	Some	Some	No	New type of production	50%	n.a.	Low	Low	Subcontractor to NEM	3.0
FAWIPMA	High	Some	No	No	Extension of production capacity	21%	5.5%	High	Medium	No linkages	1.0
KIMESHA	Some	No	No	No	Extension of production capacity	100%	30%	High	High	Subcontractor to NEM and inputs from several SI firms	0.2
NEM	Fair	No	Some	Some	Not initially but later as an exporter	33%	20%	Low	High	Linkages to several SI firms	0.8
UHANDISI	Some	No	No	No	Regional distribution of production	30%	20%	High	Low	Subcontractor to NEM and KIMESHA	0.6
MAFOTCO	High	Some	Some	No	Provides inputs	n.a.	70%	Low	Medium	Linkages to all for other firms SI firms in Moshi	4.2
PEMACCO	High	High	Fair	Fair	Essential for Tanzanian industry	n.a.	n.a.	Low	High	Natural linkages to firms inside and outside the SI programme	1.8
TANLOCKS	Fair	No	No	No	Import substitution	20%	n.a.	Low	Medium	No linkages	2.4

Table 9.16 Summary table of costs and benefits
Source: Tables 7.3, 8.7, 9.4, 9.6-9.12 and 9.15
* see note 9:18

AMI has obtained substantial production capabilities through the SI project. Administrative capabilities have, on the other hand, been acquired mainly by hiring locally skilled personnel. Through its own experiences and its programme of recurrent training design, AMI has managed to acquire some inventive but no entrepreneurial capabilities. Contact with the senior sister has been close and provided valuable supplementary advice and training opportunities in a variety of fields over the years. The senior sister has not assisted in developing export markets. The production is of a type which is new for Tanzania, a small number of products made in relatively large volumes, and the product quality is high. AMI's capacity utilization has been relatively high (50%) and there is a stable demand for the products in Tanzania. The ordinary products (valves) do not seem to be competitive on the world market, the reason primarily being the costly raw material that has to be used due to the production technique, sand-casting. Competitors, like the senior sister, use the pressure casting technique and obtain economies of scale and the advantage of being able to use cheaper raw material. The choice of technique is due to the limited Tanzanian market and its limited need for different-sized valves (low production volumes). There may be a possibility of importing raw material from Zambia in the future, which would have the advantage of increasing the business linkages between African neighbours. There are no real competitors within the country, and the alternative would thus be to import the product. The technology is very flexible and allows the production of a wide range of cast products. There is a possibility of diversifying by supplying other Tanzanian industries with cast components. This offers possibilities of shortening their lead times. AMI is also, to some extent, linked as subcontractor to NEM, utilizing scrap metal from KIMESHA for this production. The SI entrepreneurs are parts of the local network, including business activities with other SI entrepreneurs parallel to their employment at AMI. The diffusion of capabilities from AMI has been limited; only a few persons have left and most of them were dismissed. However, the risk of losing some of the persons trained in Sweden is larger than in other projects as they are employees, not owners in the case of AMI.

The opportunity costs of the SI entrepreneurs were relatively low as they did not possess very qualified positions in their prior employments. The investment was the largest of the first generation projects, 3.1 M SEK in hardware and 3.0 M SEK in costs for capability acquisition. 1.5 M SEK of the latter sum is the know-how cost, which was the highest among the eight case studies. The cost for capability acquisition was thus 84.857 SEK per employee. Seven persons have been trained in Sweden, two of them twice. The investment in these seven persons was 424.286 SEK per person (assuming that these persons share the total capability acquisition cost, see note 9:19).

In conclusion, the AMI project contributed different kinds of capabilities previously not available in Tanzania. Furthermore, the opportunity cost of the SI entrepreneurs as well as of the foreign exchange component were low. On the other hand, the cost of both the capability acquisition and the hardware investment were substantial.

FAWIPMA has acquired production capabilities from the Swedish senior, but other types of capabilities have been acquired locally. Administrative and entrepreneurial capabilities were acquired through the hiring of an experienced manager and inventive capabilities through the firm's own product developments. FAWIPMA has a link to its formal sister, the consultant Fide, but the support from this contact has been limited to the same type of general support Fide provides other junior sisters. The products were already produced in several firms in the country, which show a very low capacity utilization (5.5%). For reasons mentioned above, this indicates that the start of FAWIPMA might have been a loss to Tanzania. Furthermore, the hand-looms used by FAWIPMA for the production of coffee tray wire resulted in a product quality inferior to the competitors. FAWIPMA's product quality might have made selling difficult if there had not been a shortage of the product. This kind of machine has recently been replaced by automatic machines of a type similar to that used by as the competitors. The fencing wire is made by another technique than the competitors'. FAWIPMA uses semi-automatic machines while the competitors have automatic machinery. An advantage of FAWIPMA's machinery is that it is manufactured locally at the industrial estate. This machine has even been copied by a new local competitor, which might point to a larger potential market than the present capacity utilization indicates. The technology is not very flexible but it is simple with few production steps. The material itself, steel wire, can be used for a variety of products. FAWIPMA has no commercial links to other companies. Some persons have left the company to avoid hand-loom work, which is very strenuous. The worker dismissed from the fencing machine work is now doing the same job for a competitor on a machine that is a copy of the FAWIPMA machine.

The opportunity costs for the SI entrepreneurs are medium, as their services could have been used in other firms. The investment was 1.1 M SEK in hardware and 1 M SEK in capability acquisition or 58.353 SEK per employee. In this case the know-how cost was 216.000 SEK. Three persons have been trained in Sweden, one of them twice. The cost of capability acquisition was 333.333 SEK per person.

In summary, only production capabilities were acquired from the senior sister. Furthermore, the extremely low capacity utilization for FAWIPMA's competitors indicate that the investment is probably a loss for Tanzania

KIMESHA draws primarily on local capability sources and the contribution from the senior sister has been marginal, mainly limiting itself to an extension of production capacity. Some production/administrative capabilities have been acquired through contacts with the Swedish instructor and a visit to Sweden which took place after some years of running the business. The production technique was not new to Tanzania or to the SI entrepreneur. In comparison with the competitors, this technique shows disadvantages of scale, but it is, on the other hand, flexible and it is possible to make a great range of products according to the same formula, metal-spinning. Production is primarily geared to the local market but KIMESHA is also a subcontractor to NEM, making components for NEM's export products. KIMESHA uses local raw material (aluminium) and has a very high capacity utilization (100%), compared to the average (30%) in the industry. This means that KIMESHA is more successful in obtaining raw material than its competitors. Hence, the production at KIMESHA probably means a loss of production somewhere else in the country. Recently, the company has invested in a new production technique to obtain economies of scale, an investment that the managing director has tried to accomplish since the start of the company. There are many competitors in the country making the same or similar types of products. Most of these firms (90%) are owned by Tanzanians of Asian origin or foreigners. KIMESHA is linked through commercial relations to NEM as a subcontractor for different products, to UHANDISI as a user of rivets and to Meru Wood as a user of wooden handles for aluminium ware. The SI entrepreneurs are well connected to the local network. A few workers have left KIMESHA for other firms, but none is working with the specific spinning technique.

The opportunity cost of the SI entrepreneur is very high in this case, as he held the position of production manager in one of the large competing firms, and has now been replaced at this company by a foreigner. The question is if his abilities can be fully utilized in a small company such as KIMESHA or whether it is a loss for Tanzania, given the prevalent restrictions on investments and on raw material supply. Tanzania incurred the extra cost (in foreign currency) of paying for the expatriate manager (9:21). The hardware investment was 365.000 SEK and the cost of capability acquisition 230.000 SEK or 9.913 SEK per employee. Although the last cost is low, it is still questionable as there was probably no need to send a Swedish instructor for installation and start-up, as this could as well have been taken care of by the SI entrepreneur. However, a part of this cost refers to a later visit by the general manager and another person in Sweden, which is comparable to the second (step-wise) visit for the other SI projects. Hence, the capability acquisition cost divided between these two person was 115.000 SEK per person.

In summary, the contribution to Tanzania is doubtful in spite of this project's commercial and enterprising success. The contribution of capabilities to the junior sister was marginal. Furthermore, the opportunity costs of both the managerial resources and the foreign exchange component were high.

NEM's start was, to a large extent, based on a very qualified group of SI entrepreneurs. The contribution from the senior sister was more limited, but the firm-specific production capabilities were essential, while other types of capabilities were not provided initially. The recurrent training design has provided the SI entrepreneurs with training and opportunities through their own efforts to acquire dynamic capabilities. One of the main advantages of the SI programme has been that it has connected NEM to export customers. The initial selection of product (fuseboards according to Swedish standards) is questionable since it implied a change of standard in Tanzania without due regard to distribution problems of fuses, the existence of parallel standards and a high import content of components. On the other hand the production technique chosen is extremely flexible, allowing a wide range of alternative products, which NEM has also utilized to the full extent. Different competitors had the same type of equipment, since it is of multi-purpose type for sheet metal work. The import content has also been considerably lowered through the start of manufacture of components in Tanzania. NEM has shown to be competitive on the world market and currently exports products to Sweden (to third parties, not the senior sister). NEM also continuously gets new product ideas through the links to Sweden. NEM's capacity utilization (33%) is slightly above the average capacity utilization in the industry (20%). NEM is extremely well connected to the local network, through business relations and social relations. Several of the other SI firms are subcontractors to NEM, e.g. AMI, GIFCO, KIMESHA and KILECTRO, and NEM makes use of the Common Facility Workshops in Arusha, Moshi and Mbeya for a large tool programme to increase the share of locally produced components in its fuseboards. The diffusion from NEM into other kinds of industrial activities has been limited, although a number of individuals have left the company.

The opportunity cost for the SI entrepreneurs was very high, since they are very qualified and held important positions in other companies. During a transition period, NEM's managers assisted their former employees with advice concerning their specialist areas, which at least lowered the transition costs and some of the learning costs at this firm. It seems as though NEM may develop further to achieve the position of electric accessories supplier to East Africa, as it has a critical mass of managerial and technological capabilities and hence, the managements' abilities will be fully utilized in this new company. The hardware investment was 1.8 M SEK and the cost of capability acquisition was 780.000 SEK or 13.153 SEK per employee. There was no know-how cost. A total of five persons have been trained in Sweden, two of them twice. The investment in capability acquisition was 156.000 SEK per person.

In summary, NEM is a specific case which hardly could be regarded as justifiable considering the initial product selection and limited technology transfer. However, through the link to the international market, mediated by the SI programme, NEM is currently an exporter earning needed foreign currency for Tanzania. Also, the initial high import content has been covered. Hence, today, NEM seems to make an essential contribution to Tanzania and is thus justified, although the opportunity costs of the entrepreneurs were high.

UHANDISI's second management group has not received much assistance from its senior sister. The production capabilities have, to some extent, been developed, but other types of capabilities are still partly missing in UHANDISI. There is no longer any contact with the senior sister. UHANDISI's competitors were already using the same type of production technique. UHANDISI's capacity utilization is slightly above the industry average, 30% as compared to 20%. The products are made for the local market. Despite the low capacity utilization and shortage of raw material, UHANDISI has had difficulties selling parts of its product assortment (rivets). The SI entrepreneurs sell rivets to some of the other SI firms but are less well connected to the local network. However, owing to the problems which arose when the former management was dismissed, the estimation of benefits of the UHANDISI project is not directly comparable to the other SI projects, and the costs do not correctly reflect the investments in the present management. Some persons, including the former general and production managers, have left the company. These persons have started a new company, but the specific production technique has not been diffused. However, an assumption is that the administrative capabilities acquired at UHANDISI are of value for their new company.

The opportunity costs of the present managers are relatively low. The hardware investment was 599.000 SEK and the cost of capability acquisition was 610.000 SEK including 150.000 SEK for know-how. This means 76.250 SEK per employee for a capability acquisition which, to a large extent, has diffused out of UHANDISI. A total of four persons have been trained in Sweden and, thus, the investment has been 152.500 SEK per person.

In summary, the UHANDISI project is not directly comparable to others, as the cost and capability contribution is negatively influenced by causes outside the control of the transfer project. Nevertheless, the project seems to merely be an extension of production capacity regionally.

MAFOTCO has primarily received production capabilities from its senior sister. Administrative and dynamic capabilities were, to a large extent, missing. However, when we made our data collection, MAFOTCO was still in its phase One, i.e. was starting up. MAFOTCO has very close links to its senior sister and is a subcontractor to MOCCO, and is competitive enough to make contributions to export. There are other forging units in Tanzania, and the production capabilities as such were not new to the country. The capacity utilization in the industry was, however, quite high (75%), indicating the need for further production capacity. The technology is very flexible and makes production of different products possible, as long as the company has access to tool making capabilities. Specific for MAFOTCO is that it produces blanks for a large number of the SI firms at the industrial estate in Moshi. MAFOTCO hence has a large number of commercial linkages, to the local networks as well as internationally.

The opportunity costs of the SI entrepreneurs were medium. The training periods were extremely long (approaching 2 years) in this case, and this in itself represents a certain opportunity cost for lost working hours. However, this long training period was partly a result of delays in the construction of the forge building. The hardware investment was 6.5 M SEK and the cost of capability acquisition 4.2 M SEK or 131.656 SEK per employee. The know-how cost was 700.000 SEK. Nine persons have been in Sweden for training, i.e. the investment in these persons was 467.000 SEK per person.

MAFOTCO cannot be evalutated separately from the other firms in the Moshi industrial estate. MAFOTCO is the heart in the 'development block' of metal processing firms. It thus has a merit value and cuts down the import content of inputs for these industries. Furthermore, the opportunity cost of the foreign exchange was low since the capacity utilization was high for the industry. Hence, MAFOTCO seems to be justified, especially as it also produces spare parts for high-priority agriculture as well as blanks which are later exported.

PEMACCO has a very qualified management group and they have acquired substantial contributions of static as well as of dynamic capabilities from their senior sister. The link to the senior sister has developed further and PEMACCO has started a joint-venture together with the senior sister. There were no previous functioning production units in the country, and the need for repair and service of electrical motors and generators is substantial in Tanzania. In this field, there are some small competitors, but not with the same type of capabilities and resources. The flexibility of the technology is not very high but there is a very high demand for PEMACCO's services. PEMACCO has a lot of natural linkages to different producers of machines and equipment, as their electrical motors can be used for almost any kind of machines. Other SI firms have been customers in order to make their own production equipment. PEMACCO, orginally situated in Mbeya, now also has a large service and repair unit for electric motors in Dar es Salaam, close to the major customers. Its contact network is very wide.

The opportunity costs of the managerial resources were high in this case, as all SI entrepreneurs held high positions in one private industry, one parastatal and one leading management education institution. The hardware investment was relatively low (689.000 SEK) and the cost of capability acquisition was 1.75 M SEK or 79.545 SEK per employee. A total of six persons have been in Sweden for training and the investment was thus 291.667 SEK per person.

In summary, although the opportunity costs of the SI entrepreneurs in PEMACCO were high, the benefits seem to clearly outweigh the costs. The training provided an acquisition of both static and dynamic capabilities in an industry badly needed in Tanzania.

TANLOCKS was given a fair contribution of production capabilities by its senior sister. However, other kinds of capabilities were missing. TANLOCKS has no link to its senior sister anymore. There is a need for the product in the country and the local competitors are minor and do not produce the same quality of locks. TANLOCKS capacity utilization has been 20%, but this partly reflects production difficulties as a result of insufficient production capabilities. The alternative is for Tanzania to import locks. Some of the machinery is multi-purpose and other equipment is more specialized. At present, it seems difficult to have other, parallel production, as the management still has to learn to master the lock production. TANLOCKS uses another SI firm as its subcontractor for surface treatment.

The opportunity costs for the SI entrepreneurs were medium. Recently, some of the entrepreneurs have been replaced by new persons that have been to Sweden for training. The hardware cost was 3.1 M SEK and the cost of capability acquisition was 2.4 M SEK, i.e. 93.923 SEK per employee. The know-how cost was 865.000 SEK. TANLOCKS has had six persons trained in Sweden, and the investment in capability acquisition was 400.000 SEK per person.

In summary, this project may have been justified, although the linkages to other firms are limited. However, the technology transfer has, in this case, not been efficient, partly due to the selection of entrepreneurs and partly to the senior sister's qualifications with the result that it does not appear to be very viable.

A coarse estimation of the cost effectiveness of the senior sisters' contributions to the juniors' capability acquisition is made in table 9.17. It is primarily used to provide a basis for rank ordering the projects' cost effectiveness, and is based on the calculation of the value of the senior sister's contribution from table 7.6. This value is divided by the cost of capability acquisition per trainee who has been trained in Sweden (9:19). The resulting number can be used as a rough measure of the SI projects' relative effectiveness from the perspective of the junior sister. The higher the number, the more cost effective is the project, i.e. the more value in terms of capability contribution per invested money unit. It consists of a rough estimation of the Swedish contribution in relation to the 'Swedish' costs. However, the opportunity cost of the entrepreneurs and of foreign exchange as well as different externalities are excluded.

	The value of the senior sister's contribution to capability acquisition in the junior sister	Investment in capability acquisition per trainee (M SEK)	Relative measure of cost effectiveness	Rank order
AMI	42	0.424	99.1	4
FAWIPMA	42	0.333	121.1	3
KIMESHA	8	0.115	69.6	6
NEM	40	0.156	256.4	1
UHANDISI	4	0.153	26.1	8
MAFOTCO	36	0.467	77.1	5
PEMACCO	70	0.292	239.7	2
TANLOCKS	28	0.400	70.0	6

Table 9.17 Relative measure of SI projects' cost effectiveness

In this type of comparison, the NEM and PEMACCO cases stand out. According to table 9.17, these projects have provided more value in terms of capability contribution for the invested foreign aid money. One explanation might be the SI entrepreneurs' prior education and learning that enabled them to benefit from training and learning to a greater extent. FAWIPMA and AMI come next in cost effectiveness. In the AMI case, the know-how component is substantial, 1.5 M SEK. The classification and size of this component obviously influences this project's cost effectiveness but AMI is still among the upper half (9:20). UHANDISI, KIMESHA and TANLOCKS have the lowest cost effectiveness,

The evaluation, according to table 9.17, has many limitations. As all cost are at current values, the relative measure of MAFOTCO is especially negatively influenced owing to the inflation and this projects' duration. Hence, the three second generation projects have a somewhat better cost effectiveness than the table shows (9:22). Furthermore, although this type of calculation provides a quantitative measure, the figures used are based on qualitative judgements (see also table 7.6 and note 7:7).

Moreover, due consideration is not given to the opportunity costs of both the managerial resources and of the foreign exchange input. While it is not possible to find a conclusive quantitative ranking in which these variables are included, a sensible discussion in which we include also these variables is possible. From the firm perspective (in table 9.17), NEM and PEMACCO rank highest and their relative cost efficiency is far superior to that of the remaining firms. Both these firms have a low opportunity cost for the foreign exchange component and a high opportunity cost for the managerial resources. Including these variables would therefore not change the ranking between these two projects. Their cost efficiency superority probably means that the inclusion of the two opportunity costs does not affect their position vis à vis the remaining firms. The ranking of AMI and FAWIPMA would probably be reversed since FAWIPMA has high and medium opportunity costs for foreign exchange and managerial resources respectively, while AMI has low opportunity costs. It may even be argued that MAFOTCO should be ranked ahead of FAWIPMA since MAFOTCO has a low opportunity cost for foreign exchange. TANLOCKS should clearly be ranked before KIMESHA since the latter has high opportunity costs in both respects. Finally, UHANDISI should probably be placed last in this type of ranking also.

The findings above permit a comparison, resulting in three alternative ways of evaluating projects. First, a traditional SCB analysis as undertaken by Niklasson (1983). Second, our estimate of cost efficiency of the SI project from the point of view of the junior sister. Third, our alternative ranking where we included also the opportunity costs of the foreign exchange component and of the managerial resources. This comparison is limited here to two of our eight case projects, AMI and KIMESHA. According to Niklasson's (1983) conventional cost-benefit analysis, starting KIMESHA could be justified but AMI had a negative effect on Tanzania. This is the opposite result to that of our analyses, according to the cost effectiveness analysis in table 9.17. (9:23). In our ranking from the perspective of the firms, AMI is ranked as 4 and KIMESHA as 6. Furthermore, including the other variables results in AMI being ranked number 3 and KIMESHA number 7.

This suggests that an interesting difference in result may be obtained depending on the evaluation method used. The more qualitative methods focusing on actual capability contributions and therefore on long-term effects on industrialization and on the opportunity costs of the managerial resources and the existence of surplus capacity among local competitors, result in another priority. These methods chiefly aim at providing a dynamic evaluation for the benefit of industrialization which is in itself a dynamic process. This indicates that the traditional cost-benefit analysis in its normal form, disregarding this type of dynamic consideration, provides a more static conclusion. (9:24)

Our emphasis on estimating dynamic, long-term effects and on alternative uses of the people being trained does not mean that we consider other calculation methods of no value. Rather, they are important for the evaluation of projects (9:25), but we prefer to consider the dynamic effects as they are so essential to industrialization that they should be of primary concern for policy- and decision-makers. Instead of the Niklasson (1983) proposition of first selecting viable projects according to SCB analysis and then making long-term considerations, we prefer the opposite order, i.e. to first consider and give priority to projects with long-term dynamic effects and then to select among the projects given priority according to more short-term static methods. It could be pointed out that "... in contrast to what Western economists recommend ... neither the Japanese, Soviets, nor Chinese appear to have made an explicit benefit/cost calculation before and during ... Rather, they viewed the issue as a political choice ... " and they used, "... a kind of opportunity cost criterion." (Morse 1975, pp. 54-55).

9.4 Conclusions

The variation in costs and benefits for Tanzania is large between the different SI projects. Some projects only provide an extended production capacity, sometimes with distributive effects to new regions or new groups of the population, whereas other projects provide genuine contributions of capabilities and new kinds of production capacity.

A closer study of the SI programme's cost components shows that the average cost of in-plant training in Sweden is about the same or slightly below the cost of comparable international training programmes. The traditional governmental method of inviting competitors to tender for contracts has not been used in the SI programme. One reason is the limited supply of Swedish firms with the needed production. Another reason is the selection procedure for finding suitable technology suppliers which involves a wide range of careful considerations and not only the question of lowest bid. These include evaluation of the supplier's economic stability, long-term interest and suitability for technology transfer. The purpose has thus been to negotiate an agreement that provides the supplier with a sufficient profit to motivate long-term involvement in the project. This type of reasoning places very high demands on the capabilities of the negotiators, i.e. on the experience and abilities of SIDO, its consultant Fide and other assisting firms of consultants.

The great majority of the SI projects were started in accordance with Tanzania's Long Term Industrial Plan, the import-substitution strategy and the development trends for the industrial sector in 1976-77, when the SI programme was initiated. All the SI projects could be classified as priority projects in the context of this plan.

During the first half of the '80s, Tanzania has, however, undergone an economic decline resulting in a severe under-utilization of industrial capacity (below 30% in 1982). Nevertheless, there were substantial investments in new industrial capacity during this time, which, to a large extent, indicate a waste of scarce resources, since the new capacity was never used and impeded already existing industries with competition for scarce raw material. In reference to these general economic conditions, some of the SI projects should never have been started, among others FAWIPMA which primarily provides an extended production capacity to an industry with an extremely low capacity utilization (5.5%). The start of UHANDISI can be justified from the point of view of regional diffusion, but is foremost an extension of production capacity and does not provide any actual capability contribution to the country. The contribution to Tanzania in the case of KIMESHA is also doubtful in spite of this project's obvious commercial and enterprising success. In addition, the question is whether scarce managerial resources are used in the best way or if the transfer of KIMESHA's general manager from his previous employment in a large competing firm to the small scale resources in KIMESHA represents a loss for Tanzania as a country. Both AMI and TANLOCKS still make contributions of new capabilities to Tanzania but the question is open whether these projects should have been started in light of the economic situation, or whether the alternative of importing products financed by foreign aid would have been a better solution for the time being.

However, other SI projects are more justified, owing to special merits and to influences on Tanzania's foreign currency supply. For example, PEMACCO provides essential service, repair and production of electrical motors for the benefit of the capacity utilization of other Tanzanian industry and MAFOTCO produces blanks used as inputs for a number of Tanzanian companies and for export, as well as ploughshares for agricultural production. These types of production have special merits even in the severe economic conditions of the '80s.

NEM is a specific case which can hardly be seen as justified considering only the initial product and the limited technology transfer that took place initially. However, through the establishment of a link to the international market through the SI programme and, above all, through a group of very qualified SI entrepreneurs, NEM has succeeded in establishing itself as an exporter for the benefit of Tanzania. The most important factor in this case is the group of capable entrepreneurs who have developed their firm, its product range and its business areas in an impressive manner. The SI programme has merely served as a facilitator of this development. Nonetheless, this development was hard to anticipate and the direct benefits the supply of foreign currency from export as well as the dynamic effects of the development of technological and managerial capabilities in this company, can only be discerned now. This underlines the difficulties in estimating the development of infant industries in advance and indicates that the decision might be of a strategic nature allowing some projects to fail for the possibility of finding some 'winners'.

A study of the cost effectiveness of the SI projects in the firm perspective shows that NEM and PEMACCO have provided most capability contribution per SEK invested and that UHANDISI had the lowest cost efficiency. However, the most interesting finding was that this analysis provided the opposite conclusion to that of a traditional cost-benefit analysis, based on a comparison of two cases; AMI and KIMESHA. When using a country perspective and adding a qualitative reasoning based on opportunity costs of entrepreneurs and of use of foreign exchange, the ranking of these cases was not changed. This suggests that the traditional cost-benefit analysis may be less applicable if dynamic long-term effects on industrialization are of importance.

CHAPTER TEN

TECHNOLOGY TRANSFER, ENTREPRENEURSHIP NETWORKS AND INFANT INDUSTRIES

First, the features are described of the SI programme as being an example of direct state intervention to start new firms. Second, the specific implications of this on the selection of entrepreneurs is compared with the process in industralized market economies in which the self-made man starts his own firm. Third, a number of aspects of industrialization are discussed among which are the startups' need of various capabilities which often cannot be found within one single individual. Fourth, there is a need to extend the analysis of startups beyond the individual firm and the network approach offers one possibility. The analysis includes the new firms' local as well as their international network. Finally, the findings from the SI programme are related to the infant industry argument, i.e. to the discussion of the need of support and protection of startups during their infancy period.

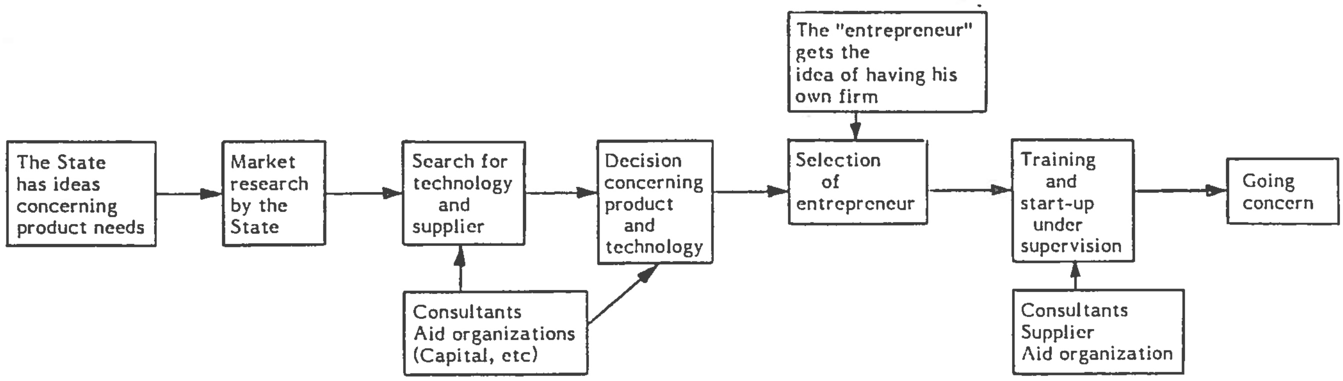
10.1 'Early phases' state entrepreneurship

The state can play an indirect role by providing an environment favourable for the establishment and development of small industries. The means are government policies, legal protection, capital market policies, etc. The state might also intervene in a more direct way to take initiatives and an active part in the establishment of new firms, i.e. to perform entrepreneurial activities. Here we reserve the concept "state entrepreneurship" for the latter, direct role.

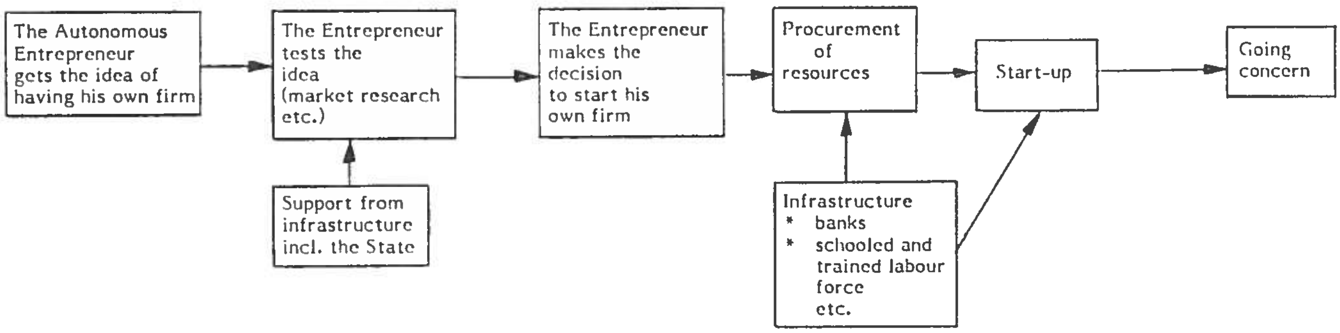
A definition of state entrepreneurship is provided by Freeman and Duvall (1984, p.374): "... when the government ... either takes entrepreneurial initiative by establishing a new commercial enterprise or takes over controlling interest in an existing enterprise ..."

Our interest primarily concerns the establishment of new small industrial firms and, more specifically, those cases where the state takes an active part in the early phases and then lets private entrepreneurs take over.

What sort of entrepreneurial activities does the state perform? Below, a comparison between autonomous entrepreneurship in an industrialized country (IC) and 'early phases' state entrepreneurship in a less developed country (LDC) is provided. In the terminology presented in section 5.1.3, autonomous entrepreneurship is equal to Schumpeter's Mark I, and state entrepreneurship is the same as Schumpeter's Mark III. Corporate entrepreneurship or Schumpeter Mark II is the third form and is not discussed here. The process of starting a new firm shows some sequential differences, as is illustrated in figure 10.1.



A. Early phases state entrepreneurship (LDC)



B. Autonomous entrepreneurship (IC)

Figure 10.1 Sequences of small industry formation through early phases LDC state entrepreneurship as compared with IC autonomous entrepreneurship
Source: Alänge and Granstrand (1986, p. 24)

There are many differences in these two ways of starting firms. Here we would like to point out a few of special importance.

1. The autonomous entrepreneur goes through a long learning process filled with trial-and-error, many times making more than one attempt to start a successful business. In comparison, the state makes several parallel studies of ideas, products and technology and selects the most promising. Then, the entrepreneur is brought, more abruptly, directly into the start-up process.

2. The IC autonomous entrepreneur has a well-developed infrastructure to rely on. This includes a capital market, trained labour force, etc. The LDC entrepreneur can not rely on either a functioning capital (especially foreign capital) market or any other kind of infrastructural services. The opportunities to start an industry other than a small backyard shop may be scarce.

3. As the general LDC infrastructure shows several weaknesses, the state intervenes to support industrial projects directly. Hence, the state performs entrepreneurial functions and contributes to establishing contacts with sources of technology. These sources of technology include foreign companies and institutions, i.e. they involve international technology transfer.

Table 10.1 summarizes some of these differences.

Autonomous IC	State (early phases) LDC
Existing capital market including venture capital Well developed industrial infrastructure	Limited capital market and shortage of foreign currency Limited industrial experience and knowledge Technology has to be imported
The entrepreneur - "a self-made man"	The entrepreneur - "a hired manager"
Business idea by the entrepreneurs	Product need (import substitution) The state and a specific support organization (state/international aid) perform entrepreneurial functions i.e.

Table 10.1 A comparison between IC autonomous and LDC 'early phases' state entrepreneurship
Source: Alänge and Granstrand (1986 p. 26)

Above, we have discussed some conditions and differences between autonomous and state entrepreneurship. In comparison, corporate entrepreneurship has been very important for an industrialized country such as Sweden. In Tanzania, market entries are very dependent on external technology and financing (aid). The majority of new business units are started in this way with heavy external assistance. Many of these projects are owned by a parastatal under the Ministry of Industry and the market entry process can be characterized as state entrepreneurship. Nevertheless, the large Tanzanian industries are important for on-the-job training of future managers and entrepreneurs. For example, the large MNC/State joint venture, General Tyre E.A. Ltd., has provided basic managerial training for as many as 8 of the SI entrepreneurs in the industrial estate in Arusha.

10.2 The self-made man versus the SI entrepreneur

A common feature of the company formation process in market economies is that, for the individual entrepreneur, the first steps in the direction of starting an industry, filled with trial-and-error experiences, mostly take a considerable amount of time. (Hult and Odéen 1979b pp. 82-88). Here, we find a decisive difference compared to the SI company formation process, where the individuals selected as SI entrepreneurs are brought more abruptly into a ready-made project. The SI entrepreneur never gets the opportunity to participate in planning and other important preparatory activities and thus misses the learning effect during the early trial-and-error phases. Instead, the SI entrepreneur gets support and is more thoroughly trained to run a ready-made industry.

There is another difference, attributable to the selection procedures. While one of the important attributes of the self-made man in a market economy is a certain kind of far-sighted stubbornness, enabling him to cope with problems and obstacles as they appear, the SI entrepreneur is selected in a totally different way. This selection is more similar to the selection of an employed manager from a group of candidates by looking at formal certificates, former work experience, and the impression made at an interview. At an interview it is very hard to see if the kind of productive stubbornness that has led to many company formations exists or not. In a way, one could say that the SI entrepreneur is bound to be an individual with more formal merits that has reached the goal of having his own company, if not by crossing a lower threshold, then via a qualitatively different selection procedure. The initiative the SI entrepreneur must take is to write an application, form a group, and go for an interview, as compared to the long process from idea, test of idea, preparation, and start up that leads the self-made man to his own business. This comes into the discussion on whether it is possible to identify and train potential entrepreneurs, as claimed by at least some scholars (10:1).

Some researchers claim that different types of leaders are needed during different phases of an enterprise's life cycle, i.e. the true entrepreneur during early phases and an administrator during more mature phases. In the SI case, we see that the very first steps are taken by a public authority, i.e. state entrepreneurship, and then the SI entrepreneurs take over the responsibilities during early growth stages of the company development. Our empirical data reveal that although they are selected like hired managers and thus have missed the very early phases, the SI entrepreneurs have, in most cases, proved to be successful and innovative in the management and further development of their companies. A tentative figure of the early development within the SI programme is provided below.

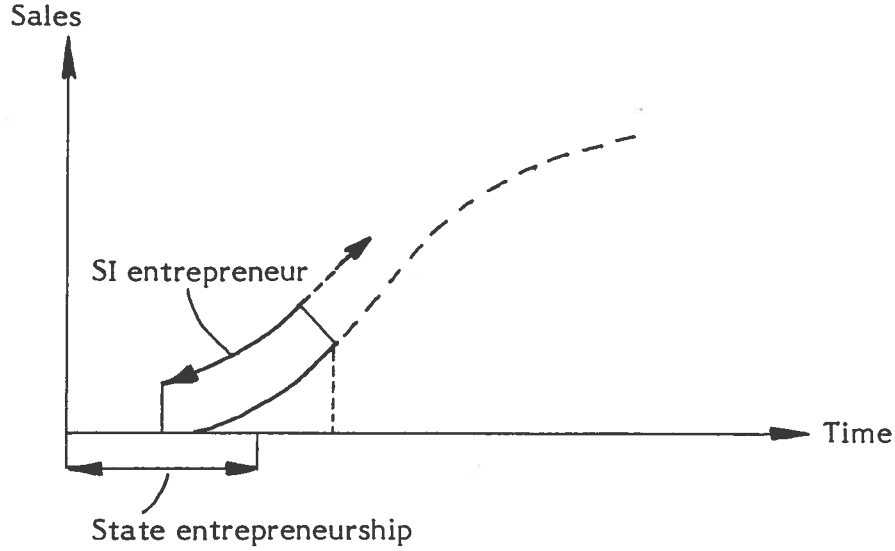


Figure 10.2 'Early phases' entrepreneurship
Source: Alänge and Granstrand (1986 p.22)

In developing countries with a capitalist market economy, the industrial sector has developed along two roads, the formal and the informal, the formal sector being the sector officially recognized by the ministries and other governmental organizations, and being supported and aided by these organizations. Another kind of development has taken place within the informal sector, where small backyard workshops have often grown up around a skilled artisan or businessman, often totally outside the registration, support, and tax control of the state. This dual development is typical of Tanzania's closest neighbour to the north, Kenya (see King 1977, for a description), and also exists to a certain extent in Tanzania. However, the possibilities of further developing a backyard business are limited, mainly because of financial constraints, especially regarding foreign currency needs for raw material import.

This last factor might partly explain why it has been possible to find competent SI entrepreneurs through the selection process described above. The potentially successful entrepreneur has few opportunities to start his own business, except of a backyard type, mainly because of financial constraints. Nevertheless, it is worth noting that in the SI programme it has been possible to establish successful privately owned small industries through 'early phases' state entrepreneurship.

10.3 Technological and managerial capabilities - the need for tandem capability

When focusing on the entrepreneur, Schumpeter (1934) distinguished this essential function from that of the financier, the administrator, and the technician. In our terminology, the essential capability is the entrepreneurial capability. However, inventive capability is also needed for the development of an industrial enterprise, as well as a certain administrative and production capability to run the daily activities, once started.

Sometimes, in a successful business enterprise, all these capabilities are found within one individual, but more often, the capabilities needed are found within a group of leaders. The history of successful industrial companies is full of examples in which a technician and an entrepreneur worked as a pair. Typical entrepreneurial and inventive pairs from the early starting period of contemporary Swedish large-scale companies are, according to Granstrand (1979, p. 64):

A.R. Nordvall - G. Dahlén (AGA)
A. Carlander - S. Wingkvist (SKF)
A. Gabrielsson - G. Larsson (Volvo)
B.A. Hjorth - J.P. Johansson (Bahco)

In other industrialized countries, the same pattern prevails, e.g. Rolls and Royce in England. Furthermore, in a recent study of new technology-based firms in Sweden, Utterback and Reitberger et al. (1982) found that "the combined expertise shown by the total group of founders in the areas of technology, marketing, and business management is an important factor of the firm's chances of being successful." (p. 4)

It is essential to realize that technological as well as managerial capabilities are needed for the successful growth of an industrial enterprise, but that these capabilities are seldom found within the same individual. Furthermore, it is quite frequently not even possible to train an inventive individual to become good at entrepreneurial activities. Nevertheless, different kinds of training are needed for technological capability as compared to managerial capability, which implies a similar difference between technology transfer and management transfer.

The realization of the importance of supplementary abilities and that these abilities do not normally exist within the same individual has even led to the design of specific training programmes for entrepreneurs in order to facilitate the formation of pairs. At Baylor University in the US, a course is given with the aim of training people to perform the entrepreneurial function and to cooperate with other individuals with inventive talent (Kent 1984, personal communication).

In general, the training programmes within the SI programme do not identify technology and management as separate but supplementary components. Instead, managers (entrepreneurs) are primarily trained in technology; i.e., to upgrade the technological capability, primarily the production capability. In combination with the selection procedure of SI entrepreneurs in Tanzania that heavily favours applicants with a mainly technical background, this implies a certain weakness concerning managerial capabilities. Our empirical data reveal that the differences between the junior sisters are considerable as regards management composition. In section 6.3.5, a measure of 'management depth' was presented showing very big differences between the eight cases.

Given the above-mentioned characteristics of the SI programme, the question arises of whether it is possible to modify the training programme. By referring to our analysis of the SI programme in Tanzania, a partial answer might be given. It has proven to be possible to increase the technological capability through training in Swedish industries. We also have some indications that the stay in Sweden and contact with role models of entrepreneurship have a certain effect.

The present SI programme trains technicians to become entrepreneurs primarily through developing technological capabilities. There might be a need to select different individuals for completely different training programmes, i.e. to train a future technical/production manager in order to improve technological capability and a future general/marketing manager in order to improve the managerial capability.

However, as is apparent from the history of small companies, most functions are often carried out by one entrepreneurial individual during the start-up period. When the company starts to grow and reaches a certain size, the founder (entrepreneur) cannot lead the company by himself. Instead, hired administration-minded managers take over the role of leading the company.

10.4 The local and the international network

In this section we will provide a short summary of the empirical findings pertaining the SI entrepreneurs' networks and relate them to the meaning of local and international networks for an LDC small scale industry.

From the very start of the SI programme, the Swedish firm of consultants had a vision of transferring the philosophy of local social network to the Tanzanian industrial estates. In Alänge et al. (1979, p. 101) this was described as follows:

> "The 'spirit of Swedish small-scale industry' can be described in several different ways. One characteristic of this spirit is the regular and informal contact among industrialists in the same district. This contact can, for example, take the form of a daily halfhour morning meeting between local industrialists at a café. Such a meeting is rather a social event, with the entrepreneurs regarding each other as colleagues rather than competitors, thereby providing each other with various forms of support."

The local social network has been established through a combination of formal and informal measures. The industries are located within industrial estates and sometimes they were designed to provide input for each other. The creation of an association of entrepreneurs was stimulated. In this formal local arena, different matters are discussed and some joint activities are initiated, e.g. joint export marketing. The selection of SI entrepreneurs from a similar background and the common seminars in Tanzania have further increased the group affiliation. The demonstration effect of experiencing the small scale business environment in Sweden and seeing role models of successful entrepreneurs, also had an impact on the understanding of informal contacts. The presence of several local arenas, e.g. the hunting team, the entrepreneurs' local bar, the industrial estate as such, all contribute to the development and maintainance of the local social network. However, the links to other parts of the Tanzanian industry are sparse, especially to the Asian community.

The junior sisters were started through international technology transfer projects. This implies that the SI entrepreneurs established international contacts from the very start, initially based on a commercial agreement, but the contact during the training and start-up periods has led to the development of personal friendship ties. Out of 16 SI projects, 9 senior/junior sisters had business contacts or other close contacts 7 years after the commencement of the SI programme. The junior sisters with such contacts have in general been more successful than the firms who have sporadic or no contacts with their senior sisters. Those SI companies that have frequent contacts have developed their business relationships further in several ways, e.g. export, import and joint marketing to third countries. Given the considerable geographical distance, it has proved to be of importance to utilize rapid communications like telex, supplemented with regular personal visits. The long training periods in the senior sisters' facilities in Sweden, however, helped to create a common firm- and industry-specific language that decreased the mental distance. What, then, is the relational content of the international contacts? It is instrumental and transactional, but also normative.

The instrumental content includes information and advice concerning markets, products and production processes. Most of it is firm- and industry-specific, but some information of a more general managerial/business nature is also provided. Due to the geographical distance, this more general information will probably be less important and local sources will supply more of this type over time. The international network is of importance for information regarding new products and new technology.

The initial content was of a transactional nature, a contract to supply a new firm with a new plant and technology. In several cases further cooperation also entails a transactional content in terms of import from and export of components and products to the senior sister. Here, we can also expect a change over time, where the aim to obtain more components locally partly might be contravened by the commencement of new product areas demanding continuing import of raw material and components. Furthermore, investment in new technology and knowledge also requires transactions.

The normative content involves those values and norms that are transferred via the network. These are naturally much weaker than the normative content of the local network, because of the social processes involved in reinforcing this type of content.

The existence of the SI programme (including the foreign aid agency SIDA), adds another dimension to the international network. The junior sister has yet another opportunity to obtain information and assistance from abroad. The basic assumption is that this part of the network shall not be there forever. However, the individual entrepreneur can count on the existence of this factor during a forseeable future.

Hence, we can see that the SI programme contains a vital local network and a network that goes beyond the local community. Both Johannisson (1985) and Reitberger (1984) have argued for the importance of two different types of networks, the local and the global. The global is of specific interest for the possibilities of acquiring new technology. However, both these studies refer to the conditions for industries in industrialized countries, with a well-developed infrastructure. Does the same situation exist for an LDC small scale firm, or is the situation qualitatively different? We will analyse this by initially describing the way in which a small scale industry is started.

The establishment of a business can be viewed as the gradual establishment of relationships with the environment. These relationships can be with customers, contractors, financiers and other parts of the infrastructure. These sources usually exist in an industrialized country. The function of a small-scale company's supporting organization can be described most easily in terms of linking the entrepreneur/new company to various existing sources. As the company develops, these relationships multiply; some of them are essential for survival, others of secondary importance.

When a developing country industry of the SI type (relatively advanced small-scale industry) is to be established, a number of the relationships described above must be developed. Often, however, the environment lacks sources suitable for providing knowledge and infrastructural service. The role of the supporting organization, when a business is established, is not only to connect the entrepreneur/new business with existing sources, but also to create new sources within or locate sources outside the country. International technology transfer of the SI type can be seen as an international relationship which performs several of the functions that sources in the environment would perform in an industrialized country. This is especially applicable to areas where transfer of knowledge is an important component. The support organization and/or international sources carry out some of the tasks accomplished by the broadly defined "infrastucture" in a developed country, such as training of workers, advisory functions and delivery of tools. Figure 10.3 illustrates a network for a pair of sister industries in Tanzania and Sweden.

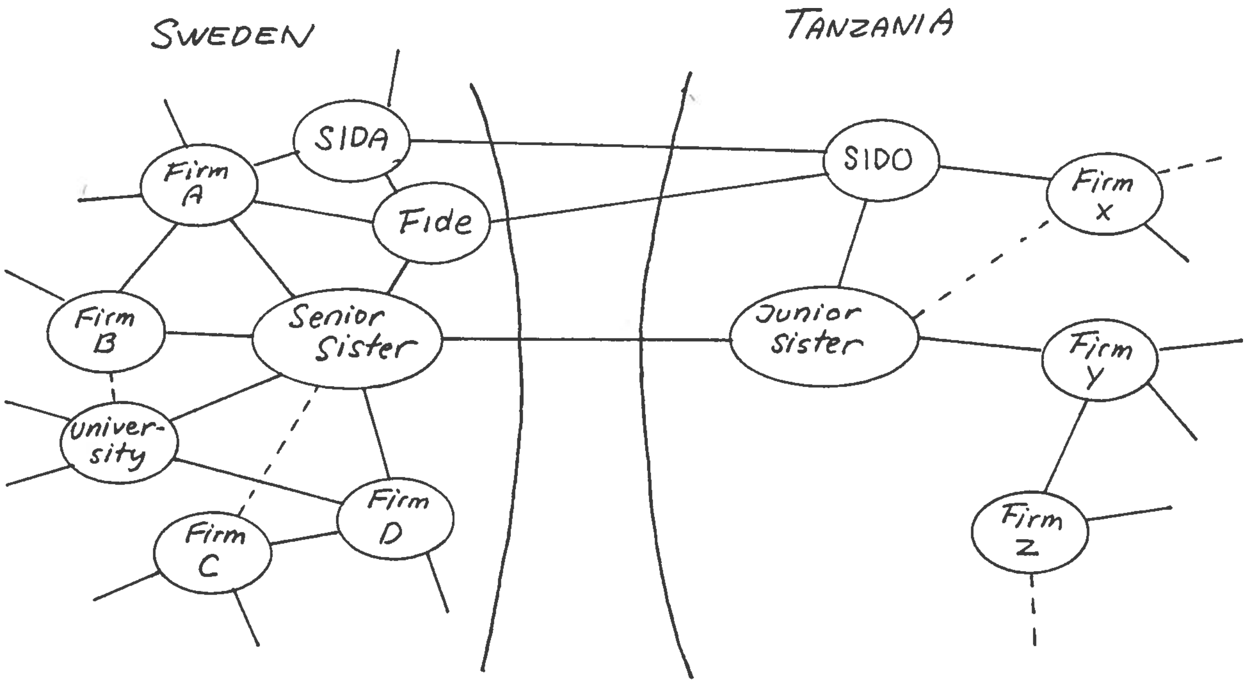


Figure 10.3 The network for a pair of sister industries in Tanzania and Sweden. It includes a senior sister, SIDA (aid organization) and Fide (SIDO's Swedish consultant) in Sweden, a junior sister and SIDO (the small industry support organization) in Tanzania

Developing a business relationship between two companies takes time. In international technology transfer projects, it may be assumed that the parties involved need time to find suitable forms of cooperation, and that the cooperation will change over time. If the requisite business conditions exist it can deepen and develop; if not, the cooperation will decline or cease. Consequently, developing a network is a long-term process, especially in a developing country where sources of capabilities are not available and must be created. The natural course of development in an international technology transfer project is that certain functions are eventually taken over by local sources, and that the foreign party's role is limited or develops toward new areas such as export marketing and product and process development.

A company must become involved in a multilateral network if it is to survive. The significance of various parties in the environment changes during the various phases of a company's development. Foreign aid to small-scale companies purports to establish independent companies that will survive without further external aid. Those parts of the network related to foreign aid should therefore not be regarded as permanent, and a gradual decrease in aid should be planned. Other components are, however, part of the local network and the local infrastructure that are important for companies' long-term survival. Appendix 2 provides a list of participants in small-scale industries' development, divided into two groups: local and those related to foreign aid.

From the above description we can draw the conclusions that the differences are substantial between the conditions for an IC small scale industry and a similar sized industry in a developing country. As some of the needed sources are non-existent locally, the international contact plays a different role. Hence, the international (global) network has to perform some tasks that are carried out by the local network in an industrialized country. As mentioned above, these stable international links seem to be related to success in the SI case.

10.5 Conceptualization of the infant industry process and implications for government policy

The most common way of viewing the infant industry process is to consider the productivity development over time as an indicator of infancy time and maturation. According to Bell et al. (1984), "... very useful diagnostic information can be obtained by measuring the infant's productivity growth." but, "A complete assessment of the performance of an infant industry requires social cost-benefit analysis. " (p. 3).

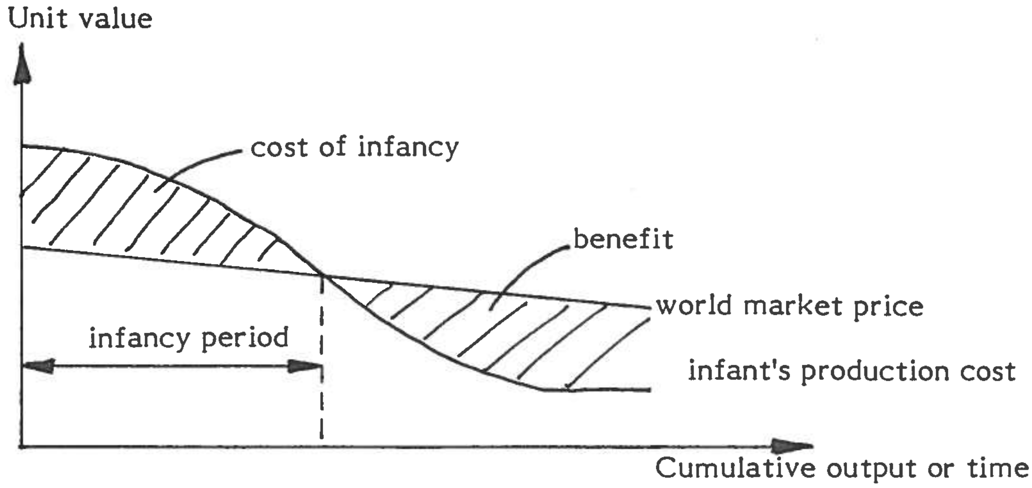


Figure 10.4 The cost, benefit and duration of infancy
Source: Bell et al. 1984, p. 5

This focus on the productivity development also means a focus on the need to foster production, and on the need for developing production skills and knowledge. The need to develop other important knowledge areas is thus less obvious.

The policy recommendations for the design of support to infants are likely to be guided by the conceptualization of the maturation process. The support is thought of as a means of compensating for higher production costs during the infancy period. This implies that the support during the infancy period gradually should be decreased proportionally with the lowering of the production costs due to the accumulation of production experiences. When the infant has reached the point where it is internationally competitive, the support should be stopped (see figure 10.4).

According to Jacobsson (1985), the above conceptualization is inappropriate when it comes to discussing policy:

> "Indeed, this view of the maturation process would appear to assume a market form of pure competition with a need to master some basic production skills. The decision-making process of the firm is, ..., much more complex and <u>the maturation process</u> will therefore have to be <u>more complex</u>."

> "It may well be the case that the firm can compete internationally pricewise but may simply not have access to a marketing network or the financial basis to build up its own organization. It may also be the case that the main risks for the firm lie in developing the minimum critical mass of design skills rather then being an initial high cost producer." (Jacobsson 1985, p. 274; our underlining).

In the light of our empirical findings, we would like to further identify of the shortcomings in the present way of conceptualizing, and to suggest some ways to develop our conceptualization of the infant industry process.

The infant industry argument essentially concerns a dynamic course of events to foster capabilities for running and developing industrial businesses, that in themselves are dynamic processes. This implies that it is not possible to consider only the development of production costs over time as a full indicator of infancy. The ability of figure 10.4 to describe the infant industry process in an appropriate way is limited, for several reasons.

First, it has been shown that several of the sister industries have internationally competitive products. The major problem has not been to fulfill demands on production and product quality (10:2). Instead, the industries have needed other kinds of specific support. It has been especially important to create contacts within an international network, enabling the small African firms to reach international markets that they would not be able to reach without assistance, at least not in a shorter time perspective. One example is a company (MOCCO/Simon Engineering) that was initially supposed to export cutlery to its Swedish sister. This export has gradually been diversified to include other stainless steel products, including export to other companies. In comparison with other junior sisters that only supply the local market, this opportunity to have a direct international commercial link from the very start has been very beneficial for the firm's maturation, e.g. through the access to information and ideas for further development of the firm and through the exposure to the customers' product quality requirements.

There are also examples where firms which originally were started to supply the Tanzanian market, but through the brokerage function of their sisters and the support organizations, succeed in establishing commercial contacts with other foreign firms. An example of this is NEM that at present is exporting lamp shades to the Swedish large multinational group of furniture department stores, IKEA. Seven years from start with another kind of product (fuse boards), the Tanzanian company has proved to be competitive on the world market, where IKEA is using subcontractors from many different countries. In these two cases, the direct link to the export market created by the SI programme has been a very essential factor. (10:3)

Hence, the international network link to Sweden opened the door to the international market. It consists mainly of market information and a brokerage function of establishing contacts, and thus constitutes a very specific support during an initial internationalization phase. In the words of Corden (1974), this has more to do with the "infant marketing argument" than the "infant industry argument". To a certain extent, it is based on inadequacy of private information. Although the above-mentioned firms have a clear strategy of developing new products and entering into export markets, it has proved to be very hard to obtain information and contacts through channels outside the SI programme. Several of the SI firms have experienced difficulties in even getting a reply to a letter sent to European firms, which might partly be explained by the low credit rating assigned to Tanzania by the international business community (The Economist, 1982). (10:4)

Second, we have previously shown that industrial development includes a complex capability build-up, embracing more than just production capabilities. Different kinds of dynamic capabilities must be included, especially in a more long-term perspective. These include entrepreneurial as well as inventive capabilities. This does not mean that we claim that all companies should have internal capabilities to develop new technology. However, for the long-term development of a company, at least some kind of dynamic capability is needed; it might be limited to the capability to evaluate and decide what sort of technology to buy, and what market to approach. This is in accordance with other recent findings, e.g. Dahlman (1984) who argues, "... since the technology required to meet particular local product or process needs may not exist even abroad, it is necessary to have some ITC (indigenous technological capability = dynamic capability, in our terminology) to at least formulate what those needs are and to seek the appropriate solutions locally or abroad." (p. 329).

Third, we have shown that one aspect of the start-up of a new company concerns linking the infant into a network of commercial and professional contacts. It might also involve international linkages. This kind of network development is another indicator of maturation. It might also be conceivable to adopt a broader approach to infancy, to include the view of 'network infancy'. For example, an LDC firm's local network might in itself show certain weaknesses originating from its infancy (10:5). This has proved to be the case in our empirical material, where the international link to Sweden could be seen as a means of compensating missing links and strengthening the local infant network. The support of a local firm might then imply considerable external benefits for the local infant network. According to Corden (1980), the presence of externalities, in the form of creating a general atmosphere that is conducive to manufacturing and to organized economic activity, is one of the most important arguments for infant industry protection. The development of a local infant network and of the infants participating in this network might be seen as a specification and development of Corden's view of creating a 'general atmosphere'. The unit of analysis thus shifts from the firm to the network.

Fourth, the assumption of a relatively stable world technology that is implicit in the figure 10.4 description of infancy, is unrealistic. If, for example, we assume that the world market production technology changes more dramatically with the resulting decrease of production cost, we get the following picture.

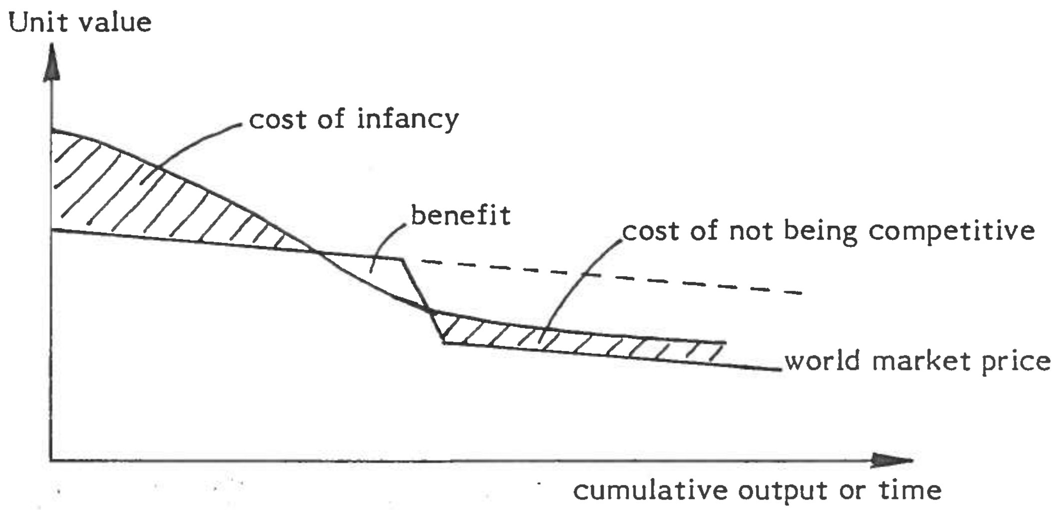


Figure 10.5 Infant industries production cost and changes of world market technology

What happens is that we get an initial period of infancy followed by a period of international competitiveness that, by the introduction of new technology on the world market is replaced by a sharply deteriorated competitiveness. Here, we assume that the product quality is the same and it is only the production technology that changes. However, the same picture can be used to describe another possible development, the development on the world market of a product with improved quality. If we assume that the price is unchanged, the old product would bring a lower price, and thus, the infant's competitiveness would deteriorate again. Normally, the changes that takes place concern both the products and the production technologies. Lastly, a change in composition of the output from the infant makes the figure less valid as a measure of infancy. For example, a concentration on a more narrow product line is reflected in lower production costs per unit (Carlsson 1980), but this is not necessarily an adequate measure of maturation.

We conclude then that the process of developing an infant industry is complex, an array of different capabilities are needed, and the technologies are not stable. Hence, a figure of this type (10.5) can only give a very partial description of the maturation process. It needs to be supplemented by other kinds of descriptions to provide a basis for policy formulation. The maturation process is more complex than previously assumed in existing policies. It involves more complex capabilities and it is not only the single firm which is the unit of analysis, but the whole network. Clearly, the policy content of the state needs to reflect this more complex view of the maturation process.

It suggests that general production subsidies given to individual firms is not always the appropriate way of fostering an infant. Instead, a more diverse and multifaceted approach of support/protection seems to be needed. The empirical experiences from Tanzania show that function-specific support, i.e. direct assistance in international marketing, has contributed to the commencement of infants' export. The motivation for this support is specifically based on the inadequacies of private information, lack of creditability (absolute entry barrier) and on externalities that can occur through the local contact network. It also shows that dynamic skills in other spheres of the company than the production department need to be developed.

These skills are a prerequisite or a necessary condition for the firms' subsequent development. There are no reasons to believe that a general production subsidy, based on the difference between local production costs and international prices, should provide the correct subsidy level. The discrepance between local production costs and international prices may be insignificant, yet, for the growth of the firms, a heavy investment is needed to develop inventive capabilities (IE). Moreover, since the unit of analysis clearly should not always be restricted to the individual firm but should be the network, specific measures need to be included to generate these networks. These networks are founded on external economies and there is, again, no reason that a production subsidy, should either well reflect the size of the external economies nor that a network is created. Finally, the exact policy need to be sensitive to changes in the needs of the firms over time in the light of their own development and that of the international market.

CHAPTER ELEVEN

CONCLUSIONS

This final chapter presents the most important findings of the study and provides some propositions for further research. First, a general discussion of international technology transfer and the maturation of infant industries is provided. Second, a summary of the impact of the SI programme on capability acquisition is given. Finally, some suggestions are made for the improvement of the sister industry programme on a more practical level.

11.1 Capability acquisition and infant industries

The state can play either an indirect role in developing an environment which is favourable to establishing and creating new firms or it can intervene in a more direct way, by taking initiatives and playing an active part in the establishment of startups. The SI programme is of the latter type, where the state actively performs the entrepreneurial activities during the early phases and then lets private entrepreneurs take over. These early entrepreneurial activities include the selection of product and production process, the estimation of market potential as well as the selection of the private entrepreneurs taking over. In the case of the SI programme, it has been shown that this type of 'early phases' state entrepreneurship can create viable small industrial firms, managed and further developed by entrepreneurs selected through an interviewing process.

Hence, there is a decisive difference between the way the above type of entrepreneur starts his company as compared to the company formation process in industrialized market economies. In the latter, the individual entrepreneur often takes gradual steps to start a new firm over a longer period of time, coping with problems and obstacles as they appear. This type of trial-and-error process is very different from the selection of an SI entrepreneur, which is more similar to the selection of a manager (who is not an owner). Hence, the SI entrepreneur is bound to be an individual with more formal merits who has reached the goal of having his own company, if not by crossing a lower threshold, then via a qualitatively different selection procedure. However, although they were selected like managers and have thus missed participating during early phases, the SI entrepreneurs have, in most cases, proved to be successful and innovative in the management and further development of their companies.

Thus, we may conclude, on the basis of this limited material, that the state may successfully substitute for the market mechanism during early phases. However, there is a risk that the selection mechanism will favour the wrong type of individual to run a new firm. On the other hand, it has been shown that it is possible to compensate for this by a careful selection process.

The private initiative and market competition as a selection mechanism have been seen as the core of the entrepreneurial process in capitalist market economies. However, we have shown that the state can play a role by creating a 'selection environment' (11:1), which is not of the pure market type, but still conducive to entrepreneurship and, at least, incremental technological innovation. This seems to be a plausible phenomenon in the case of the primarily imitative form of entrepreneurship prevalent in LDCs. However, the reader has to keep in mind that these conclusions are based on limited data. Nevertheless, recent examples of industrialization, e.g. Japan and South Korea, support this observation.

When aiming at developing small scale industries in LDCs, the relevant unit of analysis is not always the single firm. Instead, there may be a need to analyse the networks in which the startup takes part. First, the local network may have infant characteristics, there may thus be a need to develop the whole network, rather than a single firm. Second, it has been shown that a link to an international network, such as the one established by the contact between sister firms, can compensate for weaknesses in the local network. During the early phase of company development, it has been shown that the more successful junior firms have stable relations to their senior sisters, while the less successful ones have no or only sporadic contacts. Thus, this link has been a means for continued capability acquisition, as well as an inroad to the international market. This may call for a qualification of the dependency argument, since close international contact and the supply of production equipment do not necessarily mean that capabilities needed for local LDC development are not being transferred.

Once the industries have been established, the customary way of viewing the infant industry process and its maturation has been to measure the productivity development over time. Policy recommendations have depended on this way of conceptualizing, and thus, tend to focus on means of compensating for higher production costs during the infancy period. However, industrial development and maturation are essentially complex and dynamic processes, for which it is not possible to soley use the development of production costs over time as an adequate indicator of maturity.

One reason for this may be that marketing factors and not the production costs are the main barriers to being competitive on the world market. Second, learning and maturation is a complex process and dynamic capabilities are needed for the development of a firm, not only production capabilities. Third, the start-up also concerns linking the infant to a network of commercial and professional contacts, which might also include international linkages. It may also be conceivable to use the broader concept of network infancy, which indicates that there is a need to analyse infancy and maturation with more than the single firm as the unit of analysis. Fourth, technologies are not stable; there are qualitative shifts in their development, which, combined with product quality differences, make the traditional way of describing infancy and maturation by production cost development less appropriate. Hence, we can conclude that strictly relying on the production cost as a way of conceptualizing the maturation process only provides a partial understanding.

State policy needs to incorporate the more comprehensive perspective of the maturation process. This suggests that the general production subsidies that have been given to individual firms is not always the only appropriate way to foster an infant firm. Instead, a more diverse and multifaceted approach including support and protection is needed. The experiences in Tanzania have shown that function-specific support has contributed to the commencement of infants' export. The motivation for this support, direct assistance in international marketing, is based on the inadequacies of private information, the infants' lack of creditability on the international market and on externalities that can occur through the local contact network. Hence, there is no reason to believe that a general production subsidy, based on the difference between local production costs and international prices, will provide the correct subsidy level for developing needed dynamic capabilities. Moreover, there is no reason why general production subsidies should contribute to the maturation of infant networks. Lastly, the policy needs to be sensitive to changes in the needs of the firms in light of their own development and that of the international market.

11.2 The impact of the SI programme on capability acquisition and development of African entrepreneurship

African entrepreneurship necessitates capabilities to initiate, lead and develop industrial businesses in Africa. These capabilities can generally be found in the sister industries selected, i.e. static as well as dynamic capabilities. In order to support this further, SI entrepreneurs selected were required to have a general industrial background, (i.e. education and experience) as a prerequisite. Firm-specific and industry-specific knowledge has been transferred through the SI projects. This has primarily concerned production capabilities and, in some but not all cases, administrative capabilities. Concerning the development of dynamic capabilities (inventive and entrepreneurial), the influence of the SI programme has been more limited, at least during early phases. This can partly be explained by the scarcity of personnel qualified for transferring dynamic capabilities, which is an inherent weakness in using small scale firms as technology suppliers. With a few exceptions, the training programmes did not cover dynamic aspects. However, training during extension phases has had an impact on the development of dynamic capabilities, to a large extent due to initiatives from the SI entrepreneurs themselves. The continued contacts between the sister firms have had considerable importance for dynamic activities. The advisory function and the direct assistance given by the senior sisters has been important to the product development as well as for market development. However, the perhaps most significant factor influencing the outcome in terms of capability generation is the capacity and attitude of the individual, which indicates the importance of the selection of individuals who are to become SI entrepreneurs.

Developing African entrepreneurship, is a long-term process. The importance of learning at previous work places has proved to be of considerable importance for the SI entrepreneurs. There is an advantage in having a group of individuals with different prior experience and education. Specifically, it has been shown to be important to have not only technicians, but also individuals with business experience as managers in LDC startups. This selection is one of the important decisions that is made by a public authority in the SI programme.

The SI programme has played a number of roles concerning the development of local industrial businesses. One has been the function of financier for investment in firms, i.e. the SI programme has provided an opening to obtain loans, which also became available to people with somewhat more limited financial resources. Another function, at least as important, has been that the SI programme facilitates the acquisition of foreign currency for necessary machinery. Furthermore, it offers support during the start-up and later phases through market and technical assistance, as well as assistance in obtaining continued foreign currency for raw material imports. It also provides various forms of economic support to the individual entrepreneur, i.e. the training costs; which are considered 'national costs' and, thus, do not burden the individual firm.

The selection of machinery and design of production facilities are based on the senior sisters' long experiences in producing the same type of products. Initially, training is also provided in using and maintaining the plant to produce the products transferred. The above features are typical for a turn-key technology transfer project. What has been typical for the SI project is that the new firms can also get continued assistance over a long period of time. Initially this is established by a contract stipulating cooperation. In many cases this has later developed into a normal business relation, i.e. the senior sister has become a part of the junior sister's network. These continued contacts offer a wide range of possibilities to further strengthen local African entrepreneurship through advice, discussions, further training, direct development work, etc. There has been a certain variation in the stability of the contacts between different pairs of sisters. The more successful junior sisters, in terms of capability acquisition and business development, all have regular contacts with their senior sisters seven years after the commencement of the SI programme. The choice of product and production technique influences both the stability in contacts (especially if the senior sister supplies components to the junior's production) and the possibilities for the junior to innovate and diversify. It has been shown that the ability of the machinery to adapt to different kinds of raw material is important to innovative activities and for capacity utilization in general, especially in an environment such as Tanzania. This indicates the need for further consideration of the choice of product and technology as well as suitable senior sisters. Hence, the importance of well-functioning selection mechanisms for SI entrepreneurs, senior sisters, products and production processes has to be emphasized, when attempting to develop autonomous African entrepreneurship through 'early phases' state entrepreneurship.

The learning opportunities involved in running one's own business are essential for the further development of entrepreneurship. One limitation of the SI programme is that the SI entrepreneurs are not involved during the early phases when design and investment decisions are made. The learning acquired by running their own businesses in combination with recurrent training periods in Sweden has shown to be very vital for capability acquisition, especially concerning dynamic capabilities. Furthermore, the learning opportunities and possibilities of the employees' seeing role models are sources for the further diffusion of African entrepreneurship throughout society. Learning is inherent in different activities: production, product development, marketing, etc., and the importance of well-functioning feedback systems for increasing learning efficiency has been emphasized. Perhaps, the most important source for the further development of entrepreneurship, is the development of the rich network of contacts with suppliers, customers, financiers, authorities, research institutes, support organizations, etc. The SI programme's contribution in this field has been on different levels: One, is the direct international link to the network established through direct contact with Swedish small scale firms, another is the importance of seeing well-functioning networks in Swedish small scale industry areas and the inspiration and support to establish similar local networks in Tanzania. One such example is the Arusha Industralist's Association, that has served as a forum for exchange of ideas and as a starting point for different forms of cooperational activities.

An evaluation of the cost efficiency of the SI projects' contributions to Tanzania's long-term need of capabilities has been made. We have also analysed the effect of the opportunity costs of use of scarce managerial resources and of the use of foreign exchange. It was found that several of the SI projects clearly make contributions to Tanzania, while in a few cases the contributions have been very limited and the opportunity costs were high (see Chapter Nine).

Thus, the SI programme has proved to be a contributing factor to the development of African entrepreneurship in Tanzania. It has been possible to find qualified individuals to become SI entrepreneurs, a situation that may not be the case in all LDCs, but it also may reflect the limited opportunities available in Tanzania for starting an industrial firm.

11.3 Recommendations for improvement of the SI programme

Below some suggestions are provided for the improvement of international technology transfer of the SI type, in which the state takes entrepreneurial initiatives. The recommendations are primarily made from the perspective of the state, in this case SIDO and the SI programme.

As the state performs entreprenurial functions during early phases of firm development and makes a number of important selections, these selections have great importance for the success of the technology transfer projects. The following points reflect the key elements of a successful SI programme.

First, the selection of entrepreneurs is perhaps the most important step. It is necessary to focus on learning, as industrial entrepreneurship is a long-term process it is important to investigate and the individuals' previous education and experience. The motive to 'test my own ability and work for myself' has shown to be frequent among the SI entrepreneurs in successful projects. An investigation of the motives of the potential entrepreneurs may be of assistance in the selection of suitable persons. The selection process should also favour individuals who are not only technicians but also have some business background, to a greater extent than it does at present.

Second, the selection of the suitable senior sisters ought to take into account the possibility of obtaining stable relations between the sisters. Long-term stable relations develop if the sisters have a common business interest. The senior sister's motive of 'supplying the junior sister with components' strongly influences the possibility of a stable relationship which can be a channel of continued technology transfer. The inherent weakness due to shortage of qualified personnel available for training and supervising in small scale firms can partly be avoided by not selecting the smallest firms as technology suppliers. However, the possibility of the trainee being able to obtain a broad perspective of the senior firm is also of importance for learning. This limits the use of large scale units for in-plant training. A similar sized unit (senior and junior) seems to be an optimal solution.

Third, the selection of the production technique ought to include an estimation of the flexibility of the selected equipment to using alternative inputs and offering possibilities of making alternative products. Since the economic environment is unstable in most LDCs, business is characterized by uncertainty and flexible production technique has thus been shown to be positive for capacity utilization as well as for innovation.

It is not only production capabilities that are needed to run and develop a firm, but also administrative and, to some extent, inventive and entrepreneurial capabilities. The size of the senior sisters is an inherent weakness since there is a shortage of qualified personnel for training, particularly in dynamic capabilities. In addition, as producing firms they are normally relatively inexperienced in designing training programmes. To counteract these inherent weaknesses and achieve efficient technology transfer there is a need to support the senior sisters in some areas. This could involve the Swedish firm of consultants (Fide) suggesting that certain specific features should be included in the training programmes. For example, the following recommendations could be made: a step-wise design of the training programme, including periods of trial-and-error, a long-term perspective on learning, a development of a common coding (language) between the sisters, the inclusion of administrative capabilities and the covering of known trouble areas in African industry, and finally, a holistic approach to training.

What are the conceivable roles of SIDA and SIDO regarding in-plant training in Swedish firms? In Sweden, SIDA has, until now, monitored the SI projects from some distance, leaving the direct influence to the firm of consultants, Fide. However, if SIDA aims at supporting this kind of training in Swedish industry on a wider basis, it could be argued that SIDA itself should increase its capacity for evaluating and formulating guidelines for the training, especially if various firms of consultants are to be engaged. Today, SIDA possesses a lot of scattered knowledge and experience among its employees, but this has not been compiled and evaluated. For example, guidelines concerning important areas of training for different LDCs could be compiled in checklist form (see section 7.6.3). Another suggestion might be to make the senior sisters aware of the fact that technology transfer is a long-term process which might require training in steps (see section 7.6.2). Hence, it might be wise, if not to plan supplementary training in detail, at least to make a rough outline. In summary, it might be advantageous if SIDA increased its own competence in order to formulate guidelines for consultants and sisters and to monitor and evaluate different projects. In this connection, it might be wise to make both good and bad experiences public, for learning purposes.

SIDO has had a very limited influence on the training programmes in Sweden, except through its consultant Fide. However, when it comes to training efficiency in Sweden, SIDO could assist the senior sisters by providing better information concerning the needs of the trainees. The involvement of the trainees at an early stage of project planning and training programme design would further increase the efficiency of capability accumulation (see section 7.5.2). Finally, a further increase in the capabilities of the local SIDO staff for monitoring and evaluating the training programmes would be desirable.

There are some areas in which a certain awareness is recommended. First, both the senior sisters and the junior sisters have experienced the SI programme as a risk free route to obtain some profit and LDC business experience, and to start one's own business, respectively. This condition has evolved since the support structure SIDO and SIDA have been seen as guarantors for the projects. This has also proven to be advantageous as it made the involvement of Swedish small scale firms possible which would otherwise never have considered themselves in the role of technology supplier to an LDC. On the other hand, there may be other implications and the establishment of businesses without any risk element at all is not advisable. Recently, SIDO has taken some steps in this direction by replacing parts of the management in two SI firms which did not function satisfactorily.

Second, it is common in Tanzania to have a mradi, i.e. side activity parallel to one's regular job. This is also common among the SI entrepreneurs and their employees. It is wise to be aware of this, especially concerning individuals without ownership, and to take steps if necessary to ensure that their main efforts are put into the new industrial firm, e.g. by providing them with part-ownership.

The capabilities obtained through the SI projects have only been diffused into other activities in Tanzania to a very limited extent. Partly, this is a reflection of the few years that have elapsed since the start of the SI programme. However, the main factor is probably the limited availability of opportunities for an individual to start an industrial business in Tanzania, except of a back-yard type. If diffusion is desired, it can be obtained in two principle ways. First, through the direct involvement of the junior sister in the activity, e.g. to start a new firm with joint ownership or a junior daughter. The other way is to provide opportunities for individuals with a desire to start their own business based on the knowledge and experience acquired while working at the junior sisters, i.e. to create possibilities for spin-offs.

Given the changed macro-economic conditions in Tanzania with a severe shortage of foreign currency, more emphasis must be put on selecting production which has a positive influence on the foreign exchange. Ear-marking a certain part of the production for export makes the companies less vulnerable to fluctuation on the local market.

Finally, the support needed for the maturation of infant industries is often function-specific, e.g. it may be that the linking of the infant to the international market is the most important measure for their development. Often, a broader approach to the development of new industrial firms is also needed, an approach that not only focuses on the individual firm but also on the development of an infant network. The SI programme has primarily directed its efforts towards developing industrial firms at industrial estates. The experience thus gained suggests that the industrial estate concept can be advantageous to the development of a local network, if business links and other linkages are promoted. One explanation for the negative experience from industrial estates in other countries may be that they merely offered industrial sheds.

11.4 Suggestions for further research

The present study uses a methodological approach to the study of capability stocks, which is based on in-depth interviews. With this approach, we have been able to show the complexity of capabilities needed for industrial development and we have indicated in what way learning takes place. However, a more thorough study is needed in order to fully grasp the complex reality of learning and, thus, to be able to provide a more comprehensive understanding as well as practical recommendations.

Any future study should be directed toward a more narrow field of knowledge, and the interviews would have to go deeper than those of our present study, where the aim to provide a wider coverage of the SI programme partly counteracted the wish and possibilities to conduct in-depth interviews. In this way, we believe that it would be possible to provide a qualitative description of the change in the individual's frame of reference during the course of a technology transfer project and the gradual development of an industrial firm. It is essential to understand not only the 'surface' learning manifested in actions indicating more dynamic capabilities, but also the preceding shifts in the individual's frame of reference making those actions possible.

A possible scenario for the development of an individual into a 'dynamic' African entrepreneur could be described as follows. During childhood, the first frame of reference is established, involving features such as the extended family, role models of having one's own business, etc. During the school period, the first shift of the frame of reference takes place. New principles are introduced based on the natural sciences, and the individual eventually undergoes direct training for industrial work. In his first employment by a large industrial firm, gradually advancing to middle management level, the individual consolidates his frame of reference and develops his qualities in performing certain managerial and technical work tasks. The individual is then selected for training in Sweden, where he acquires and accumulates basic production skills not by applying a new 'Swedish' frame of reference, but according to his old frame of reference. The start of the new junior sister and subsequent going concern provides new experiences and new challenges. Here, a qualitative shift in takes place towards a frame of reference which is a fusion between the old family-related frame of reference from childhood, the school/industry based frame of reference of the next period and additions of new understanding primarily acquired through the running of one's own business. The second training period in Sweden is seen in a new light, in a more advanced frame of reference, which makes it possible for the individual to utilize the training provided more efficiently and to take initiatives to acquire knowledge needed during the stay abroad. After this the individual continues his work at home, benefiting from the deeper understanding made possible by the new frame of reference. This is manifested in the development of new products, processes and business areas.

The above is a scenario for the possible outcome of a study according to the outline given, and might well describe a more correct way of looking at the learning process.

The data collection for this study was carried out during a specific period in Tanzania's development, when the economy gradually deteriorated resulting in an extremely low capacity utilization in the industry.

This specific condition, as well as the specific characteristics of Tanzania as a country, make the findings of our study of the sister industry programme less accessible to generalization.

We believe that it would be of interest to analyse similar international technology transfer programmes in a comparative perspective. The findings of our study could be tested in other environments. For example, the possibility of finding qualified and able entrepreneurs-to-be through advertisments and a selection mechanism based on interviews might not exist in another environment. The existence of too few opportunities for entrepreneurial events within the economy might be the cause of an accumulated supply of potential entrepreneurs. Furthermore, it would be of interest to analyse in more detail similarities and differences between the learning processes in different cases of international technology transfer.

Although it was not our original intention, the first steps were taken during the course of this study, toward developing a method of evaluating the dynamic cost efficiency of technology transfer. While it is theoretically possible to include dynamic components in existing methods for project and social evaluation (SCB), the analyses are mostly of a more static type, possibly supplemented by a list of relevant dynamic factors, owing to practical restrictions. Although it is merely a first step, we believe that this method might be developed further, perhaps making it possible to include dynamic assessment in more static analyses.

APPENDICES

Junior sister	Contracted products	New products	No. of employees (1986)	Ownership	Production start (performance test date)	Senior sister(s)	No. of emp. (at contract date)	Contract date
ARUSHA INDUSTRIAL ESTATE								
Arusha Cutlery Co. Ltd. (ACCO)	Cutlery	Slashers	48	Private	May 1978	Hermanssons Metallfabrik AB	13 (discont-tinued 1977)	Feb. 1978
						Rönnkvist & Söner AB	56 (discon-tinued 1979)	Dec. 1978
						GAB Gense	250	Aug. 1979
Arusha Hot Dip Galvanizing Co. Ltd. (AGACO)	Hot dip galvanizing	Buckets	11	Private	Dec. 1982	DEFAB International	25	Oct. 1981
Arusha Metal Industries (AMI)	Globe and gate valves and water taps	Switch boxes, gravity die casted products	35	SIDO (parastatal)	Feb. 1980	Tour & Andersson AB, Ljung	400	June 1978
Chemical & Allied Industries	Disinfectants	-	34*	Private	May 1979	AB Blifa	97	June 1978
Fabrication & Wire Products (FAWIPMA)	Chain-link fencing wire, mosquito net and coffee tray wire	Clothes hangers, office trays	17	Private	March 1980	AB Finnveden Development	Firm of Consultants	1979
						AB Nya Metall-duksfabriken	15	Nov. 1983
Grey Iron Foundry Co. (GIFCO)	Service foundry, grey iron products, (manhole covers etc.)	Spares, furniture	35	Private	May 1980	Hybe Maskin AB	12	Aug. 1978
Kilimanjaro Metal Shapers Ltd. (KIMESHA)	Aluminum household utensils	Wall light brackets, Welded and pressed products	23	Private	June 1978	AB Finnveden Development	Firm of consultants	July 1977

Junior sister	Contracted products	New products	No. of employees (1986)	Ownership	Production start (performance test date)	Senior sister(s)	No. of emp. (at contract date)	Contract date
Meru Wood	Wooden rulers	Furniture, wooden toys	18*	Private	June 1978	Hultafors AB	110	June 1978
Northern Electrical Manufacturers Ltd. (NEM)	Fuse boards	Switch boxes, cable trunkings, wall light brackets, ceiling lamps, fluorescent fittings, etc,	59	Private	March 1979	Eldon AB	784	June 1978
Shuma Special Wires and Nails Co. Ltd.	Wire nails	-	30	District Development Corporation	May 1982	NTS Spik & Tråd AB	14	Sept. 1979
Uhandisi Industrial Fasteners	Wood screws and rivets	-	8	Cooperative	Oct. 1978	Nitfabriken Wulkan AB	90	Jan. 1978
IRINGA INDUSTRIAL ESTATE								
Iringa Maintenance Co. Ltd. (IMAC)	Repair and maintenance	-	30	SIDO	Oct. 1984	Maintec AB	11	Nov. 1983
TANGA INDUSTRIAL ESTATE								
Kodawa Ltd.	Sisal reinforced concrete roofing sheets	Hooks for sheets	17	Private	May 1986	National Fibre Concrete AB	4	June 1985

* mainly daily workers

Junior sister	Contracted products	New products	No. of employees (1986)	Ownership	Production start (performance test date)	Senior sister(s)	No. of emp. (at contract date)	Contract date
MOSHI INDUSTRIAL ESTATE								
AMOCO	Polishing buffs and wax	-	6	Private	Mid 1983	Gutex	8	March 1982
HAMAX	Axes and hammers	-	8	Private with SIDO as minority owner	Aut. 1984	GAB Gense	250	Aug. 1983
Kilimanjaro Electroplates Ltd. (KILECTRO)	Electro-plating	-	14	Private	Nov. 1982	Stenbergs Galvano AB	9	April 1980
Kibo Scissors Industrial Co. Ltd. (KISCICO)	Scissors	Surgical instruments	15	Private	Feb. 1982	GAB Gense	250	Jan. 1981
Mawenzi Forging & Tool Co. Ltd. (MAFOTCO)	Hot forged producer goods	Plough shares, planer blades	32	Private (SIDO 40%)	July 1983	GAB Gense	250	Aug. 1979
Moshi Cutlery Co. Ltd. (MOCCO)	Knife blades	Knifes	60 excl. Simon Eng.	Private	May 1981	GAB Gense	250	Aug. 1979
Simon Engineering Ltd.	Stainless steel products		**	Same owner as MOCCO	1984			
Moshi Handtools (MOTO)	Coffee shears and pliers	Combination plier	16	SIDO	March 1983	GAB Gense	250	Oct. 1981
Northern Packages Co. Ltd. (NORRAPAK)	Folding boxes, prints and packing materials	Printing block	10	Private	Beg. 1982	GAFS Kartong AB	15	Sept. 1980
Tanlocks Ltd.	Padlocks and doorlocks	Simple types of locks, telephone locks	26	Private	May 1981	Låsbolaget AB Möbellås AB	62 25	June 1979 Spring 1986
Tanoptic Ltd.	Optical lenses	-	12	Private	Feb. 1983	Optileks	20	March 1981
Tanzania Eyelets Co. Ltd. (TECO)	Shoe eyelets, battery caps Tent eyelets Bottom discs	Mosquito coils	9	Private	April 1982	Götarps Industri AB	145	Sept. 1980

Junior sister	Contracted products	New products	No. of employees (1986)	Ownership	Production start (performance test date)	Senior sister(s)	No. of emp. (at contract date)	Contract date
MBEYA INDUSTRIAL ESTATE								
Highlands Knitwear Manufacturers Ltd. (HIMA)	Knitted garments	-	28	Private	April 1981	Bolgo AB	30	June 1979
Mbeya Ceramics	Ceramic household items	-	25	SIDO	Spring 1985	Gabrielverken	38	Nov. 1983
Mbeya Clog Manufacturers Ltd. (Mbeya Clogs)	Clogs	Sandals	26	Private	Feb. 1982	Hultgrens Trätoffelfabrik AB	45	Oct. 1979
Mbeya Plastic Industry Ltd.	Injection molded details, plastic toys	Plastic soles, household items etc.	20	Private	June 1981	Green & Co	13	June 1979
Mbeya Wood Joinery Works Ltd.	Wooden furniture	Wooden crates	10	Private	End 1985	Karl Andersson & Söner AB	50	Nov. 1984
PEMACCO Ltd.	Electric motors and service and repair of electrical motors, generators and transformers	Extended repair capacity of other sizes and types of electrical equipment	22	Private	1981	EL AB BEVI	65	June 1979
DAR ES SALAAM PEMACCO-BEVIA Ltd.	Service and repair of electrical motors, generators and transformers		20**	Private (joint venture with junior and senior sisters and SWEDFUND)	Autumn 1986	EL AB BEVI	90	1985

** Simon Engineering Ltd., Moshi and PEMACCO-BEVIA Ltd., Dar es Salaam are not included in the calculation of total number of employees in the SI projects, since these two companies have been considered as extensions, partly outside the SI programme.

LOCAL AND FOREIGN AID NETWORKS

Local network

Actors	Comments: e.g. concerning, activities influencing small scale industries
Ministry of Industry	Government agency for industrial policies, makes decisions about forms of support, leads the governmental agencies involved in industrial development.
Other government agencies	Can make decisions regarding import licences, allocation of foreign currency, protective duty, standardization, price freezes, etc.
National organizations for small-scale industrial development	Have direct contact with the industrialists. Channel foreign aid.
Other national, regional or community organizations	Not specifically occupied with small-scale industrial development, but with regional development, etc.
Credit agencies	In some countries, loans are managed directly by the national organization for small-scale industrial development.
Contractors	Can give advice.
Customers, especially industrial customers	Are, in certain cases, very important for small-scale industrial development by making demands on quantity and quality and by training and advising sub-contractors.
Local consultants	Available for certain types of assignment, have varying degrees of competence and experience.
Universities and other institutes of higher education	Provide advice, night courses, etc. May also have advanced machinery to assist small companies with tool-making, repairs, and other specialists.

Foreign aid network

Actors	Comments: e.g. concerning, activities influencing small scale industries
SIDA and other foreign aid or international agencies	Provide the recipient country with support resources, study the project's realization, and contribute to problem-solving. Different organizations often have different goals, which can result in "patchwork". For instance, SIDA must consider the Swedish foreign aid policy's goals.
Experts	Usually hired by foreign aid or international agencies. Are available to the recipient country in order to develop/educate/advise the industrialists, usually under two-year contracts.
Consultants	Are hired by foreign aid organizations and/or the recipient country to study specific problems for a limited period of time.
Foreign companies	Connected to companies in the recipient country in order to provide training, support and advise. In the long run, foreign firms may become part of the "local network" for business reasons.
Non governmental organizations (NGO)	Voluntary and missionary organizations.

CAPABILITY CLASSIFICATION SCHEME

Source		Classification
Family background	E =	Business firm within the family (not only agriculture)
	- =	No business firms among close relatives
School	O =	Primary/secondary school etc.
	P =	Technical high school, Trade schools
	I =	University level technical education
	A =	Accountancy education, Economic high school, etc.
	E =	University level studies in Business administration or Economics
Work experience	P =	Work experience from industry
	I =	Involved in product or process development to some extent
	A =	Foreman in industry or accountant, etc.
	E =	Holder of position that involves one's own planning and procuring of resources
Courses	P =	Night courses at technical college, etc.
	I =	More qualified courses, specialist education
	A =	Accountancy courses, etc.
	E =	Courses in entrepreneurship, development of business ideas, etc.
Investment planning	- =	No participation
	I =	One's own design of production line, etc.
	E =	Participation in formulating investment criteria, decision-making, monitoring, etc.
Training programme	P =	If the purpose is only to start a production and a firm
	I =	Includes an emphasis on product-development, and/or training in calculation and design of production systems, etc.
	A =	Foreman training, basic administration
	E =	Training with the purpose of developing management and entrepreneurship, developing planning skills, e.g. thinking in alternative development routes, etc.

Stay in an industrial environment	P =	Stay in industry, production
	I =	Participation in product development or capability acquired through trainees' own questioning (a certain knowledge level a pre-condition)
	A =	Stay in industry, administration routines
	E =	Stay where there are possibilities of obtaining a good view in perspective of a firm
Disembodied technical knowledge; literature, etc.	P =	Production planning and inventory control, quality, etc.
	I =	Assisting product/process development
	A =	Business administration, forms and routines
	E =	Business development, technology management, strategic planning, etc.
Production experience	P =	Keeping the production going with existing resources and given product line
	I =	Minor improvements, incremental change
	A =	Foreman or administrative/marketing experience
	E =	Participation in discussions and planning of the development of the firm
Change activities	- =	No radical change activity
	I =	Product and/or process development
	E =	Radical development of the firm, new business unit, etc.
Communication with supplier	P =	Daily production problems, trouble shooting, etc.
	I =	Discussions and information concerning product/process development
	A =	Assistance in routine firm matters
	E =	Development of business markets and firm

n.a. = Data not available
O = No contribution
\- = No participation

NOTES

Chapter One INTRODUCTION

1:1 One definition in this field was provided by Peno (1975) where, "... this term 'technical knowledge' includes not only the purely engineering aspects of the productive process, but also the economic and organizational aspects of the operations of a firm, including management and marketing." (pp. 113-114).

1:2 Blomström (1983) classified those plants of which at least 15% of the shares were foreign owned as "foreign". In his study the foreign share variable was defined as the foreign share of employment in each industry.

1:3 For a review, see Davies (1979).

1:4 For a review of small and medium-sized firms as channels for technology transfer, see Goldberg (1978).

1:5 For instance, see Mansfield (1968), Freeman (1974) and Bell and Hill (1978) for slightly different definitions of technology.

1:6 Mattsson (1983) uses the Marxian concept 'arbetsprocess' (=work process) instead of 'produktions process' (= production process)

1:7 The difference between transfer and acquisition is sometimes defined as depending on who initiates and controls the process. Acquisition is hence referred to when the initiative comes from within the developing country, when the technology import is planned and decided upon in the developing country. According to a similar definition, when a multinational company takes the initiative, it is called transfer. (Brodén 1983, doct.diss.)

Chapter Two FRAME OF REFERENCE

2:1 According to the dependency school, orginating in Latin America in the '60s, explained the underdevelopment of LDCs in the 'periphery' was a direct result of colonial and trade links with the industrialized countries in the 'center'. See e.g. Frank (1967), Cardoso and Faletto (1969) and Sunkel and Paz (1970).

2:2 For a review of research and literature on entrepreneurship, see Kent et al. eds. (1982) and Sexton and Smilor eds. (1986).

2:3 However, Barth (1963) placed the entrepreneur in a wider context of interaction. He saw the entrepreneurial career as a process, "... as a chain of transactions between the entrepreneur and his environment ..." (p. 7), and emphasized the entrepreneur's relations with other people.

2:4 According to Rogers (1983), the number of studies was about 3100, in a variety of research areas, e.g. anthropology, education, communication, marketing and geography. See Rogers (1983) for a review.

2:5 However, Mill's condition that the infant should be able to compete internationally in the future is not enough to qualify the infant for protection. The discounted social return must also cover the discounted cost of the protection (Bastable 1921, Corden 1974).

2:6 Corden (1974) also mentions a third possible way, 'pecuniary external economies', which, however, he considers to be less valid as a basis for the infant industry argument.

2:7 This type of externality only occurs if the wages are higher than the marginal productivity of the worker during the training period.

2:8 The notion concerning economy of scale might need some qualification. This argument is based on work by Kreuger (1981) and Katz (1983). In Kreuger (1981), reference is made to auto production and a certain minimum efficient output size. However, the minimum efficient size might vary, due to different ways of organizing production as well as of specific product designs (Karlsson 1979?). Furthermore, in some industries, what are assumed to be economies of scale show up as diseconomies of scale under certain circumstances, e.g. this has been shown for the Swedish sawmill industry and for chipboard plants (Gustavsson 1979). Gustavsson pointed out that differences in management, culture and working conditions may affect the economy of scale. The supply of raw material may also be of a decisive importance. This was a problem for some of the chipboard plants in Sweden and this would be assumed to be an even more frequent problem for most developing countries , suggesting that the optimal efficient size of an LDC plant might be less than 'normal' world size.

2:9 However, according to Kreuger (1981) referring to the Asian NICs, "... the difference in growth rates seems to be greater than can conceivably be accounted for by the exporting sector of the economy." (p. 4).

Chapter Four TANZANIAN INDUSTRY AND THE SISTER INDUSTRY PROGRAMME

4:1 The description of the basic industry strategy is an excerpt from Alänge et al. (1979).

Chapter Six STOCKS OF CAPABILITIES

6:1 Bo Carlsson (1980) referring to a study by Lars Vinell. In the original Horndal case, the annual productivity increase was 2%, without any additional investments (Lundberg 1961).

6:2 The terminology administrative and entrepreneurial capability is in accordance with e.g. Stevenson and Gumpert (1985) in their discussion of the entrepreneurial culture versus the administrative culture.

6:3 An overview of innovations carried out in the junior sisters is provided in Löwbäck (1987a).

Chapter Seven THE PROCESS OF CAPABILITY ACQUISITION

7:1 "In principle, there are ... three main ways" (training, learning and disembodied technical knowledge). "In addition, ... may be acquired even ... in an embodied form. For example, the technical knowledge ... may be extracted by 'reverse engineering' ..." (Bell and Hoffman 1981, pp. 88-90).

7:2 'Production' should here be seen in a wide sense, e.g. including assembly work as well as sales visits and development work.

7:3 See Bell (1984, pp. 194-195) concerning 'system performance feed-back' and Fitts and Posner (1967, pp. 27-33) on feed-back and human performance.

7:4 For learning curves see Wright (1936), de Jong (1956) and Franklin (1963).

7:5 "...the acquisition of technological capability does not come merely from experience, though experience is important. It comes from conscious efforts -- to monitor what is being done, to try new things, to keep track of developments throughout the world, to accumulate added skills, and to increase the ability to respond to new pressure and opportunities." (Dahlman et al. 1985)

7:6 This scale is not based on monetary value but is a subjective estimate related to the stock of capability in the most qualified firm in our sample. However, it is possible to transform it to monetary value by adding a constant (c) reflecting an exchange rate into a currency.

In principle, it would be possible to assume that 100c is the value a perfect market would place on a 'complete' know-how agreement in which the firm agrees to supply all its knowledge.

7:7 In the present study, the estimation of the capability stock is made by one person. This way of making an estimate could be considered as unreliable. However, there are ways to improve the method of estimating capability stocks. For example, it is possible to control the intersubjectivity by using a panel of experts. In this specific case, a panel could consist of representatives from SIDO, Fide and the research group. However, the original intention of the present study was not to develop a method for measuring the effect of technology transfer on the dynamic process of capability acquisition. Rather, the method was developed during the course of the analysis of our data, when the lack of instruments for quantifying dynamic effects became evident. Nevertheless, although some of the practical measures taken have not been so sophisticated, the calculations of the value of the senior sisters' contributions and of the SI projects' cost efficiency still represent the method design in principle.

7:8 In Swedish industry, there is a rule of thumb never to run production systems with high manual work content at a low pace as it has been shown to be very hard to increase the pace after a period of lower capacity utilization. Instead close-down of the production section for a limited period of time is preferred to cope with periods of lower demand (Karlsson 1979).

7:9 The social value of dynamic capabilities acquired to handle certain situations may be less than optimal. For example, in India the legislation aiming at protecting indigenous industry by stipulating the use of local subcontractors has contributed to the development of a high dynamic capability in making local components. However, this dynamic capability has not proven competitive in relation to international competitors. (Sigurdson and Bhargava 1983, pp. 275-276)

7:10 However, there is no necessary causal effect of stability/uncertainty.

7:11 For a review, see Davies (1979) and Caves (1982, chapter 9).

7:12 The determining factor is not always size, but the degree of global strategy, since there are small-scale firms with a global market within narrow segments. This is especially common in the case of new high-tech firms. However, the differences between small firms in the same industry are considerable. For example, it was advantageous for Korean lathe manufacturers to acquire NC-technology from small European manufacturers, as these only had regional strategies, whereas the Japanese competitors had world-wide strategies. The size of the supplier is not always the decisive factor for the presence of an international strategy and market.

7:13 Inventive capabilities might rest on few persons, but knowledge might be available about other existing products in the IC, which however are new for the LDC. In this case there would as well be a potential for transfer of inventive capability.

7:14 Long-term technological ties to foreign suppliers might also be of considerable value for 'mature' industries, since it would be a waste of resources to develop all parts of the technology by oneself. This also holds true for firms in industrialized countries, e.g. Japanese firms import technology to a very large extent (which later is adapted and developed further).

7:15 For example, Bhagavan (1979) uses the concepts 'structural dependency' and 'technological dependency of the primary kind'.

7:16 "The psychic distance is defined as the sum of factors preventing the flow of information from and to the market. These include differences in language, education, business practices, culture, and industrial development" (Johansson and Vahlne 1977, reprinted in Engwall ed. 1984, p. 49).

7:17 MAFOTCO's senior sister Gense imports cutlery from one of their other junior sisters MOCCO. MAFOTCO supplies MOCCO with blanks for knives.

7:18 The history of industrial development in other countries, e.g. Korea and Japan, supports this emphasis on initially developing production capabilities through international technology transfer (see Kim 1980). However, it should be kept in mind that the subsequent steps towards developing an indigenous dynamic capability do not come automatically.

7:19 The SI programme involves new firms started from scratch. For more advanced LDC firms, the appropriate sequence may not be the same. Instead, a more selective strategy is needed, to acquire knowledge elements that correspond to the company's developmental level, e.g. training programmes to increase the inventive capability.

7:20 Of greater concern is the fact that earlier research has found that "It is in the domain of internal coordination and control that the formation of human competencies have proved most difficult" (Kilby 1973).

7:21 Other concepts with a similar meaning have also appeared in literature: deep/surface (Marton and Säljö 1976) and function/additive (Karlsson 1979).

7:22 It has been shown (Kjellberg and Sjösten, 1979) that by applying a holistic type of training, assembly operators have managed to learn a significantly longer work cycle during a given period than is indicated by Wright's (1936) and de Jong's (1956) learning curves (20 hours, compared to 2 hours according to de Jong's curves for a 6-month training period).

Chapter Nine COSTS AND BENEFITS OF THE SISTER INDUSTRY PROJECTS

9:1 Within the frame of the SI programme, personnel have also been trained for the common facility workshops at the industrial estates. Furthermore, parts of the SIDO staff have been in Sweden for managerial and technical training. These costs are not considered here.

9:2 In table 9.1 the time is shown with one decimal, while the monthly cost is calculated based on the real time.

9:3 The costs of the Swedish in-plant training in tables 9.1 and 9.5 are based on the consultant Fide's check-up of invoices from autumn 1985. The figures for the eight case studies' total costs in tables 9.2, 9.3 and 9.4 are based on estimations by Fide in August 1985. The figures are not completely compatible, which might be due to the way the costs have been classified. We use the costs according to table 9.1 and 9.5 for our discussion of Swedish in-plant training, since these figures are more detailed. For the discussion of total costs and the more coarse division between hardware and software (know-how and training), the other figures are used.

9:4 The difference between this figure (15 M SEK) from Table 9.1 and the one provided in the introduction of section 9.2.1 (16 M SEK) for training in Sweden, is probably a result of differences in classification of costs.

9:5 The firm of consultants, Fide, has been involved in direct training activities in Tanzania. Hence, the cost of Fide's monitoring activities has been estimated to be of the same magnitude as in the project where Fide has not conducted training. Hence, the cost of Fide as a consultant has been estimated at 2.6% of the total cost, and the rest has been transferred to the training cost in Tanzania.

9:6 The monthly cost of in-plant training in Sweden for KIMESHA is ten times higher than for the other projects (see table 9.5). The reason for this is not clear; the most plausible explanation is that it is due to the way the cost has been classified. If not, the cost is unacceptably high.

9:7 The comparison of the SI firms' cababilities with already existing capabilities within other local industries is relatively superficial, since it was not possible to study the other firms' capabilities in detail within the framework of this thesis.

9:8 The FAWIPMA hand-loom technology may, however, offer an opportunity for production in rural villages where electricity is missing. In that case, other factors, for example the procurement and distribution of raw material, have to be considered.

9:9 Furthermore, this is supplemented in a subtle way by making the senior sisters interested in working with Tanzania; letting the Swedish industrialist have a feeling of importance and appreciation as early as their first preparatory visit to Tanzania.

9:10 The data utilized for comparison in this section come from Forss (1985a), who made an evaluation of the total technical training within the SIDA-supported small scale industry programme in

Tanzania. He included the training of SIDO staff, common facility workshop personnel, etc., while our study only considers the in-plant training in SI projects.

9:11 Here, Forss (1985a) uses the cost 35.000 SEK a month for the total technical training, including training for personnel from the common facility workshops and from SIDO, as compared with 28.876 SEK if only the SI projects are concerned.

9:12 To a certain extent, Forss recognizes the need to relate the costs to impact of training in his comments on missing data in evaluations of the ILO and UNIDO programmes.

9:13 In the basic industry strategy, outlined in the first half of the '70s, steel-using, import-substituting industries were to be given priority in order to establish a demand for steel. The start of a local steel mill was then seen as the next logical step. This policy, based on experiences from larger economies, was, however, later considered less appropriate for Tanzania as it places very high demands on investment resources. Hence, these ideas were replaced or at least postponed to an unforeseeable future. (see also section 4.2.2 'The Basic Industry Strategy')

9:14 Skarstein and Wangwe (1985) calculated this according to the assumed figure of 80% capacity utilization in 1970.

9:15 The selection of a specific product or production technique can be justified in different ways, e.g. by being input to other industry or incentive goods for producers, by making use of local raw material or saving foreign exchange through more efficient use of imported inputs, by being an export product or by providing 'essential goods for the bulk of the population for use in their everyday life'. In Tanzania a priority list for foreign exchange allocations was made according to this type of consideration as a measure to deal with the economic crisis. The guidelines for this were written in the Structural Adjustment Programme of 1982-1985, e.g. see TISCO (1982).

9:16 There are a number of variants of social cost-benefit analysis, e.g. UNIDO (1972) and Little and Mirrlees (1974). In theory, any kind of benefit can be quantified and included in the SCB analysis. In practise, however, all SCB analyses are, by necessity, partial, as it is not practical, to include all possible effects.

9:17 Niklasson (1983) commented on the possibility of first selecting a number of project that give a positive value in a cost-benefit analysis. Other criteria, indirect and long-term, can then be of importance for ranking the projects first selected. (p. 45)

9:18 It is assumed that the choice of product is given and correct, and that the alternative is to use the foreign exchange to buy raw material for the existing plants.

9:19 An assumption is made that the total cost of capability acquisition could be considered as benefiting only the persons that were trained in Sweden. This is not completely correct, because other individuals also benefited from training during the Swedish instructors' stay in Tanzania for installation and start-up. Nevertheless, the above assumption makes it possible to construct an artificial measure of cost effectiveness, which compensates for the differences in size and investment of the SI projects.

9:20 The specific way different costs are met has a certain influence on the way they are classified during the negotiation phase. For a Swedish firm, the total sum is of primary interest; exactly how it is classified is of less interest, i.e. if it is payment for hardware, know-how or training activities. For the junior sisters, on the other hand, it is of vital interest that the hardware sum is as low as possible, because it is on this that their loans are based. Training and know-how costs are considered as 'national costs' and are covered by the Tanzanian State. During the negotiation phase, the junior sisters are not yet involved. Instead, SIDO, Fide and the senior sister conclude the negotiation assisted by business lawyers. However, Fide and SIDO feel obligated to ensure that the junior sister gets a fair deal, as it is in their interest to be able to show successful junior sisters making profits. Hence, it can be assumed that the costs for different projects are not always directly comparable and that the know-how component allows the negotiators to put a greater or lesser burden on the individual junior sister (see table 9.2). This cost is zero in some projects, whereas it is 1.5 M SEK for AMI.

9:21 In 1982, the direct salary cost for an expatriate manager was 170.000-180.000 Shs, one third of which was payed in foreign exchange. The comparative salary level for a Tanzanian manager was 50.000 Shs per year.

9:22 Inflation does not seem to influence ranking between KIMESHA and AMI. AMI had its major training period in 1978-79 (6 persons), 1981 and 1985 (one person each time). Furthermore, the know-how component in the contracts is 50% of the total capacity acquisition cost and it was paid in 1979. KIMESHA's training in Sweden took place in 1980, but the major capability acquisition cost (75%) concerns the Swedish consultants' stay in Tanzania in 1978 (according to table 9.2). An inflation table for Swedish currency is provided under 'abbreviations'.

9:23 Regarding AMI and KIMESHA, the difference in cost effectiveness is 43% (AMI = 5.0 and KIMESHA = 3.5, according to table 9.17). However, it could be argued that the KIMESHA cost, now divided between two persons, should be allocated to the general manager alone, as the other person who went to Sweden for training, has his occupation outside the SI project, to a very large extent. In this case, the difference in cost effectiveness would be 186%.

9:24 However, this conclusion is based on data from two cases only. The present study did not purport to make a social cost-benefit analysis and has thus no data permitting a SCB analysis of the other six case projects.

9:25 This is especially so since our method does not provide any reference to a zero value of costs in relation to benefits. It is a relative measure for ranking different projects according to their long-term dynamic effects. Hence, it may be relevant to view our method as a complement to traditional SCB analysis.

Chapter Ten TECHNOLOGY TRANSFER, ENTREPRENEURSHIP AND LDC INDUSTRIALIZATION

10:1 See Hult and Odéen (1979b), Shapero (1981) and Vesper (1982, 1985) for a summary of research in education for entrepreneurship.

10:1 According to the Swedish importer of cutlery, the quality of the Tanzanian products, was as high or higher than that of other suppliers from Austria, Finland and Japan after just a few years of production (1982). To a certain extent, this might be explained by the fact that the Tanzanian company was able to sell the second-grade products on the local market, and thus only exported first-grade products. (Second-grade in this case refers primarily to minor "finish" defects that do not influence the function as such).

10:3 It is not possible to make a comparison of the influence of export promotion versus import substitution policies based on our empirical data. The SI programme was started as an inward-looking import substitution programme. All but one of the firms studied were originally started in order to produce products that would replace imports. Some of them have later started to export and acquired international experience. However, observations of these firms suggest that exposure to the export market is beneficial in terms of providing information and ideas for the further development of the firms. In this way, it seems like the firms with more international experience have developed more maturity than the ones that only supply the local market. However, the cause-effect might also be the opposite, i.e. that the more mature firms also start exporting to a greater extent.

10:4 The discussion above concerns measures to cope with information and creditability inadequacies. However, it should be pointed out that any type of government policy might be in vain if it is counteracted by other governmental actions or restrictions. For example, the Tanzanian foreign exchange market is highly distorted. The result is that Tanzanian companies are not motivated to export, even if they succeed in obtaining needed foreign currency for raw material imports, since their short-term profit from sales on the local market widely exceeds that from the export markets. However, there are means of adjusting this condition. One way of steering companies towards export is to provide exporters with an advantageous position for obtaining scarce foreign currency. This kind of policy has been applied in Tanzania. The risk is, however, that an extensive system of different kinds of partly counteracting government interventions result in inefficiencies and even in difficulties in knowing what affects what.

10:5 There are some similarities with this view of 'net work infancy' and the concept 'development block' used by Dahmén (1950) to explain the pattern of industrialization in Sweden. Development blocks refers to a 'cluster of contingent partial developments' - for example, parts of the industrial infrastructure, such as the 'electric development block' where the electrical engineering industry is a part. (see e.g. Dahmén 1970, p. 65 and pp. 398-400 and Granstrand 1982 p. 11).

Chapter Eleven CONCLUSIONS

11:1 Nelson and Winter (1977) introduce the concept 'selection environment' and a model describing the components of the selection environment (worth, manner, investment and imitation processes). It is seen primarily as a tool for describing the considerable institutional complexity and variety which provide the basis for the innovation process. The start-up of a new imitation-based firm can be seen as one form of diffusion of an innovation.

Sources

When otherwise not indicated the source for tables and figures is the author's own interview data.

REFERENCES

Abernathy, W.J. and Utterback, J.M. (1978), "Patterns of Industrial Innovation", Technology Review, Vol. 80, No. 7, June/July 1978, pp. 3-9

Africa Now (1982), "Tanzania Survey, a verbal safety valve", December 1982, pp. 67-69

Ahmed, A.S. (1982), Promotion of transfers of technology by small and medium-sized enterprises to developing countries: public policy implications and applicable instruments, UNCTAD, TD/B/C.6/79

Aldrich, H., Rosen, B. and Woodward, W. (1986), A Social Role Perspective of Entrepreneurship: Preliminary findings from an empirical study, School of Business Administration, University of North Carolina at Chapel Hill, (mimeo presented at the 1986 Entrepreneurship Research Conference at Babson College, Wellesley)

Aldrich, H. and Zimmer, C. (1986), "Entrepreneurship through Social Networks", in Sexton, D. and Smilor, R. eds. (1986), The Art and Science of Entrepreneurship, Ballinger, Cambridge, Massachusetts

Allen, T.J. (1984), Managing the Flow of Technology, The MIT Press, Cambridge, Massachusetts

Alloway, R.M. (1977), Research and Thesis Writing Using Comparative Cases, Massachusetts Institute of Technology, (mimeo)

Almgren, B. and Söderberg, S. (1980), "Arbetsorganisationen som bas för social och professionell utveckling", (The work organization as a basis for social and professional development), UARDA-report, No. 9, Dept. of Ind. Management, Chalmers University of Technology, Göteborg, (in Swedish)

Alänge, S. (1980), Sister Industries in Arusha, April 1980, Dept. of Ind. Management, Chalmers University of Technology, Göteborg, (mimeo)

Alänge, S. (1986a), "The Sister Industry Programme in Tanzania; Eight Case Studies", CIM-Working Papers, No. 86:01, Dept. of Industrial Management, Chalmers University of Technology, Göteborg

Alänge, S. (1986b), "Motives for Becoming an Entrepreneur", CIM-Report, No. 86:04, Dept. of Industrial Management, Chalmers University of Technology, Göteborg

Alänge, S., Fatukubonye, A., Löwbäck, T., Mushi, E., Niklasson, H. and Nyoni, C. (1981), Transfer of Technology through Small-Scale Sister Industry Agreements - two years later, Dept. of Ind. Management, Chalmers University of Technology, Göteborg

Alänge, S. and Granstrand, O. (1984), The Various Roles of Technology and Technical Change in Development Theory, proposal for an exploratory literature study and seminar series, Dept. of Industrial Management, Chalmers University of Technology, Göteborg (mimeo)

Alänge, S. and Granstrand, O. (1986), "Autonomous, Corporate or State Entrepreneurship? the cases of Sweden and Tanzania", CIM-Report, No. 86:03, Dept. of Industrial Management, Chalmers University of Technology, Göteborg

Alänge, S., Hult, M. and Löwbäck, T. (1979), Transfer of Technology through Small-Scale Sister Industry Agreement - a study, Dept. of Ind. Management, Chalmers University of Technology, Göteborg

Alänge, S. and Löwbäck, T. (1979), The generation of technological knowledge via technology transfer, Dept. of Ind. Management, Chalmers University of Technology, Göteborg, (mimeo)

Alänge, S. and Löwbäck, T. (1981a), "Transfer of Technology through Small-Scale Sister Industry Agreements - en analys av motiv till ulandsengagemang", Research report, No. 7, Marketing Techniques Center, Stockholm, (in Swedish. Alänge and Löwbäck (1986) is a slightly revised English version)

Alänge, S. and Löwbäck, T. (1981b), Technological knowledge - a pilot study, Dept. of Ind. Management, Chalmers University of Technology, Göteborg, (mimeo)

Alänge, S. and Löwbäck, T. (1982), Mechanisms for the Relocation of Technology Capital, Dept. of Ind. Management, Chalmers University of Technology, Göteborg, (mimeo).

Alänge, S. and Löwbäck, T. (1986), "Motives for small scale industries to involve themselves as suppliers of technology to developing countries", CIM-Report, No. 86:02, Dept. of Ind. Management, Chalmers University of Technology, Göteborg

Alänge, S., Löwbäck, T. and Theman, J. (1981), Mätning av transkulturell kunskapsöverföring, (Measurement of trans-cultural knowledge transfer), Dept. of Ind. Management, Chalmers University of Technology, Göteborg, (in Swedish)

Balassa, B. (1975), "Reforming the System of Incentives in Developing Countries", World Development, Vol. 3, No. 6, June, pp. 365-382

Balasubramanyam, V.N. (1973), International Transfer of Technology to India, Praeger Publishers, New York

Baldwin, R.E. (1969), "The Case against Infant-Industry Tariff Protection", Journal of Political Economy, Vol. 77 (1969), pp. 295-305

Barker, C.E., Bhagavan, M.R., von Mitschke-Collande, P.M. and Wield, D.V. (1976), Industrial production and transfer of technology in Tanzania; The political economy of Tanzanian industrial enterprises, University of Dar es Salaam, Institute of Development Studies, Dar es Salaam, (mimeo)

Barth, F. ed. (1983), The Role of the Entrepreneur in Social Change in Northern Norway, Årbok for Universitetet i Bergen, Humanistisk Serie, 1963, No. 3, Norwegian Universities Press, Bergen

Bastable, C.F. (1921), The Commerce of Nations, 10th ed., Macmillan and Co, London

Bell, R.M. (1984), "'Learning' and the Accumulation of Industrial Technological Capacity in Developing Countries", in Fransman and King eds. (1984)

Bell, R.M. and Hill, S.C. (1978), "Research on Technology Transfer and Innovation", in Bradbury, F., Jervis, P., Johnston, R. and Pearson, A. eds. (1978), Transfer Processes in Technical Change, Sijthoff & Noordhoof, Alphen aan den Rijn

Bell, R.M. and Hoffman, K. (1981), Industrial Development with Imported Technology: A Strategic Perspective on Policy, Science Policy Research Unit, University of Sussex, (mimeo)

Bell, M., Ross-Larson, B. and Westphal, L.E. (1984), "Assessing the Performance of Infant Industries", World Bank Staff Working Papers, No. 666, World Bank, Washington, D.C.

Bell, M., Scott-Kemmis, D. and Satyarakwit, W. (1980), "Learning and Technical Change in the Development of Manufacturing Industry: A Case Study of a Permanently Infant Enterprise", SPRU Working Paper, University of Sussex, Falmer

Bhagavan, M.R. (1979), "Inter-relations Between Technological Choices and Industrial Strategies in Third World Countries", Research Report, No. 49, Scandinavian Institute of African Studies, Uppsala

Bhagavan, M.R. (1984), "Technological Transformation of Developing Countries", SAREC Report, No. R4, Stockholm

Bhalla, A.S. (1974) "Small Industry, Technology Transfer and Labour Absorption" in OECD (1974), Transfer of Technology for Small Industries, Paris

Birley, S. (1985), "The role of networks in the entrepreneurial process", pp. 325-337 in Hornaday, J.A. et al. eds. (1985)

Blomström, M. (1983), Foreign Investment, Technical Efficiency and Structural Change, Department of Economics, University of Göteborg, (doct.diss.)

Bohlin, H. (1981), Management - ett försök till definition, (Management -a tentative definition, our transl.), Dept. of Industrial Management, Chalmers University of Technology, Göteborg, (mimeo in Swedish)

Brandström, P. (1981), Personal communication

Brockhaus, R.H.,Sr. (1982), "The psychology of the entrepreneur", in Kent et al., eds. (1982)

Brodén, M. (1983), From Transfer to Acquisition of Technology, a study of the industrialization process in Tanzania, Dept. of Management and Economics, Linköping University, Linköping, (doct. diss.)

Broehl, W.G., Jr. (1982), "Entrepreneurship in the less developed world", in Kent et al., eds. (1982)

Cardoso, F.H. and Faletto, E. (1969), Dependencia Y Desarrollo en América Latina, Mexico, Siglo XX1

Carlsson, B. (1980), "Technical Change and Productivity in Swedish Industry in the Post-War Period", Research Report, No. 8, The Industrial Institute for Economic and Social Research, Stockholm

Carlsson, J. (1986), Proposal for a Sister-Daughter Programme for the Small Scale Industry in Tanzania, Fide, Värnamo (mimeo)

Carroll, J.J. (1965), "The Filipino Manufacturing Entrepreneur", Cornell University Press, Ithaca

Caves, R.E. (1982), Multinational Enterprise and Economic Analysis, Cambridge University Press, Cambridge

Chada, S.I.S. (1981), Technology Transfer Project Management, Department of Industrial Economics and Management, Royal Institute of Technology, Stockholm (doct. diss.)

Cole, R.E. (1979), Work, Mobility and Participation, University of California Press, Berkeley

Cooper, A.C. (1970), The Founding of Technology-Based Firms, the Center for Venture Management, Milwaukee, WI

Cooper, A.C. (1971), "Spin-offs and technical entrepreneurship", IEEE Transactions of Engineering Management, Vol. EM-18, No. 1 (February 1971)

Cooper, A.C. (1984), "Contrasts in the role of incubator organizations in the founding of growth-oriented firms", pp. 159-174 in Hornaday et al. eds. (1984)

Cooper, C. (1980), "Policy Interventions for Technological Innovation in Developing Countries", World Bank Staff Working Papers, No. 441, World Bank, Washington, D.C.

Cooper, C. (1985), "Technical Collaborations between Firms in the Benelux and in Inida", Economic and Political Weekly, Vol. xx, Nos. 45, 46 and 47, Special Number 1985, pp. 2005-2022.

Cooper, C.M. and Hoffman, H.K. (1978), Transactions in technology and implications for developing countries, Science Policy Research Unit and the Institute of Development Studies, University of Sussex, (mimeo)

Cooper, C.M. and Maxwell, P. (1975), Machinery suppliers and the transfer of technology to Latin America, Science Policy Research Unit, University of Sussex, (mimeo)

Cooper, C.M. and Sercovitch, F. (1970), The Mechanism for Transfer of Technology from Advanced to Developing Countries, Science Policy Research Unit, University of Sussex and UNCTAD (mimeo)

Corden, W.M. (1974), Trade Policy and Economic Welfare, Oxford University Press, Oxford

Corden, W.M. (1980), "Trade Policies" pp. 39-92 in Cody, J., Hughes, H. and Wall, D. eds. (1980), Policies for Industrial Progress in Developing Countries, Oxford University Press, Oxford

Cortes, M. (1976), Transfer of petrochemical technology to Latin America, University of Sussex, Falmer (doct. diss.)

Coulson, A. (1976), "Blood-sucking contracts" in Mapolu, H. ed. (1976)

Dahlgren, L.O. (1981), Personal communication

Dahlman, C.J. (1984), "Foreign Technology and Indigenous Technological Capability in Brazil", pp. 317-334 in Fransman, M. and King, K. eds. (1984)

Dahlman, C.J. and Fonseca, F.V. (1978), "From Technological Dependence to Technological Development: The Case of the Usiminas Steel Plant in Brazil", IDB/ECLA/UNDP/IDRC, Working Paper, No. 21, Buenos Aires

Dahlman, C.J., Ross-Larson, B. and Westphal, L.E. (1985), "Managing Technological Development, Lessons from Newly Industrialized Countries", World Bank Staff Working Papers, No. 717, Washington, D.C.

Dahlman, C.J. and Sercovich, F.C. (1984), "Local Development and Exports of Technology: The Comparative advantage of Argentina, Brazil, India, the republic of Korea, and Mexico", World Bank Staff Working Papers, No. 667, World Bank, Washington, D.C.

Dahlman, C.J. and Westphal, L.E. (1981), "The Meaning of Technological Mastery in Relation to Transfer of Technology", Annals of the American Academy of Political and Social Science, Vol. 458 (Nov. 1981), pp. 12-26

Dahlman, C.J. and Westphal, L.E. (1982), "Technological Efforts in Industrial Development: An Interpretating Survey of Recent Research", (pp. 105-37) in James and Stewart, eds. 1982, The Economics of New Technology in Developing Countries, Frances Pinter Publishers and Westview Press, London and Colorado

Dahlström, E. et al. (1966), Teknisk förändring och arbetsanpassning, (Technical change and work adaptation, our transl.), Prisma, Stockholm, (in Swedish)

Dahmén, E. (1950), Svensk industriell företagarverksamhet, IUI, Almqvist & Wiksell Boktryckeri AB, Uppsala (doct. diss. in Swedish with an English Summary)

Dahmén, E. (1970), Entrepreneurial Activity and the Development of Swedish Industry, 1919-1939, Irwin, Homewood, Ill. (a Swedish version of this study was published in 1950, "Svensk Industriell Företagarverksamhet")

David, P.A. (1975), Technical choice, innovation and economic growth, Cambridge University Press, London

Davies, H.A. (1977), "Technology Transfer Through Commercial Transactions", Journal of Industrial Economics, Vol. 26, No. 2, Dec. 1977

Davies, H. (1979), "Transfer of Technology and the Multinational Enterprise", Management Bibliographies & Reviews

Dore, R. (1984), "Technological Self-reliance: Sturdy Ideal or Self-serving Rhetoric", in Fransman and King eds. (1984)

Draheim, K., Howell, R.P. and Shapero, A. (1966), The Development of a Potential Defense R&D Complex: A study of Minneapolis - St. Paul Menlo Park, Stanford Research Institute

Drucker, P. (1977), People and Performance: The Best of Peter Drucker on Management, Harper & Row, New York

Ellison, R. (1976), "An Alternative to Direct Investment Abroad", International Management, June 1976, pp. 25-27

Engvall, L., ed. (1984), Uppsala Contributions to Business Research, Department of Business Administration, University of Uppsala

Farrel, T.M.A. (1979a), "Do Multinational Corporations Really Transfer Technology?", in D.B. Thomas and M.S. Wionczek (1979), pp. 69-78

Farrel, T.M.A. (1979b), "A Tale of Two Issues: Nationalization, the Transfer of Technology and the Petroleum Multinationals in Trinidad and Tobago", Social and Economic Studies, Vol. 28, No. 1, Institute of Social and Economic Research, University of the West Indies

Fitts, P.M. and Posner, M.I. (1967), Human Performance, Brooks/Cole Publishing Company, Belmont, California

Forss, K. (1985a), Training Abroad, an evaluation of technical training within the SIDA-supported small scale industry programme in Tanzania, Institute of International Business, Stockholm School of Economics, Stockholm

Forss, K. (1985b), Planning and Evaluation in Aid Organizations. The Economic Research Institute, Stockholm School of Economics, (doct. diss.)

Frank, A.G. (1967), Capitalism and Underdevelopment in Latin America, Monthly Review Press, New York

Franklin, L. (1963), "Inlärningsförlopp och Instruktionseffekter" ("Experience Learning and Effects of Instructions", our transl.), Arbets studietekniska Institutet, Stockholm, (in Swedish, but with an English summary)

Fransman, M. (1984a), "Explaining the Success of the Asian NICs: incentives and technology", IDS Bulletin, 1984, Vol. 15, No. 2, pp. 50-56, Institute of Development Studies, Sussex

Fransman, M. (1985), "Conceptualising Technical Change in the Third World in the 1980s: An Interpretative Survey", The Journal of Development Studies, Vol. 21, July 1985, No. 4, pp. 572-652

Fransman, M. and King, K. eds. (1984), Technological Capability in the Third World, Macmillan, London

Freeman, C. (1974), The Economics of Industrial Innovation, Penguin Books, Harmondsworth, Middlesex, England

Freeman, C. (1982), The Economics of Industrial Innovation, 2nd Edition, Frances Pinter, London

Freeman, C., Clark, I. and Soete, L. (1982), Unemployment and technical innovation, Frances Pinter, London

Freeman, J.R. and Duvall, R.D. (1984), "International Economic Relations and the Entrepreneurial State", Economic Development and Cultural Change, Vol. 32, No. 2, Jan. 1984, pp. 373-400

Frej, I. (1981), "Grundläggande teknologier för småindustrietablering", (Basic technologies for small scale industry development, our transl.), Examensarbete 1980-9, Dept. of Ind. Management, Chalmers University of Technology, Göteborg, (in Swedish)

Friberg, M. (1975 and 1976), "Är lönen det enda som sporrar oss att arbeta?", (Is the salary the only incentive for work, our transl.), Sociologisk Forskning, No. 4, 1975, pp. 52-65 and No. 1, 1976, pp. 24-42, (in Swedish)

Gabriel, P.P. (1967), The International Transfer of Corporate Skills, Harvard University, Graduate School of Business Administration, Boston

Galtung, J. (1969), Theory and Methods of Social Research, Universitetsforlaget, Oslo

Ghosh, A.B. and Forss, K.S. (1981), Sister Industry Program, an Experiment in the Transfer of Technology, RP 81/2, Institute of International Business, Stockholm School of Economics, Stockholm

Gibbs, G., Morgan, A. and Taylor, L. (1980), A Review of the Research of Ference Marton and the Göteborg Group, Study Methods group report No. 2, Institute of Educational Technology, The Open University, Milton Keynes

Girvan, N. ed. (1973), "Dependence and Underdevelopment in the New World and the Old", Social and Economic Studies, Special Number, Vol. 22, No. 1, (March 1973)

Glaser, B.G. and Strauss, A.L. (1967), The Discovery of Grounded Theory: Strategies for Qualitative Research, University of California, San Francisco Medical Center, Aldine Publishing House, Chicago

Goldberg, A.I. (1978), "The small - and medium-sized firm as a channel for technology transfer between nations", R&D Management, Vol. 8, No. 2, 1978 pp. 91-93

Granovetter, M.S. (1973), "The strength of weak ties", American Journal of Sociology, No. 78, pp. 1360-1380

Granstrand, O. (1979), Technology, Management and Markets, Dept. of Industrial Management, Chalmers University of Technology, Göteborg, (doct. diss.) available in a revised version with the same title published by Frances Pinter (Publishers) Ltd., London, 1982

Granstrand, O. (1980), The role of technology trade in Swedish companies, Dept. of Industrial Management, Chalmers University of Technology, Göteborg, (mimeo)

Gustafsson, H. (1981), On-the-Job Learning and Resource Allocation in Developing Countries: A measurement Problem in Project Appraisal and a Proposal on its Solution, University of Sussex, Falmer, (MA diss.)

Gustavsson, S.-O. (1979), Drivkrafter till och konsekvenser av olika anläggningsstorlek (Motive Forces for and Consequences of Different Plant Size), Dept. of Industrial Management, Chalmers University of Technology, Göteborg, (doct. diss.)

Hallén, L. and Wiedersheim-Paul, F. (1979), Psychic Distance and Buyer-Seller Interaction, in Engvall, L., ed. (1984)

Hammarkvist, K.-O. (1978), "Lansering av nya produkter - en granskning av diffusionsteorins tillämpbarhet på producentvarumarknaden" (Introduction of new products - a review of the applicability of the diffusion theory on the producer goods market, our transl.), pp. 166-181 in Arndt, J., Grönroos, C. and Mattsson, L.-G. eds. (1981), Marknadsföring -Nordiska perspektiv, Studentlitteratur, Lund (in Swedish)

Harris, J.R. (1970), "Nigerian entrepreneurship in industry", in Eicher, C. and Liedholm C. (1970), Growth and Development of the Nigerian Economy, Michigan State University, East Lansing

Harris, J.R. and Rowe, M.P. (1966), "Entrepreneurial Patterns in the Nigerian Sawmilling Industry", Nigerian Journal of Economic and Social Studies, Vol. 8, No. 1, March 1966

Hart, G.P. (1972), African Entrepreneurship, Occasional Paper Number Sixteen, Institute of Social and Economic Research, Rhodes University, Grahamstown

Harwood, E. (1982), "The Sociology of entrepreneurship", in Kent et al., eds. (1982)

Havnevik, K.J., Skarstein, R. and Wangwe, S.M. (1985), Small Scale Industrial Sector Study - Tanzania, Ministry of Industries and Trade, Dar es Salaam and SIDA, Stockholm

Hedlund, G. and Hägg, I. (1978), "Case Studies" in Social Science Research, Working paper, No. 78-16, EIASM, Brussels

Hettne, B. (1982), Development Theory and the Third World, SAREC Report, R2 1982, Stockholm

Hofstede, G. (1980), Culture's Consequences: International Differences in Work-Related Values, Sage Publications, Beverly Hills

Hornaday, J.A., Timmons, J.A. and Vesper, K.H. eds. (1983), Frontiers of Entrepreneurship Research 1983, Center for Entrepreneurial Studies, Babson College, Wellesley, Massachusetts

Hornaday, J.A., Tarpley, Jr., F., Timmons, J.A. and Vesper, K.H. eds. (1984), Frontiers of Entrepreneurship Research 1984, Center for Entrepreneurial Studies, Babson College, Wellesley, Massachusetts

Hornaday, J.A., Shils, E.B., Timmons, J.A. and Vesper, K.H. eds. (1985), Frontiers of Entrepreneurship Research 1985, Center for Entrepreneurial Studies, Babson College, Wellesley, Massachusetts

Hult, M. (1980), Planning the development of the sister-industries, Växjö University, Växjö

Hult, M. and Odéen, G. (1979a), Creation of small-scale industry in southern Sweden - the Gnosjö case, Dept. of Business Administration, Växjö University, Växjö, (mimeo)

Hult, M. and Odéen, G. (1979b), Det svenska nyföretagandet, (Swedish Entrepreneurship), Dept. of Business Adm., University of Uppsala, Uppsala, (in Swedish)

Hult, M. and Odéen, G. (1980), Nyföretagandet, (The establishment of new firms, our transl.), University of Uppsala, Uppsala, (in Swedish)

Hult, M. and Odéen, G. (1983), Etableringsprocessen, Småskrifter Nr. 12, Centrum för Småföretagsutveckling, Högskolan i Växjö, (in Swedish)

Hyden, G. (1980), Beyond Ujamaa in Tanzania, underdevelopment and an uncaptured peasantry, Heinemann, London

Hyden, G. (1983), No Shortcuts to Progress, African development management in perspective, University of California Press, Berkeley and Los Angeles

Håkansson, H. and Johanson, J. (1982), Analys av industriella affärsförbindelser (Analysis of Industrial Business Relations, our transl.), Market Technology Center, Stockholm, (in Swedish)

Håkansson, H. and Laage-Hellman, J. (1984), "Developing a Network R&D Strategy", The Journal of Product Innovation Management, No. 4, 1984, pp. 224-237

Jacobsson, S. (1985), Technical Change and Industrial Policy - the Case of Numerically Controlled Lathes in Argentina, Korea and Taiwan, Dept. of Economics, University of Sussex, Falmer (doct. diss.) available in a revised version Electronics and Industrial Policy, the Case of Computer Controlled Lathes, George Allen & Unwin, London, 1986

Jansson, H. (1981), Interfirm linkages in a developing economy, Dept. of Business Administration, University of Uppsala, Uppsala, (doct. diss.)

Johannisson, B. (1985), Business and Local Community - Swedish experiences in bottom-up planning for local industrial development, Report 1985:4, University of Östersund, Östersund

Johannisson, B., Hult, M. and Holm, C.G. (1976) Framgångsrika familjeföretagare, Stockholm (ska kompl.)

Johanisson, B. and Peterson, R. (1984), The Personal Networks of Entrepreneurs, Faculty of Administrative Studies, York University, Toronto

Johanson, J. and Vahlne, J.E. (1974), "The Internationalization Process of the Firm", Working Paper, University of Uppsala, in Engvall, ed. (1984)

Johansson, B. (1981), Krafter vid rörelse. Teknologers uppfattningar av några grundläggande fenomen inom mekaniken, Rapporter från Pedagogiska Institutionen. 1981:14, Göteborgs Universitet, Göteborg, (in Swedish)

de Jong, J.R. (1956), Fertigkeit, Stückzahl und benötigte Zeit, REFA e.v., Darmstadt, (in German)

Kanawaty, G. and Thorsrud, E. (1981), "Field experiences with new forms of work organization", International Labour Review, Vol. 120, No. 3, pp. 263-277, International Labour Office, Geneva

Kaplinsky, R. (1984), "Trade in Technology - Who, What, Where and When?" pp. 139-160 in Fransman, M. and King, K. eds. (1984)

Karlsson, C. and Gadde L.-E. (1983), "Villkor för teknikbaserat nyföretagande i Västsverige", (Conditions for technology-based start-up firms in western Sweden, our transl.), Report 257, Royal Swedish Academy of Engineering Sciences, Stockholm, (in Swedish)

Karlsson, U. (1979), Alternativa produktionssystem till lineproduktion, Sociologiska Institutionen, Göteborg, (doct. diss. in Swedish)

Katz, J. (1984), "Technological Innovation, Industrial Organisation and Comparative Advantages of Latin American Metalworking Industries", pp. 113-136 in Fransman, M. and King, K. eds. (1984)

Katz, J. and Ablin, E. (1978), From infant industry to technology exports: The Argentine experience in the international sale of industrial plants and engineering works, IDB/ECLA, Buenos Aries, (mimeo)

Kent, C.A. (1982), "Entrepreneurship in economic development", in Kent et al., eds. (1982)

Kent, C.A., Sexton, D.L. and Vesper, K.H. eds. (1982), Encyclopedia of Entrepreneurship, Prentice-Hall Inc., Englewood Cliffs

Kilby, P. (1969), Industrialization in an Open Economy: Nigeria 1945-1966, Cambridge University Press, London

Kilby, P. (1971), Entrepreneurship & Economic Development, Free Press

Kilby, P. (1973), "Farm and Factory: A Comparison of the Skill Requirements for the Transfer of Technology", in Cooper, C. ed. (1973), Science. Technology and Development, Frank Cass, London

Kim, L. (1976), Technological Innovation, Structure, Environment, and Policy Implications, Graduate School of Business of Indiana University, Bloomington, (doct. diss.)

Kim L. (1980), "Stages of development of industrial technology in a developing country: a model", Research Policy, Vol. 9 (1980), pp. 254-277, North Holland Publishing Company, Amsterdam

King, K. (1977), The African Artisan, education and the informal sector in Kenya, Heinemann Educational Books, London and Nairobi

Kjellberg, H. och Sjösten, K. (1979), Inlärning av montör för dockmonteringsarbete, Examensarbete 1979-05, Institutionen för Industriell Organisation, Chalmers Tekniska Högskola, Göteborg, (in Swedish)

Kjellén, B. and Söderman, S. (1980), Praktikfallsmetodik, Liber, Stockholm (in Swedish)

Kling, D. (1981), Spridning av ny teknik (The Diffusion of New Technology), Dept. of Economics, University of Stockholm, (doct. diss. in Swedish with English summary)

Knight, F. (1921), Risk, Uncertainty and Profit, Houghton Mifflin, Boston

Knoke, D. and Kuklinski, J.H. (1982), Network Analysis, Sage Publications, Beverly Hills, California

Kotkin, J. (1986), "Pacific Inc.: Mr. Iacocca, meet Mr. Honda", Inc, Nov. 1986, pp. 37, 38, 40

Krueger, A.O. (1981), "Export-led Industrial Growth Reconsidered", pp. 3-27 in Hong, W. and Krause, L.B. eds. (1981), Trade and Growth of the Advanced Developing Countries in the Pacific Basin, Korea Development Institute, Seoul

Lall, S. (1978), Developing Countries as Exporters of Technology: A Preliminary Analysis, Institute of Economics & Statistics, Oxford University, Oxford

Lall, S. (1979) "Third World Technology Transfer and Third World Transnational Companies" in UNIDO (1979), International Flows of Technology, Industry 2000, UNIDO/IOD. 326

Lall, S. (1984), "India's Technological Capacity: Effects of Trade, Industrial, Science and Technology Policies", pp. 225-243, in Fransman, M. and King, K. eds. (1984)

Leibenstein, H. (1957), Economic backwardness and economic growth, John Wiley & Sons, New York

Lekwall, P. and Wahlbin, C. (1979), Information för marknadsförings-beslut, IHM, Göteborg (in Swedish)

Leonard-Barton, D. (1983), "Interpersonal communication patterns among Swedish and Boston-area entrepreneurs", pp. 538-563 in Hornaday et al. eds. (1983)

Lester, M. (1980), The Transfer of Managerial and Technological Skills by Electronic Assembly Companies in Free trade Zones in Malaysia, Culture Learning Institute, East-West Center, Honolulu, (mimeo)

Little, I.M.D. and Mirrlees, J.A. (1974), Project Appraisal and Planning for Developing Countries, Heinemann, London

Lund, A. (1969), "Informella intervjuer som undersökningsinstrument". (Informal Interviews as a Research Instrument, our transl.), SOU 1969:48, (in Swedish)

Lundberg, E. (1961), Produktivitet och räntabilitet, Studieförbundet Näringsliv och Samhälle, Stockholm

Löwbäck, T. (1979), Transfer of Technology through Small-Scale Sister Industry Agreement, Arusha - April 79, report No. 79-03, Dept. of Ind. Management, Chalmers University of Technology, Göteborg

Löwbäck, T. (1987a), "Potential for Capability Acquisition in some Technology Transfer Projects to Tanzania", CIM Working Papers, No. 87:01, Dept. of Industrial Management, Chalmers University of Technology, Göteborg

Löwbäck, T. (1987b), "Technological Change and Performance at the Firm Level", CIM Working Papers, No. 87:02, Dept. of Industrial Management, Chalmers University of Technology, Göteborg

MacMillan, I.C. (1983), "The politics of new venture management", Harvard Business Review, No. 6, November-December 1983, pp. 8-10, 12 and 16

Mansfield, E. (1968), The Economics of Technological Change, Longmans, London

Mansfield, E., Romeo, A., Schwartz, M., Teece, D., Wagner, S. and Brach, P. (1982), Technology Transfer, Productivity and Economic Policy, Norton, New York

Mapolu, H. ed. (1976), Workers and Management, Tanzania Publishing House, Dar es Salaam

Markkula, M. (1986), Talk at the Scandinavian Entrepreneurship Conference in Helsinki, Finland, August 29-30, 1986

Marquis, D.G. (1969), "The Anatomy of Successful Innovations." Innovation Magazine, Nov. 1969, (Also published in Rothberg 1976, pp. 14-25.)

Marris, P. and Somerset, A. (1971), African Businessmen, a study of entrepreneurship and development in Kenya, Routledge & Kegan Paul, London

Marton, F. (1976), Omvärldsuppfattning hos vuxna: projektbeskrivning, Department of Education, No. 143, University of Göteborg, Mölndal (in Swedish)

Marton, F. (1978), "Describing Conceptions of the world around us", Reports from the Institute of Education, No. 66, 1978, University of Göteborg, Göteborg

Marton, F. (1982), Towards a Phenomenography of Learning, Department of Education, No. 6-8, University of Göteborg, Mölndal

Marton, F. and Säljö, R. (1976), "On Qualitative Differences in learning: II Outcome as a function of the learner's conception of the task", Br. J. Educ. Psychology, Vol. 46, pp. 115-127

Maton, J. (1969), "Experience on the Job and Formal Training as Alternative Means of Skill Acquisition: an Empirical Study", International Labour Review, June 1969

Mattsson, J. (1983), Att förändra teknik, (To change production technology), Dissertations, No. 6, Dept. of Management and Economics, University of Linköping, Linköping, (doct. diss. in Swedish with an English summary)

Maxwell, P. (1977), Learning and Technical Change in the Steel Plant of Acindar SA in Rosario, Argentina, IDB/ECLA Research Programme in Science and Technology, Working Paper, No. 4, Buenos Aires

McClelland, D.C. (1961), The Achieving Society, Van Nostrand Reinold, Princeton, N.J.

McClelland, D.C. and Winter, D.G. (1969), Motivating Economic Achievement, The Free Press, New York

McQueen, D.H. and Wallmark, T. (1985), "Support for New Ventures at Chalmers University of Technology", pp. 609-620, in Hornaday, J.A. et al. eds., (1985)

MEIDA (1981a), MEIDA HABARI, No. 4, Sept. 1981, Metals and Engineering Industry Development Association, Dar es Salaam

MEIDA (1981b), Directory of what could be offered by MEIDA members, June 1981, Metal Engineering Industries Development Association, Dar es Salaam

Meier, G.M. and Baldwin, R.E. (1957), Economic Development, theory, history, policy, John Wiley & Sons, New York

Miles, L.D. (1961), Techniques of Value Analysis and Engineering, McGraw-Hill, New York

Miron, D. and McClelland, D.C. (1979), "The Impact of Achievement Motivation Training on Small Businesses", California Management Review, Summer 1979, Vol. XXI, No. 4, pp. 13-28 von Mitschke-Collande, P. (1980), Transfer and Development of Technology, Arbeiten aus dem Institut für Afrika-kunde No. 26, Verbund Stiftung Deutsches Ubersee-Institut, Hamburg, (doct. diss.)

Morse, C. (1975), "Making Science and Technology for LDC's", Columbia Journal of World Business, spring 1975, pp. 51-57

Mushi, E.K. (1983), personal communication

Mushi, E.K. (1986), personal communication

Mytelka, L.K. (1979), Regional Development in a Global Economy: The Multinational Corporation, Technology, and Andean Integration, Yale University Press, New Haven and London

Nabseth, L. and Ray, G.F. (1974), The Diffusion of New Industrial Processes, Cambridge University Press, London

Nafziger, W.E. (1977), African Capitalism; A Case Study in Nigerian Entrepreneurship, Hoover Institution Press, Stanford, California

Ndulu, B.J. (1986), "Investment, Output Growth and Capacity Utilization in an African Economy: The Case of Manufacturing Sector in Tanzania", Eastern Africa Economic Review, Vol. 2, No. 1, pp. 14-30

Nelson, R.R. (1981), "Research on Productivity Growth and Productivity Differencies: Dead Ends and New Departures", Journal of Economic Literature, Vol. X4, pp. 1029-64

Nelson, R.R. and Winter, S.G. (1977), "In search of useful theory of innovation", Research Policy, 6, 1977, pp. 36-76

Nelson, R.R. and Winter, S.G. (1982), An Evolutionary Theory of Economic Change, The Belknap Press of Harvard University Press, Cambridge

Niklasson, H. (1983), An Economic Study of Transfer of Technology through small-scale Sister Industries, Småskrifter No. 11, Center for Small Business Development, Växjö University, Växjö

Nilsson, L. (1979), "Karaktäristika i förändring av yrkesinriktad utbildning", (Characteristics in the Change of Vocational Training, our transl.), PM:14, Institute of Education, University of Göteborg, (mimeo in Swedish)

Normann, R. (1976), På spaning efter en metodologi, SIAR, Stockholm, (mimeo, Swedish)

Nyerere, J.K. (1968), Freedom and Socialism, a selection of writings and speeches 1965-1967, Oxford University Press, Dar es Salaam

Nyoni, C. (1982), Employee Motivation in Tanzania: a diagnostic view, University of Illinois, Urbana

Nzomo, N.D. (1986), "Entrepreneurship Development Policy in National Development Planning: The Kenya Case", Eastern Africa Economic Review, Vol. 2, No. 1, pp. 99-105

Oberschall, A. (1973), "African Traders and Small Businessmen in Lusaka", African Social Research, 16, December, 1973

Odle, M.A. (1979), "Commercialization of Technology and Dependent Underdevelopment - Some Current Issues and Future Policies" in Thomas, D.B. and Wionczek, M.S. (1979), pp. 98-119

OECD, (1981), North/South Technology Transfer: The Adjustments Ahead, Organisation for Economic Co-operation and Development, Paris

Olofsson, C. and Wahlbin, C. (1984), "Technology-based new ventures from technical universities: a Swedish case", pp. 192-211 in Hornaday et al. eds. (1984)

Onida, F., Balcet, G., Hermitte, R.B. and Viesti, G. (1985), Technology Transfer to developing countries by Italian small and medium-sized enterprises, UNCTAD/TT/81

Onyemelukwe, C.C. (1973), Men and management in contemporary Africa, Longman, London

Ostheimer, J. (1965?), Achievement Motivation among the Chagga People of Tanzania, (mimeo)

Ozawa, T. (1985), International transfer of technology by Japan's small and medium enterprises in developing countries, UNCTAD/TT/68

Peno, J. (1975), The Multinational Firm: The Utilization and Development of Host Country High-Level Manpower, Michigan State University, (doct. diss.)

Perroux, F. (1935), "La Théorie Pure de la Dynamique Capitaliste", reprinted in Perroux, F. (1965), La Pensée Economique de Joseph Schumpeter, Les Dynamiques du Capitalisme, Geneva

Peterson, R.A. (1981), "Entrepreneurship and Organization", in Nystrom, P.C. and Starbuck, W.H. eds. (1981), Handbook of Organizational Design, Oxford University Press, New York, pp. 65-83

Pierce, D.W. (1971), Cost-Benefit Analysis, Macmillan

Philips, N.V. Gloeilampenfabrieken (1978), Industrial know-how, its creation and transfer, Eindhoven

Philips, N.V. Gloeilampenfabrieken (undated), The Philips Pilot Plant, Eindhoven, (broshure)

Phillips, A. (1971), Technology and Market Structure, Lexington Books, Lexington

Poznanski, K.Z. (1984), "Review article, Technology Transfer: West-South Perspective", World Politics, October 1984, Vol. XXXVII, No. 1

Ranis, G. (1984), "Determinants and Consequences of Indigenous Technological Activity", in Fransman and King eds. (1984)

Reddy, Y.R.K. (1979), "Cost-Benefit Analysis of Training - An Appraisal", Long Range Planning, Vol. 12, December 1979, pp. 50-55

Reitberger, G. (1984), Forskning om teknikspridning (Research on diffusion of technology, our transl.), Report submitted to the National Swedish Board for Technical Development (STU), Stockholm (in Swedish)

Rogers, E.M. (1980), Technological Innovation in High Technology Industries, Institute for Communication Research, Stanford University, (mimeo presented at the International Conference on Technology Transfer, International Institute of Management, Berlin, Dec. 8-10, 1980)

Rogers, E.M. (1981), The Rise of Silicon Valley, Institute for Communication Research, Stanford University, Stanford, (mimeo)

Rogers, E.M. (1983), The Diffusion of Innovations (3rd edition), The Free Press, New York

Rogers, E.M. and Kincaid, D.L. (1981), Communication Networks, Towards a New Paradigm for Research, The Free Press, New York

Rogers, E.M. and Larsen, J.K. (1984), Silicon Valley Fever - Growth of High-Technology Culture, Basic Books, New York (1986 paperback edition)

Rosenberg, N. (1976), Perspectives on Technology, Cambridge University Press, Cambridge

Rosenblatt, S.M. ed. (1979), Technological and Economic Development: A Realistic Perspective, Westview Press, Boulder

Rweyemamu, J.F. (1973), Underdevelopment and Industrialization in Tanzania, Oxford University Press, Oxford

Rweyemamu, J.F. (1975), The Formulation of an Industrial Strategy for Tanzania, Dar es Salaam, (mimeo)

Ryle, G. (1949), The Concept of Mind, Barnes & Noble, New York

Sagasti, F. (1980), Science and Technology for Development, A Review of Schools of Thought on Science, Technology, Development and Technical Change, STPI Module 1, International Development Research Centre, Ottawa, Canada

Sahal, D. (1981a), Patterns of Technological Innovation, Addison-Wesley Publising Company, Reading, Massachusetts

Sahal, D. (1981b), "The farm tractor and the nature of technological innovation", Research Policy, Vol. 10 No. 4 (1981) pp. 368-402, North-Holland Publishing Company, Amsterdam

Sandkull, B., Lindén, K.G., Svensson, C.G. and Engström, J. (1976), Development of small industries in Tanzania, SIDA, Stockholm, (mimeo)

Schuetz, A. (1945), "On Multiple Realities", Journal of Philosophy and Phenomenological Research, Vol. 5

Schuetz, A. (1953), "Common-Sense and Scientific Interpretation of Human Action", Philosophy and Phenomenological Research, Vol. 14, No. 1, pp. 1-37

Schumpeter, J.A. (1934), The Theory of Economic Development, Harvard Economic Studies Vol. XLVI, Harvard University Press, Cambridge, Massachussets

Schumpeter, J.A. (1976), Capitalism, Socialism and Democracy, 5th ed., George Allen & Unwin Ltd, London, (first edition in 1942)

Schädler, K. (1968), Crafts, Small Scale Industries and Industrial Education in Tanzania, Veltforum Verlag, München

Schöllhammer, H. and Kuriloff, A.H. (1979), Entrepreneurship and Small Business Management, John Wiley & Sons, New York

Seddon, J.W. (1985) "The Development and Indigenisation of Third World Business, African values in the workplace", in Hammond, V. ed. (1985), Current Research in Management, Frances Pinter, London

Sexton, D.L. and Smilor, R.W. eds. (1986), The Art and Science of Entrepreneurship, Ballinger Publishing Company, Cambridge

Shapero, A. (1980), Some Social Dimensions of Entrepreneurship, The Ohio State University, (mimeo)

Shapero, A. (1981), National Policy for Entrepreneurship Education, (mimeo presented at the six countries programme on aspects of government policies towards technological innovation in industry workshop on industry-university relations, May 10-11, 1982, Stockholm)

Shapero, A. (1982), National Policy for Entrepreneurship Education, The Ohio State University, (mimeo)

Shapero, A. and Sokol, L. (1982), "The Social Dimensions of Entrepreneurship", in Kent et al. eds. (1982)

Sharma, D.D. (1981), Swedish Firms and Management Contracts, Dept. of Business Administration, University of Uppsala, Uppsala, (doct. diss.)

Shivji, I.G. (1976), "Capitalism Unlimited: Public corporations in partnerships with multinational corporations" in Mapolu, H. ed. (1976)

SIDO, (1976), Objectives and Functions of SIDO, Small Industries Development Organization, Dar es Salaam (undated)

Sigurdson, J. (1974), The Role of Small Scale and Rural Industry and its Interaction with Agriculture and Large Scale Industry in China, Economic Research Institute, Stockholm School of Economics, Stockholm

Sigurdson, J. and Bhargava, P. (1983), "The Challenge of the Electronics Industry in China and India", pp. 249-291 in Jacobsson, S. and Sigurdson, J. eds. (1983) Technological Trends and Challenges in Electronics, Research Policy Institute, University of Lund

Skarstein, R. and Wangwe, S.M. (1985), Industrial Development in Tanzania: Some Critical Issues, Trondheim, (preliminary report)

Sporre, S. (1985), "The development of small industries in Tanzania", in Havnevik et al. (1985), Small scale industrial sector study -Tanzania, annex C

Stevenson, H.H. and Gumpert, D.E. (1985), "The heart of entrepreneurship", Harvard Business Review, March-April 1985, pp. 85-88

Stewart, F. (1977), Technology and Underdevelopment, Macmillan, London

Stewart, F. (1979), "International Technology Transfer: Issues and Policy Options", World Bank Staff Working Paper, No. 344, World Bank, Washington, D.C.

Stout, H.P. and Bradbury, F.R. (1979), Technology Transfer Practices of Small and Medium Sized Enterprises, Research Monograph No. 2, Technological Economics Research Unit, University of Stirling

Strassman, W.P. (1968), Technological change and economic development, Cornell University Press, New York

Ståhl, M. (1980), Tanzania: landanalys Mars 1980, SIDA, Stockholm

Svensson, B. (1984), Acquisition of Technology through Licensing in Small Firms, Dissertations No. 10, Dept. of Management and Economics, Linköping University, Linköping, (doct. diss.)

Svensson, L. (1976), Study skill and learning, Acta Universitatis Gothoburgensis, Göteborg

Svensson, L. (1977), "On Qualitative Differencies in Learning. III. Study Skill and Learning", British Journal of Educational Psychology, 47, pp. 233-243

Svensson, L. (1984), Människobilden i INOM-gruppens forskning: Den lärande människan, Department of Education, University of Göteborg, Mölndal, (in Swedish)

Svensson, L. and Theman, J. (1983), The Relation between Categories of Description and an Interview Protocol in a Case of Phenomenographic Research, No. 2, Department of Education, University of Göteborg, Mölndal

Säljö, R. (1982), Learning and Understanding, Göteborg Studies in Educational Sciences No. 42, ACTA Universitatis Gothoburgensis, Göteborg, (doct. diss.)

Teece, D.J. (1976), The Multinational Corporation and the Resource Cost of International Technology Transfer, Ballinger Publishing Company, Cambridge, Massachusetts

Teece, D. (1982), "The Resource Costs of Transferring Industrial Technology", pp. 65-86 in Mansfield et al. (1982)

Theman, J. (1976), Vad man lär sig när man lär sig mäta, Förändringskonsult, Göteborg, (mimeo in Swedish)

Theman, J. (1983a), "Maktlöshet och emancipation i relationen mellan försöksledare och försöksperson", pp. 133-157 in Granström, K. ed. (1983); Om Kommunikation, 2, SIC 6, 1983, Studies in Communication, University of Linköping, (in Swedish with English summary)

Theman, J. (1983b), Uppfattningar av Politisk Makt, (Conceptions of Political Power), ACTA Universitatis Gothoburgensis, Göteborg, (doct. diss. in Swedish with English summary)

Thomas, C.Y. (1974), Dependence and Transformation, Monthly Review Press, New York

Thomas, D.B. and Wionczek, M.S. eds. (1979), Integration of Science and Technology with Development: Caribbean and Latin American Problems in the Context of the United Nations Conference on Science and Technology for Development, Pergamon Press, New York

Tilton, J.E. (1971), International Diffusion of Technology: the Case of Semiconductors, The Brooking Institution, Washington D.C.

TISCO (1981), Directory of Industrial Enterprises and Products in Tanzania 1981, Tanzania Industrial Studies and Consulting Organization, Dar es Salaam

TISCO (1982), Industrial Rehabilitation, Priority Goods Packages, Ministry of Industries and TISCO

UNCTAD (1972), Guidelines for the Study of the Transfer of Technology to Developing Countries, UN, New York (TD/B/AC. 11/9)

UNCTAD (1975), Major Issues Arising from the Transfer of Technology to Developing Countries, UNCTAD Secretariat, Geneva, TD/B/AC 11/10, Rev 2

UNCTAD (1984), International transfer of technology to developing countries by small and medium sized enterprises, UNCTAD, TD/B/C.6/119

UNCTAD (1986), Trends in international transfer of technology to developing countries by small and medium-sized enterprises, UNCTAD, TD/B/C.6/138

United Republic of Tanzania (1981), Economic Survey

Utterback, J.M. and Reitberger, G. et al. (1982), Technology and Industrial Innovation in Sweden, A study of new technology-based firms, CPA, MIT, Boston and STU, Stockholm

Vaitsos, C.V. (1973), "Bargaining and the Distribution of Returns in the Purchase of Technology by Developing Countries", in Bernstein, H. (1973), Underdevelopment and Development, Penguin Books, (Also available in Bullentin of the Institute of Development Studies, Vol. 3, No. 1, 1970.)

Vaitsos, C.V. (1974), Intercountry Income Distribution and Transnational Enterprises, Clarendon Press, Oxford

Vaitsos, C.V. and Lall, S. et al. (1978), Industrial technology in the third world, an agenda for research, OECD, Paris

Vedin, B.-A. (1980), Corporate Culture for Innovation, Studentlitteratur, Lund (partial report for doct. diss.)

Vernon, R. (1966), "International Investment and International Trade in the Product Cycle", Quarterly Journal of Economics, Vol. 80

Vesper, K.H. (1982), "Introduction and summary of entrepreneurship research", in Kent et al., eds. (1982)

Vesper, K.H. (1985), Entrepreneurship Education 1985, Center for Entrepreneurical Studies, Babson College, Wellesley, Massachusetts

Vitelli, G. (1979), Imported Technology and Development of Local Skills, Institute of Development Studies, University of Sussex, (mimeo)

Wallender III, H.W. (1979), Technology Transfer and Management in Developing Countries, Ballinger Publishing Company, Cambridge, Massachussets

Wangwe, S.M. (1976), "Excess Capacity in Manufacturing - a study of selected firms in Tanzania", ERB-paper 76.2, Economic Research Bureau, University of Dar es Salaam, Dar es Salaam

Wangwe, S.M. (1983), "Industrialization and Resource Allocation in a Developing Country", The Case of Recent Experiences in Tanzania, World Development, Vol. II, No. 6, pp. 483-492, London

Welford, A.T. (1976), Skilled Performance: Perceptual and Motor Skills, University of Adelaide, Scott, Foresman and Company, Clenview, Illinois

Welford, A.T. (1980), "On the nature of higher-order skills", Journal of Occupational Psychology, 1980, 55, pp. 111-116

Wendeberg, B. (1982), Gnosjöandan; myt eller verklighet, U.B. Wendeberg förlag HB, Värnamo, (in Swedish)

Westphal, L.E. (1981), "Empirical Justification for Infant Industry Protection", World Bank Staff Working Paper, No. 445, World Bank, Washington D.C.

White, E. and Feldman, S. (1980), The role of small and medium-sized enterprises in the international transfer of technology: Issues for research, UNCTAD, TD/B/C.6/64

White, E. and Feldman, S. (1982), Organizational forms of transfer of technology to developing countries by small and medium-sized enterprises: a case study of equity joint ventures and technology agreements in Latin America, UNCTAD, TD/B/C.6/77

World Bank (1983), World Development Report 1983, Oxford University Press, New York

Wright, T.P. (1936), "Factors Affecting the Cost of Airplanes", Journal of the Aeronautical Sciences, Vol. 3, (1936), pp. 122-128

Zahlan, A.B. (1978), "Established Patterns of Technology Acquisition in the Arab World", in A.B. Zahlan ed. (1978), Technology Transfer and Change in the Arab World, Pergamon Press, Oxford